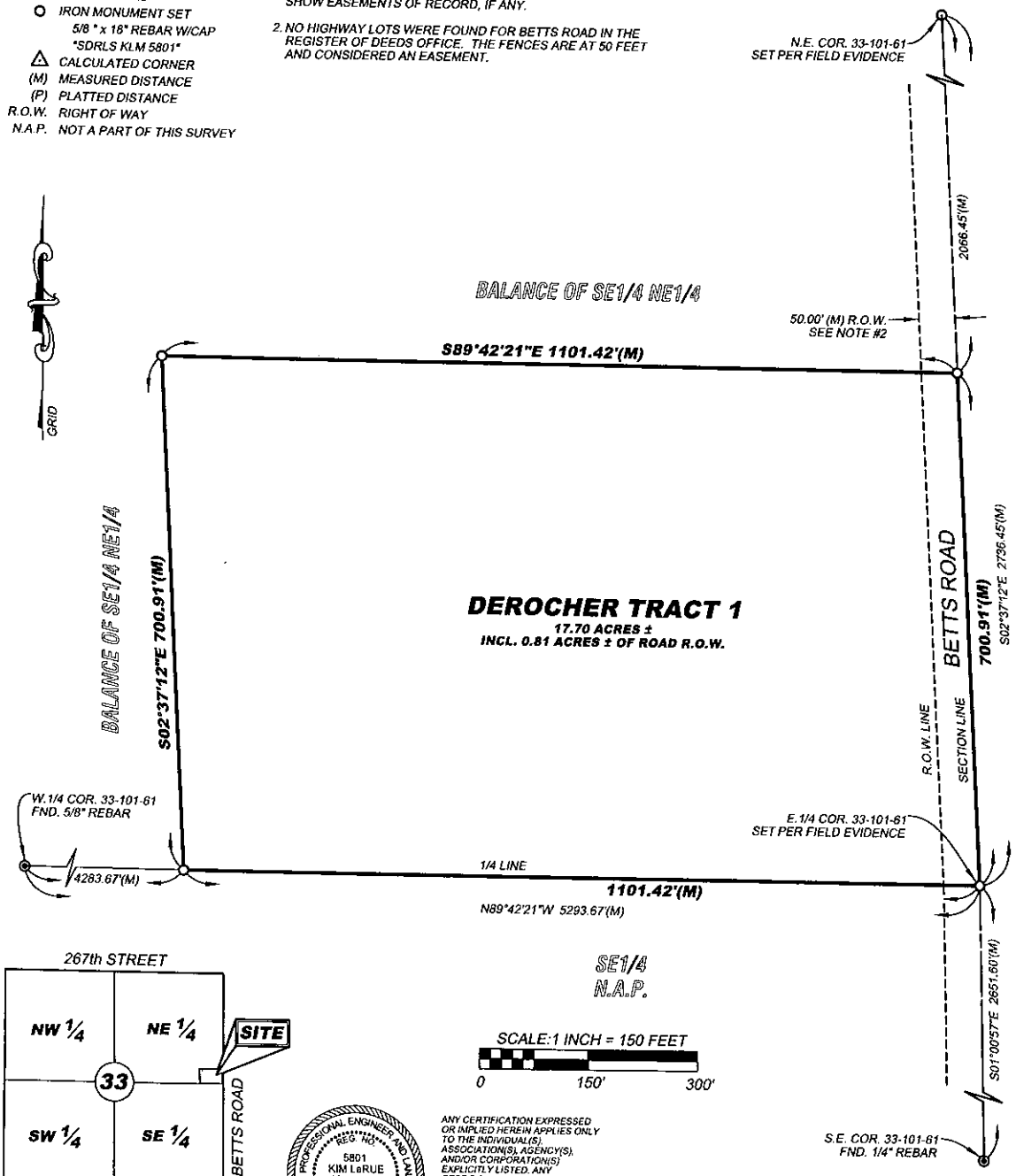
SURVEY PLAT
OF
DEROCHER TRACT 1
IN THE SOUTHEAST QUARTER OF THE NORTHEAST QUARTER OF SECTION 33, TOWNSHIP 101 NORTH, RANGE 61 WEST OF THE 5TH P.M., DAVISON COUNTY, SOUTH DAKOTA

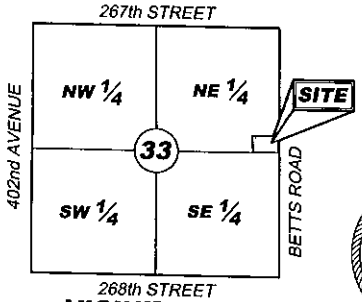
LEGEND

- ◉ IRON MONUMENT FOUND TYPE NOTED
- O IRON MONUMENT SET 5/8 " x 18" REBAR W/CAP "SDRLS KLM 5801"
- △ CALCULATED CORNER
- (M) MEASURED DISTANCE
- (P) PLATTED DISTANCE
- R.O.W. RIGHT OF WAY
- N.A.P. NOT A PART OF THIS SURVEY

SURVEYOR'S NOTES:

1. THIS SURVEY WAS PERFORMED WITHOUT THE BENEFIT OF A COMPLETE TITLE REPORT AND DOES NOT PURPORT TO SHOW EASEMENTS OF RECORD, IF ANY.
2. NO HIGHWAY LOTS WERE FOUND FOR BETTS ROAD IN THE REGISTER OF DEEDS OFFICE. THE FENCES ARE AT 50 FEET AND CONSIDERED AN EASEMENT.





VICINITY MAP
NO SCALE

SE1/4
N.A.P.

SCALE:1 INCH = 150 FEET
0 150' 300'

REGISTERED PROFESSIONAL ENGINEER AND LAND SURVEYOR
REG. NO.
5801
KIM LaRUE
McLAURY
8-30-17
SOUTH DAKOTA

ANY CERTIFICATION EXPRESSED OR IMPLIED HEREIN APPLIES ONLY TO THE INDIVIDUAL(S), ASSOCIATION(S), AGENCY(S), AND/OR CORPORATION(S) EXPLICITLY LISTED. ANY CERTIFICATION EXPRESSED OR IMPLIED IS INVALID WITHOUT THE SIGNATURE AND ORIGINAL SEAL OF "KIM LaRUE McLAURY, STATE OF SOUTH DAKOTA, REGISTERED PROFESSIONAL LAND SURVEYOR, NUMBER 5801".

SURVEY CREW: MSB 08/16/16	DRAWN BY: TDW 08/3/17	PROJECT NO. 22160801	SCALE: 1" = 150'

MET Professional Engineers and Land Surveyors

McLaury Engineering, Inc.

P.O. BOX 916
110 N. FIRST STREET
PARKSTON, SD 57366
(605) 928-7676

Comprehensive Nutrient Management Plan

For

Chris Derocher

(Producer)

Davison

(County)

Prepared in Cooperation with the

USDA-Natural Resources Conservation Service

Comprehensive Nutrient Management Plan (CNMP)

Comprehensive Nutrient Management Plans (CNMP)

The objective of a CNMP is to provide AFO owners/operators with a plan to manage manure and organic by-products by combining conservation practices and management activities into a conservation system that, when implemented, will control soil erosion.

A CNMP is a conservation plan for an AFO that must include the production area including the animal confinement, feed and other raw materials storage areas, animal mortality facilities, and the manure handling containment or storage areas, and the land treatment area, including any land under control of the AFO owner or operator, whether it is owned, rented, or leased, and to which manure or process wastewater is, or might be, applied for crop, hay, pasture production, or other uses.

Meets Natural Resources Conservation Service (NRCS) FOTG Section III quality criteria for Water Quality (nutrients, organics, and sediments in surface and groundwater) and Soil Erosion (sheet and rill, wind, ephemeral gully, classic gully, and irrigation induced natural resource concerns on the production area and land treatment area).

Mitigates, if feasible, any excessive air emissions and/or negative impacts to air quality resource concerns that may result from practices identified in the CNMP or from existing on-farm areas/activities.

Complies with Federal, State, tribal, and local laws, regulations, and permit requirements.

Signature Page

Farmstead (Production Area)

Crop and Pasture (Land Treatment)

Nutrient Management Plan (590)

Contact Information

Producer Name:	Chris Deroucher	**Phone:**	
Email:		**Cell Phone:**	712-540-6236
Address:	33609 260th Street, LeMar IA 51031		
Nurient Planner:	Jason Gilb	**Phone:**	605-996-1564
Email:	jason.gilb@sd.usda.gov	**Cell Phone:**	NA
Address:	1820 N Kimball, Suite 4, Mitchell, SD 57301		
Engineer's Name:		**Phone:**	
Email:		**Cell Phone:**	
Address:			
Local NRCS Office:	Mitchell Service Center	**Phone:**	605-996-1564
Address:	1820 N. Kimball, Suite B	Mitchell, SD	57301

NUTRIENT MANAGEMENT PLAN INFORMATION

1. Type of Livestock: Swine Finishers
   Animal Units: 2400 AU's
   Average Weight: 150 lbs

2. Total Number of Acres Included in NMP: _____ acres

3. Will this be a DENR State Permitted Facility? Cert of Compliance

4. Is there any anticipated funding? (EQIP, 319, none) none

This nutrient management plan was developed based on criteria from the following documents:

- ☐ **SD DENR General Water Pollution Control Permit for Concentrated Animal Feeding Operations** — **2017** (Date)
- ☐ **USDA, Natural Resources Conservation Service (NRCS) Nutrient Management Standard (590)** — **2012** (Date)
- ☐ **County Zoning Ordinance for Animal Feeding Operations As Amended** — _____ (County) _____ (Date)

Additional notes:
Max Leischner; 999-6930;max@sbranchfarms.com: Land operator
Richard Leubke - Land Owner of land that manure is going to be applied to
Lance Thury, 770-3702 feed saleman - heading the development

Table of Contents

Section 1. Farmstead (Production Area)

1.1 Maps of Farmstead, Existing and Planned Conservation Practices
1.2 Farmstead Conservation Practices – Record of Decision
1.3 Farmstead Conservation Practices – Implementation Requirements
1.4 Animal Inventory
1.5 Manure Storage Information
1.6 Planned Manure Exports
1.7 Planned Manure Imports
1.8 Planned Internal Transfers of Manure
1.9 Brief Description of, or Additional Information about Animal Feeding Operation (Optional)

Section 2 Crop and Pasture (Land Treatment)

2.1 Maps of Fields, Soils, Application Setbacks, Existing and Planned Crop and Pasture Conservation Practices
2.2 Crop and Pasture Conservation Practices – Record of Decision
2.3 Crop and Pasture Conservation Practices – Implementation Requirements
2.4 Predicted Soil Erosion

Section 3. Nutrient Management Plan (590)

3.1 Nitrogen and Phosphorus Risk Analysis Results
3.2 Manure Application Setback Distance
3.3 Soil Test Result Data
3.4 Manure Nutrient Analysis
3.5 – 3.10 SD-CPA-63 which addresses Planned Crops, Fertilizer Recommendations, Nutrient Applications, Field Nutrient Balance, Manure Inventory, Fertilizer Summary, and Plan Nutrient Balance

Section 1
Farmstead (Production Area)

- ☐ 1.1 Maps of Farmstead, Existing and Planned Conservation Practices
- ☐ 1.2 Farmstead Conservation Practices – Record of Decision
- ☐ 1.3 Farmstead Conservation Practices – Implementation Requirements
- ☐ 1.4 Animal Inventory
- ☐ 1.5 Manure Storage Information
- ☐ 1.6 Planned Manure Exports
- ☐ 1.7 Planned Manure Imports
- ☐ 1.8 Planned Internal Transfers of Manure
- ☐ 1.9 Brief Description of, or Additional Information about Animal Feeding Operation (Optional)
- ☐ 1.10 Air Quality Assessment

SOUTH DAKOTA CNMP AIR QUALITY COMPONENT

As part of an NRCS Comprehensive Nutrient Management Plan (CNMP) the potential resource concern of air quality must discussed with each producer receiving NRCS technical assistance for CNMP development. During our site assessment the following potential air quality resource concerns were observed:

1. Particulate matter (dust) noted coming from feedlot, roads, and feed storage/mixing area.

2. Slight odor (ammonia) emitting from manure storage area.

The National Air Quality Site Assessment Tool (NAQSAT) has been developed for the voluntary use of livestock producers and their advisors or consultants. It is intended to provide assistance to livestock and poultry producers in determining the areas in their operations where there are opportunities to make changes that result in reduced air emissions. NAQSAT is based on the most accurate, credible data currently available regarding mitigation strategies for air emissions of ammonia, methane, volatile organic compounds, hydrogen sulfide, particulates, and odor. NAQSAT was designed to provide information and education, only. It is not intended to provide emissions data and/or regulatory guidance. All users receive a report of priority areas where improvements can be made, regardless of the amount of emissions produced by the facility. These priorities are not a reflection of risk, but rather a relative evaluation of current production systems based on the most accurate data and understanding of management systems currently available.

If you would like to have NRCS run NAQSAT on your farm please indicate below:

☐ I **want** NRCS to run NAQSAT on my farmstead

☐ I **do not want** NRCS to run NAQSAT on my farmstead

_____ _____

Signature Date

For more information practices to improve air quality please reference the following publications:

PM 1970a *Practices to Reduce Odor from Livestock Operations* is found on the Web at:
http://www.extension.iastate.edu/Publications/PM1970a.pdf

PM 1971a *Practices to Reduce Ammonia Emissions from Livestock Operations* is found on the Web at:
http://www.extension.iastate.edu/Publications/PM1971a.pdf

PM 1972a *Practices to Reduce Hydrogen Sulfide from Livestock Operations* is found on the Web at:
http://www.extension.iastate.edu/Publications/PM1972a.pdf

PM 1973a *Practices to Reduce Dust and Particulates from Livestock Operations* is found on the Web at:
http://www.extension.iastate.edu/Publications/PM1973a.pdf

Section 1.6, 1.7, 1.8
Manure Tracking

1.6 Planned Manure Exports off the Farm

Month-Yr.	*Manure Source*	*Amount*	*Receiving Operation*	*Location*

1.7 Planned Manure Imports onto the Farm

Month-Yr.	*Manure Source*	*Amount*	*Receiving Operation*	*Location*

1.8 Planned Internal Transfers of Manure

Month-Yr.	*Manure Source*	*Amount*	*Receiving Operation*	*Location*

Dealing with a Manure Spill

Nutrient management professionals urge producers and professional nutrient applicators alike to remember the **"Four Cs"** if the worst happens and they are faced with a manure spill emergency:

Step 1: Control-eliminate the source of the manure spill.

Step 2: Contain-limit the area impacted.

Step 3: Comply-assess and report damage to the proper authorities.

Step 4: Clean up-restore the affected area.

During the recent North American Manure Expo, officials demonstrated ways producers and applicators could create dams with hay or straw bales to help slow the manure's spread. Five-gallon buckets, PVC pipe, plastic sheets and plywood are some examples of items that can be used to help plug tile outlets and cover tile inlets in the event of a spill. If the spill is sizeable, using tillage equipment to stop the manure's movement toward vulnerable waterways may be necessary. Using sand or other materials to soak up or slow the manure's spread can also be a containment option.

Experts recommend assembling a manure spill response kit to have ready and accessible on the farm when pumping and applying manure. The kit should include:

1. A copy of the farm's emergency response plan, if it has one, including emergency numbers and a site map;
2. Hay or straw bales that could be used to block a culvert or build a berm or diversion;
3. T-posts to support plywood or bale stacks;
4. 14-inch diameter PVC pipe in both 3-foot and 2-foot sections to be used to cover tile inlets;
5. Several 6-mil plastic sheets of approximately 12-foot x 25-foot lengths that could be applied to tile inlets or other sensitive areas with duct tape;
6. At least one sheet of 4-foot x 4-foot plywood that could be used to block culverts. Round the plywood on one end to fit the curve of the ditch;
7. Pliers, vice grips, fencing pliers, channel lock pliers, hammers, utility knife, hand saw, hatchet, post driver;
8. 1 roll duct tape;
9. Baling wire; and
10. Sand shovels.

At the minimum, nutrient management experts recommend a mini-kit that could be kept in the truck or tractor. The mini-kit should contain a sand shovel, duct tape, utility knife and 6-mil plastic sheets.

The Department of Environment and Natural Resources (DENR) should be contacted as soon as possible after the spill, but no later than twenty-four (24) hours from the time the producer first became aware of it. The report shall be made to the State of South Dakota at (605) 773-3351. If after normal business hours (8:00 am to 5:00 p.m. Central time on Monday through Friday), the producer shall report the discharge by calling (605)773-3231. The producer shall also take immediate steps to stop the discharge and notify anyone downstream that may be impacted by the discharge. When notifying the DENR, be prepared to provide information about the location, time, and estimated amount and source of the manure spill. Let the DENR know about any water resources that have been or could be impacted by the spill.

Section 2
Crop and Pasture (Land Treatment)

- ☐ 2.1 Maps of Fields, Soils, Application Setbacks, Existing and Planned Crop and Pasture Conservation Practices
- ☐ 2.2 Crop and Pasture Conservation Practices – Record of Decision
- ☐ 2.3 Crop and Pasture Conservation Practices – Implementation Requirements
- ☐ 2.4 Predicted Soil Erosion

Water Qulaity Risk Assessment Map
14-100-62

Prepared with assistance from USDA-Natural Resources Conservation Service

Legend

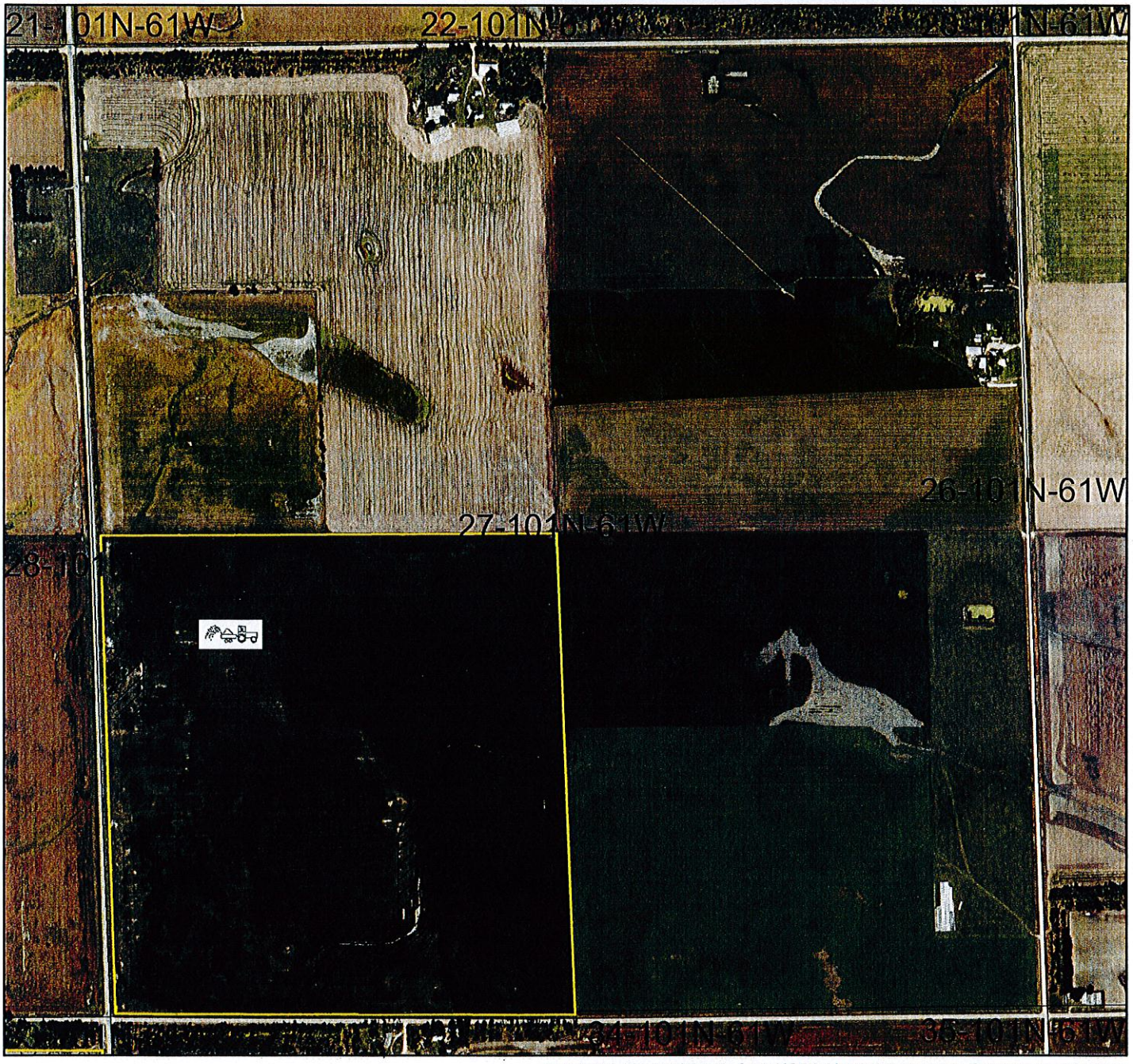
- CNMP
- R Runoff - High Risk
- Manure Application
- Exclusions
- plss_a_sd_utm14

Note: Manure application may not occur within 100 feet of any open inlet tile lines. Also see well log inventory for well setbacks.

480 0 480 960 1,440 1,920 Feet

N

Water Quality Risk Assessment Map
27-101-61



Prepared with assistance from USDA-Natural Resources Conservation Service

Legend

- CNMP
- R Runoff - High Risk
- Manure Application
- Exclusions
- plss_a_sd_utm14

Note: Manure application may not occur within 100 feet of any open inlet tile lines. Also see well log inventory for well setbacks.

480 0 480 960 1,440 1,920 Feet

N

Water Quality Risk Assessment Map
33-101-61

Prepared with assistance from USDA-Natural Resources Conservation Service

Legend

- CNMP
- R Runoff - High Risk
- Manure Application
- Exclusions
- plss_a_sd_utm14

Note: Manure application may not occur within 100 feet of any open inlet tile lines. Also see well log inventory for well setbacks.

480 0 480 960 1,440 1,920 Feet

N

Soils Map
33-101-61

Prepared with assistance from USDA-Natural Resources Conservation Service

Legend

- CNMP
- plss_a_sd_utm14
- soilmu_a_sd035

480 0 480 960 1,440 1,920 Feet

N

Soils Map
14-100-62

Prepared with assistance from USDA-Natural Resources Conservation Service

USDA

Legend

- CNMP
- Soils

480 0 480 960 1,440 1,920 Feet

N

Soils Map
27-101-61

Prepared with assistance from USDA-Natural Resources Conservation Service

Legend

- CNMP
- plss_a_sd_utm14
- soilmu_a_sd035

480 0 480 960 1,440 1,920 Feet

N

Info: Max Leischner

Soils: has, HpA, and CpA
Printout date: May 12, 2017
Prepared by: Jason Gilb

Purpose (select at least 1) The following conservation practice(s) are being installed to:

___Reduce sheet-and-rill or wind erosion (328,329,345)
___Utilize excessive plant nutrients (328)
___Manage saline seeps (328)
___Provide feed for domestic livestock (328)
___Provide food and cover for wildlife, including pollinator forage, cover, and nesting (328, 329)
___Maintain or increase soil quality and organic matter content (328,329,345)
___Conserve water (328,329,345)
___Manage plant pests (328)
___Reduce tillage-induced particulate emissions (329,345)
___Reduce energy use (329)

Conservation Crop Rotation (328) The crop rotation is the foundation that a healthy, productive, and profitable agricultural ecosystem is based on. Considerable thought and careful consideration will have gone into the planning of the following Conservation Crop Rotation. The crops, their planned yields, and the sequence they will be grown in is:

Vegetation	*Yield units*	*# yield units*	*Planting op.*
vegetations\Corn, grain	bushels	112.00	1
vegetations\Soybean, mw 7in rows	bu	20.000	2

Duration: 2 yr

Residue and Tillage Management – Mulch-till (345), No-till (329):
The following schedule of tillage, planting, and harvest operations are designed to result in the listed percentags of the soil surface being covered with residues from the previous crops on the listed dates. The presence of the residues in at least the listed amounts on the listed dates will be evidence of practice implementation.

Date	*Operation*	*Vegetation*	*Surf. res. cov. after op, %*
11/1/0	Fert applic. surface broadcast		71
5/1/1	Sprayer, pre-emergence		57
5/1/1	Planter, double disk opnr w/fluted coulter	Corn, grain	57
6/7/1	Sprayer, post emergence and fert. tank mix		50
10/20/1	Harvest, killing crop 50pct standing stubble		74
5/10/2	Sprayer, pre-emergence		76
5/10/2	Drill or air seeder single disk openers 7-10 in spac.	Soybean, mw 7in rows	76
6/7/2	Sprayer, post emergence		75
8/1/2	Sprayer, insecticide post emergence		61
10/10/2	Harvest, killing crop 20pct standing stubble		75

County and Soil: SSURGO\Davison County, South Dakota\HsA Houdek-Stickney loams, 0 to 2 percent slopes\Houdek Loam 50

RUSLE2 Results: The following estimate of average annual rainfall-induced soil loss is based on factors that are beyond cooperater control, such as climate and soil type, as well as those factors that are within cooperators control, such as the Crop Rotation and Residue Management decisions documented here.

Soil loss erod. portion	*T value*	*Slope length (horiz)*	*Avg. slope steepness, %*
0.21	5.0	400	2.0

Soil Conditioning index (SCI):
The above **Conservation Crop Rotation**, and its associated **Tillage and Residue Management** are designed to maintain and improve the quality and health of the planned soils. The best measure of soil quality and health in South Dakota is the amount of soil organic matter (SOM) or soil carbon (C) they possess. The SCI is an index score (no units) designed solely for comparing the relative impact of different management alternatives on long-term soil quality trends.. If SCI is negative (less than zero), SOM and soil C (soil quality) are predicted to decline over time on the modeled slope under the modeled management system. If SCI is positive (greater than zero), SOM and soil C and soil quality are predicted to stay the same or to increase over time. SCI scores usually range from -1 to +1 in typical SD situations, although more extreme values are possible. When calculating SCI, RUSLE2 considers three key factors: (1) amount and type of surface and subsurface biomass returned to the soil; (2) tillage-induced oxidation of soil carbon; and (3) predicted sheet & rill erosion. Climate and soil type inputs are also considered due to the influence of these factors on soil C oxidation trends.

Soil conditioning index (SCI)	*Wind & irrigation-induced erosion for SCI, t/ac/yr*
0.587	0

Soil Tillage Intensity Rating (STIR):

STIR measures the intensity of tillage or soil disturbance. STIR is an index (no units) designed solely for comparing the relative impact of different management alternatives on soil disturbance. STIR increases with increasing tillage and can range from 0 to 200+. Average annual STIR values reflect the total amount of soil disturbance that occurs during the overall rotation, averaged across the number of years in the rotation. STIR values can also be calculated for individual crops. The STIR for an individual crop represents the sum of all soil disturbance associated with establishing and harvesting that crop. Both types of STIR values are shown below. STIR values in the 5 to 20 range are typical of no-till crops and/or continuous no-till or low soil disturbance cropping systems. This cropping system is designed to result the following STIR values.

Avg. annual slope STIR: 3.04 (averaged across all years in the rotation)

Crop Interval Stir Values

Veg.	*STIR value*	*Start date*	*End date, m/d/y*
vegetations\Corn, grain	3.04	10/11/1	10/20/2
vegetations\Soybean, mw 7in rows	3.04	10/21/2	10/10/3

Operation and Maintenance Summary: Evaluate/measure the crop residues cover and orientation after each crop to ensure the planned amounts and orientation are being achieved. Adjust management as needed to either plan a new residue amount and orientation or adjust the planting and/or harvesting equipment.

NRCS Planning and Application Certification:

I certify the conservation practice planning and design in this specification and supporting plan documents meet the purposes, associated criteria and client objectives. I have the required Job Approval Authority or TSP certification required for planning and design for this conservation practice standard.

Conservationist signature: _____ **Date:** 7-17-17

I certify the conservation practice has been installed according to practice standard criteria and specification requirements. The operation and maintenance requirements for the practice have been reviewed with the client. I have the required Job Approval Authority or TSP Certification for this conservation practice installation

Conservationist signature: _____ **Date:** _____

Section 3
Nutrient Management Plan (590)

- ☐ 3.1 Nitrogen and Phosphorus Risk Analysis Results
- ☐ 3.2 Manure Application Setback Distance
- ☐ 3.3 Soil Test Result Data
- ☐ 3.4 Manure Nutrient Analysis
- ☐ 3.5 - 3.10 Planned Crops, Fertilizer Recommendations, Nutrient Applications, Field Nutrient Balance, Manure Inventory, Fertilizer Summary, and Plan Nutrient Balance (SD-CPA-63)

South Dakota Phosphorus Loss Risk Assessment						
Soil Test Phosphorus (ppm)		Predicted annual erosion = sum of wind and water				
		<6 *tons per acre per year*		6 - 8 *tons per acre per year*		>8 *tons per acre per year*
		100' vegetative buffer		100' vegetative buffer		
Olson	Bray-1	yes	no	yes	no	
0-25	0-35	Low	Low	Low	Low	Moderate
26-50	36-75	Low	Low	Low	Moderate	High
51-75	76-110	Low	Moderate	Moderate	Moderate	High
76-100	111-150	High	High	High	High	No application
>100	>150	No application	No application	No application	No application	No application

Low Risk - Phosphorus can be applied at rates greater than crop phosphorus removal not to exceed the nitrogen requirement for the succeeding crop.

Moderate Risk - Phosphorus can be applied not to exceed crop phosphorus removal for up to a 5 year crop sequence. Application cannot exceed the nitrogen requirement for the succeeding crop.

High Risk - Phosphorus can be applied not to exceed one year crop phosphorus removal. Application cannot exceed the nitrogen requirement for the succeeding crop. The following requirements must also be met: 1. A soil phosphorus drawdown strategy has been implemented. 2. A site assessment for nutrients & soil loss has been conducted to determine if mitigation practices are required to protect water quality. 3. Any deviation from these high risk requirements must have the approval of the Chief of the NRCS.

Planning Considerations:

Wind erosion (WEPS) should be completed for all fields with predominate soils of I =>134 or if a wind erosion resource concern exists.

Crop removal is the amount of phosphorus used in one crop year according to SDSU-Extra 8009, "Quantities of Nutrients Contained in Crops."

All fertilizer phosphorus sources should be placed below the soil surface. However, surface application is permitted on no-till cropland, pastureland, or hayland. In all other cropland tillage systems, phosphorus sources will be placed below the soil surface.

Winter manure applications are allowed only when all of the following conditions are met: 1. When incidental amounts of manure is collected during feedlot snow removal or cleaning of feed bunks or enclosed pens to facilitate livestock feeding and handling. 2. Winter manure applications will not exceed the rate per acre calculated in the nutrient budget for the application field based on fall soil test results. 3. Set back distances from surface waters or water conveyances will be 300 ft and 1,000 ft from named lakes, rivers, and perennial streams. 4. Winter manure applications are prohibited on floodplains with soils classified as frequently or occasionally flooded as listed in National Cooperative Soil Survey. 5. Applications will only be allowed on fields with slopes less than 4 % slope and be prioritized based on the water erosion prediction technology as listed in the SD tech guide. 6. Fields with lowest predicted soil loss (water erosion) will generally have the highest priority for winter applications. 7. Manure will be uniformly spread.

December 2012

Section 3.1 Inventory of Water Wells

Field ID	Location (Legal)	Well Depth (Ft.)	Use of Well	Required Setback Distance From Well For Manure Application (Ft.)	
				County Rule	State Rule
4	SE 14-100-62	320	Private	250	250

County Rule

Refer to the following website:
http://sdda.sd.gov/farming-ranching-agribusiness/county-ordinances/

State Rule

DENR General Permit 1.4.3, 4.Ground Water Protection (page 22)
Wastewater and manure containment structures or the manure and wastewater application sites cannot be located closer than **1,000 feet from an existing public water well** or drinking water source nor **250 feet from an existing private water well** or drinking water source. Wastewater and manure containment structures and the manure and wastewater application sites shall not be located closer than **150 feet from a water well or drinking water source that is owned by the producer.** These setback requirements do not apply to wastewater and manure containment structures constructed prior to August 14, 1996.

Section 3.2
Buffer and Setback Requirements

Specific buffer zone and/or setback distances applicable to land application of manure are as follows:

Alternative Chosen by Producer

Option 1

☒ • Do not apply manure (broadcast or incorporated) within **100-feet** of surface water or on either side of a conveyance.

-Or-

Option 2

☐ • Establish and maintain a minimum **35-foot wide (quality) perennial grass filter strip** next to surface water or on either side of a conveyance; an area within which manure will not be applied.

Option 3

☐ • The livestock operator may choose to maintain or establish a minimum **100-foot wide perennial grass filter strip** in select cases where the soil test phosphorus and potential soil erosion in the field are such as to allow application of manure based on multiple years of phosphorus crop removal (not to exceed N needs of crop). See Table I in the Manure Application Planning section of this plan.

Review and comply with other specific setback requirements in the current South Dakota **General Livestock Permit** regulations or your **local county zoning ordinance** when dealing with state and locally permitted facilities.

Endangered Species Action Plan

Chris Derocher

Species of Concern: Topeka Shiner

No action required at this time, facility and manure application fields are outside of the ¼ mile buffer of known occupied streams (see attached map).

Topeka Shinner Map

Prepared with assistance from USDA-Natural Resources Conservation Service

Legend

- FWS_SD_TS_OccupiedStreams
- CNMP
- plss_a_sd_utm14

2,400 0 2,400 4,800 7,200 9,600 Feet

N

Possible Alternative Manure Application Methods

Producer/Operation: Chris Derocher

Animal Type: (circle those that apply)	Dairy Cattle, Beef Cattle, Cow, Nursey Pig, Growing Pig, Gestating Sow, Sow and litter, Boar, Sheep, Poultry Layer, Poultery Broiler, Turkey, Duck, Horse

Manure Type: (circle those that apply)	**Solid**: daily scrape and haul, manure pack, open lot, manure stacking, deep pit poultry, liter (birds), separator system **Liquid:** Anaerobic pit, above-ground (covered), above-ground (uncovered), earth storage holding pond, lagoon, separator system

Check if applicable	Method	Solid (S) Liquid (L)
X	Injection	L
	Flood Irrigation	L
X	Sprinkling	L
X	Sprinkling (partial incorp.)	L
X	Sprinkling (incorp. within 24 hrs.)	L
	Broadcast (no incorp.)	S
	Broadcast (incorp. within 24 hrs.)	S
	Broadcast (incorp. 1 - 5 days)	S
	Broadcast w/ partial incorporation	S

Possible Alternative Crops Included in Crop Rotation

Producer/Operation: Chris Derocher

Check if applicable	Crop	Yield
X	Alfalfa (T)	4
X	Barley (bu)	60
	Barley, Malting (bu)	
	Buckwheat (bu)	
	Canola (cwt)	
	Chickpea	
X	Corn (bu)	180
X	Corn Silage (ton)	12
X	Cover Crops (T)	4
	Edible Beans (lbs)	
X	Fallow	0
	Field Pea	
	Flax (bu)	
X	Grass (Ton)	2
	Grass, Sudan (ton)	
	Lentil	
	Melons	
X	Millet (lbs)	1200
	Mustard (cwt)	
X	Oats (bu)	65
	Potatoes (cwt)	
	Rapeseed (cwt)	
X	Rye (bu)	60
X	Rye Forage (T)	
	Safflower (lbs)	
X	Sorghum (bu)	60
	Sorghum, Forage (T)	
X	Soybean (bu)	40
X	Sunflowers (lbs)	1800
X	Triticale (T)	3
X	Wheat, Sp. (bu)	60
X	Wheat, W. (bu)	65

Check if applicable	Crop (list others)	Yield

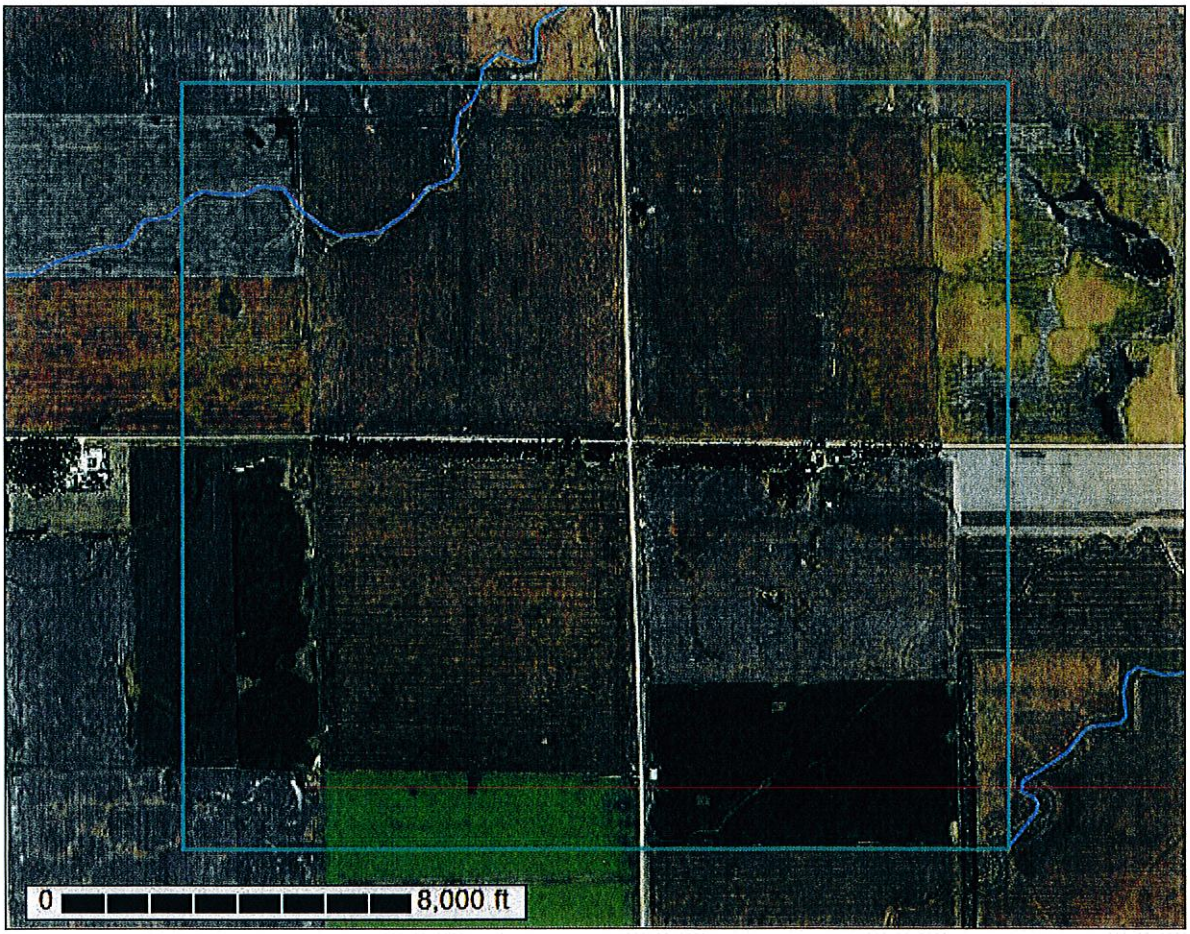
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Davison County, South Dakota



May 12, 2017

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

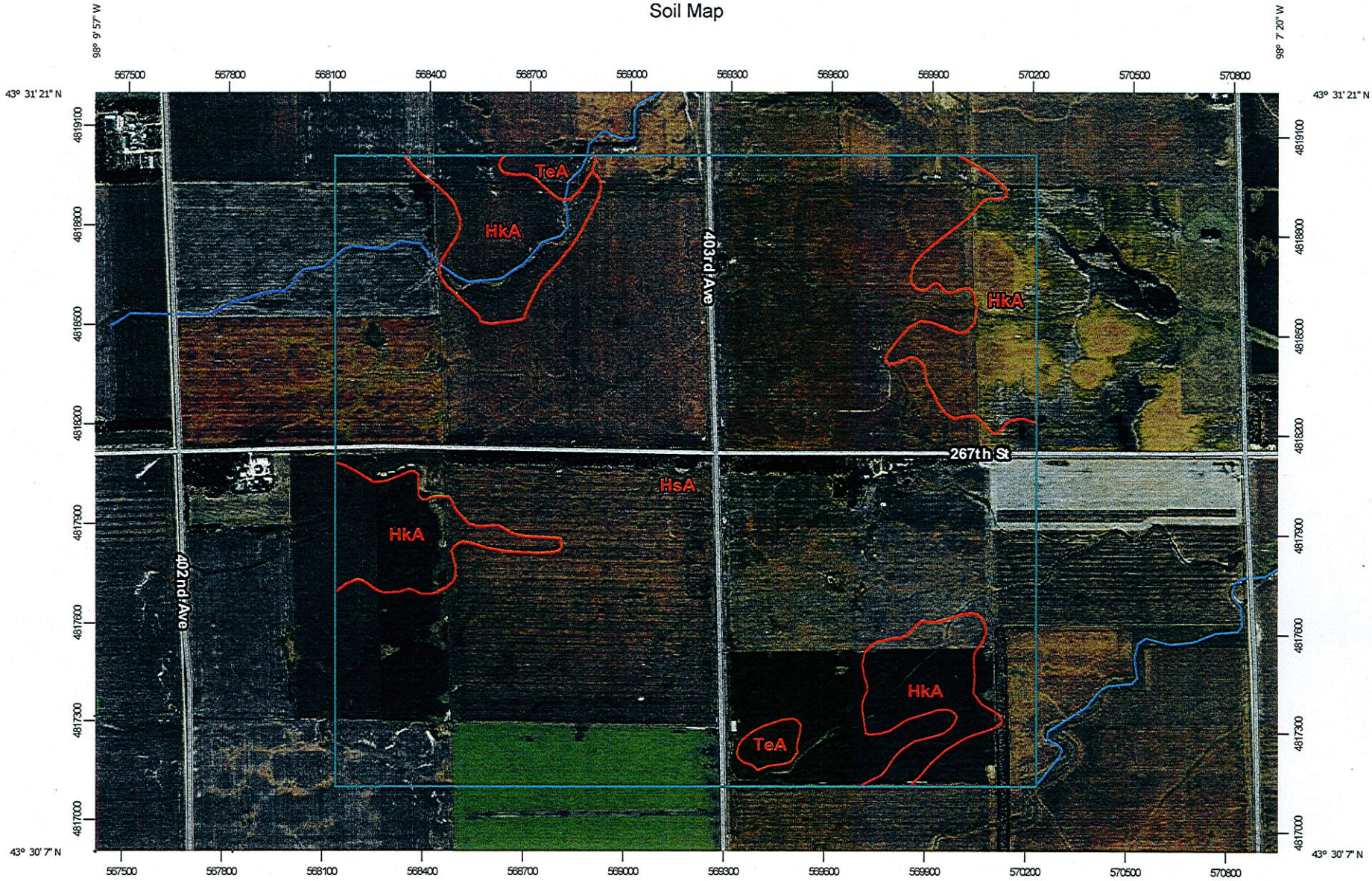
Contents

Preface 2
Soil Map 5
Soil Map 6
Legend 7
Map Unit Legend 8
Map Unit Descriptions 8
Davison County, South Dakota 10
HkA—Houdek-Prosper loams, 0 to 2 percent slopes 10
HsA—Houdek-Stickney complex, 0 to 2 percent slopes 12
TeA—Tetonka silt loam, 0 to 1 percent slopes 14
Soil Information for All Uses 17
Suitabilities and Limitations for Use 17
Disaster Recovery Planning 17
Catastrophic Mortality, Large Animal Disposal, Pit 17

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:16,200 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 200 400 800 1200

Feet: 0 500 1000 2000 3000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 14N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Davison County, South Dakota
Survey Area Data: Version 19, Sep 26, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 15, 2010—Sep 27, 2010

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Davison County, South Dakota (SD035)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
HkA	Houdek-Prosper loams, 0 to 2 percent slopes	157.5	15.9%
HsA	Houdek-Stickney complex, 0 to 2 percent slopes	823.4	83.0%
TeA	Tetonka silt loam, 0 to 1 percent slopes	11.2	1.1%
Totals for Area of Interest		**992.1**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or

landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Davison County, South Dakota

HkA—Houdek-Prosper loams, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2tlbg
Elevation: 1,150 to 2,130 feet
Mean annual precipitation: 20 to 27 inches
Mean annual air temperature: 43 to 52 degrees F
Frost-free period: 130 to 160 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Houdek and similar soils: 58 percent
Prosper and similar soils: 32 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Houdek

Setting

Landform: Plains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy till

Typical profile

Ap - 0 to 6 inches: loam
Bt - 6 to 19 inches: clay loam
Bk - 19 to 42 inches: clay loam
C - 42 to 79 inches: clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 30 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 10.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2c
Hydrologic Soil Group: C
Ecological site: Loamy (R055CY010SD)
Other vegetative classification: Loam (G055CY100SD)
Hydric soil rating: No

Description of Prosper

Setting

Landform: Swales
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Loamy till

Typical profile

Ap - 0 to 6 inches: loam
A - 6 to 11 inches: loam
Bt - 11 to 28 inches: clay loam
Bk - 28 to 40 inches: clay loam
C - 40 to 79 inches: clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 30 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 10.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2c
Hydrologic Soil Group: C
Ecological site: Loamy Overflow (R055CY020SD)
Other vegetative classification: Overflow (G055CY500SD)
Hydric soil rating: No

Minor Components

Stickney

Percent of map unit: 7 percent
Landform: Plains
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: Clayey (R055CY011SD)
Other vegetative classification: Clayey Subsoil (G055CY210SD)
Hydric soil rating: No

Tetonka, undrained

Percent of map unit: 3 percent
Landform: Potholes
Landform position (two-dimensional): Toeslope

Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: Wet Meadow (R055CY004SD)
Other vegetative classification: Wet (G055CY900SD)
Hydric soil rating: Yes

HsA—Houdek-Stickney complex, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2wkp9
Elevation: 1,150 to 2,130 feet
Mean annual precipitation: 20 to 27 inches
Mean annual air temperature: 43 to 52 degrees F
Frost-free period: 130 to 160 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Houdek and similar soils: 50 percent
Stickney and similar soils: 40 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Houdek

Setting

Landform: Ground moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy till

Typical profile

Ap - 0 to 6 inches: loam
Bt - 6 to 19 inches: clay loam
Bk - 19 to 42 inches: clay loam
C - 42 to 79 inches: clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 30 percent

Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 10.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2c
Hydrologic Soil Group: C
Ecological site: Loamy (R055CY010SD)
Other vegetative classification: Loam (G055CY100SD)
Hydric soil rating: No

Description of Stickney

Setting

Landform: Ground moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Fine-loamy till

Typical profile

Ap - 0 to 6 inches: silt loam
E - 6 to 10 inches: silt loam
B/E - 10 to 13 inches: silty clay loam
Btn - 13 to 28 inches: clay loam
Bkyz - 28 to 40 inches: clay loam
Cyz - 40 to 79 inches: clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 30 percent
Gypsum, maximum in profile: 5 percent
Salinity, maximum in profile: Moderately saline to strongly saline (8.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 12.0
Available water storage in profile: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: D
Ecological site: Clayey (R055CY011SD)
Other vegetative classification: Clayey Subsoil (G055CY210SD)
Hydric soil rating: No

Minor Components

Dudley

Percent of map unit: 4 percent

Landform: Ground moraines
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: Claypan (R055CY013SD)
Other vegetative classification: Claypan (G055CY800SD)
Hydric soil rating: No

Prosper

Percent of map unit: 3 percent
Landform: Swales
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: Loamy Overflow (R055CY020SD)
Other vegetative classification: Overflow (G055CY500SD)
Hydric soil rating: No

Tetonka, undrained

Percent of map unit: 3 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: Wet Meadow (R055CY004SD)
Other vegetative classification: Wet (G055CY900SD)
Hydric soil rating: Yes

TeA—Tetonka silt loam, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2tlcd
Elevation: 1,150 to 2,230 feet
Mean annual precipitation: 16 to 27 inches
Mean annual air temperature: 43 to 52 degrees F
Frost-free period: 120 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Tetonka, undrained, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Tetonka, Undrained

Setting

Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Local alluvium over loamy till

Typical profile

Ap - 0 to 8 inches: silt loam
E - 8 to 16 inches: silt loam
Bt - 16 to 39 inches: silty clay
Cg1 - 39 to 46 inches: silty clay loam
2Cg2 - 46 to 79 inches: clay loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.60 in/hr)
Depth to water table: About 0 to 18 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 9.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C/D
Ecological site: Wet Meadow (R055CY004SD)
Other vegetative classification: Wet (G055CY900SD)
Hydric soil rating: Yes

Minor Components

Davison

Percent of map unit: 3 percent
Landform: Rims on depressions
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: Limy Subirrigated (R055CY006SD)
Other vegetative classification: Subirrigated (G055CY700SD)
Hydric soil rating: No

Hoven

Percent of map unit: 3 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: Closed Depression (R053CY019SD)
Other vegetative classification: Not suited (G053CY000SD)
Hydric soil rating: Yes

Crossplain

Percent of map unit: 2 percent
Landform: Drainageways
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: Loamy Overflow (R055CY020SD)
Other vegetative classification: Subirrigated (G055CY700SD)

Hydric soil rating: No

Worthing, undrained

Percent of map unit: 2 percent
Landform: Depressions
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: Shallow Marsh (R055CY001SD)
Other vegetative classification: Not suited (G055CY000SD)
Hydric soil rating: Yes

Soil Information for All Uses

Suitabilities and Limitations for Use

The Suitabilities and Limitations for Use section includes various soil interpretations displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each interpretation.

Disaster Recovery Planning

Disaster recovery planning interpretations are tools for evaluating the suitability of soil for various aspects of recovery operations in response to catastrophic events such as hurricanes, earthquakes, large fires, or terrorist attacks. Example interpretations include burial of large numbers of dead cattle, disposal of large amounts of debris, and composting of vegetative materials.

Catastrophic Mortality, Large Animal Disposal, Pit

"Catastrophic mortality, large animal disposal, pit," is a method of disposing of dead animals by placing the carcasses in successive layers in an excavated pit. The carcasses are spread, compacted, and covered daily with a thin layer of soil that is excavated from the pit. When the pit is full, a final cover of soil material at least 2 feet thick is placed over the burial pit.

The interpretation is applicable to both heavily populated and sparsely populated areas. While some general observations may be made, onsite evaluation is required before the final site is selected. Improper site selection, design, or installation may cause contamination of ground water, seepage, and contamination of stream systems from surface drainage or floodwater. The risk of contamination can be reduced or eliminated by installing systems designed to eliminate or reduce the adverse effects of limiting soil properties. Ratings are for soils in their present condition. The present land use is not considered in the ratings.

Ratings are based on properties and qualities to the depth normally observed during soil mapping (approximately 6 or 7 feet). However, because pits may be as deep as 15 feet or more, geologic investigations are needed to determine the potential for pollution of ground water and to determine the design needed. These investigations,

which are generally arranged by the pit developer, include examination of stratification, rock formations, and geologic conditions that might lead to the conducting of leachates to aquifers, wells, watercourses, and other water sources. The presence of hard, nonrippable bedrock, bedrock crevices, or highly permeable strata at or directly below the proposed pit bottom is undesirable because of the difficulty in excavation and the potential pollution of underground water.

Properties that influence the risk of pollution, ease of excavation, trafficability, and revegetation are major considerations. Soils that are flooded or have a water table within the depth of excavation present a potential pollution hazard and are difficult to excavate. Slope is an important consideration because it affects the work involved in road construction, the performance of the roads, and the control of surface water around the pit. It may also cause difficulty in constructing pits in which the pit bottom must be kept level and oriented to follow the contour of the land.

The ease with which the pit is dug and with which a soil can be used as daily and final cover is based largely on soil texture and consistence, which determine workability when the soil is dry and when it is wet. Soils that are plastic and sticky when wet are difficult to excavate, grade, or compact and difficult to place as a uniformly thick cover over a layer of carcasses. The uppermost part of the final cover should be soil material that favors the growth of plants. It should not contain excess sodium or salts and should not be too acid. In comparison with other horizons, the surface layer in most soils has the best workability and the highest content of organic matter. Thus, it may be desirable to stockpile the surface layer for use in the final blanketing of the filled pit area.

The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses. "Not limited" indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected of a properly designed and installed system. "Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. "Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings indicate the severity of the individual limitations. The ratings are shown in decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are determined by the aggregation method chosen. An aggregated rating class is shown for each map unit. The components listed for each map unit are only those that have the same rating class as listed for the map unit. The percent composition of each component in a particular map unit is presented to help the user better understand the percentage of each map unit that has the rating presented.

Other components with different ratings may be present in each map unit. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the equivalent report from the Soil Reports tab in Web Soil Survey or from the Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

Custom Soil Resource Report
Map—Catastrophic Mortality, Large Animal Disposal, Pit

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Soil Rating Lines
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Soil Rating Points
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Davison County, South Dakota
Survey Area Data: Version 19, Sep 26, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 15, 2010—Sep 27, 2010

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Tables—Catastrophic Mortality, Large Animal Disposal, Pit

Catastrophic Mortality, Large Animal Disposal, Pit— Summary by Map Unit — Davison County, South Dakota (SD035)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
HkA	Houdek-Prosper loams, 0 to 2 percent slopes	Somewhat limited	Houdek (58%)	Dusty (0.07)	157.5	15.9%
				Unstable excavation walls (0.01)		
			Prosper (32%)	Water gathering surface (0.20)		
				Dusty (0.07)		
				Unstable excavation walls (0.01)		
			Stickney (7%)	Water gathering surface (0.33)		
				Dusty (0.09)		
				Unstable excavation walls (0.01)		
HsA	Houdek-Stickney complex, 0 to 2 percent slopes	Somewhat limited	Houdek (50%)	Dusty (0.07)	823.4	83.0%
				Unstable excavation walls (0.01)		
			Stickney (40%)	Dusty (0.11)		
				Unstable excavation walls (0.01)		
			Prosper (3%)	Water gathering surface (0.20)		
				Dusty (0.07)		
				Unstable excavation walls (0.01)		
TeA	Tetonka silt loam, 0 to 1 percent slopes	Very limited	Tetonka, undrained (90%)	Ponding (1.00)	11.2	1.1%
				Wetness (1.00)		
				Water gathering surface (0.50)		
				Dusty (0.11)		
				Unstable excavation walls (0.01)		
			Hoven (3%)	Ponding (1.00)		
				Wetness (1.00)		
				Excess sodium (1.00)		

Catastrophic Mortality, Large Animal Disposal, Pit— Summary by Map Unit — Davison County, South Dakota (SD035)						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
				Water gathering surface (0.50)		
				Dusty (0.11)		
			Crossplain (2%)	Flooding (1.00)		
				Wetness (1.00)		
				Water gathering surface (0.33)		
				Dusty (0.07)		
				Unstable excavation walls (0.01)		
			Worthing, undrained (2%)	Ponding (1.00)		
				Wetness (1.00)		
				Unstable excavation walls (0.51)		
				Water gathering surface (0.50)		
				Dusty (0.11)		
Totals for Area of Interest					**992.1**	**100.0%**

Catastrophic Mortality, Large Animal Disposal, Pit— Summary by Rating Value		
Rating	Acres in AOI	Percent of AOI
Somewhat limited	980.9	98.9%
Very limited	11.2	1.1%
Totals for Area of Interest	**992.1**	**100.0%**

Rating Options—Catastrophic Mortality, Large Animal Disposal, Pit

Aggregation Method: Dominant Condition

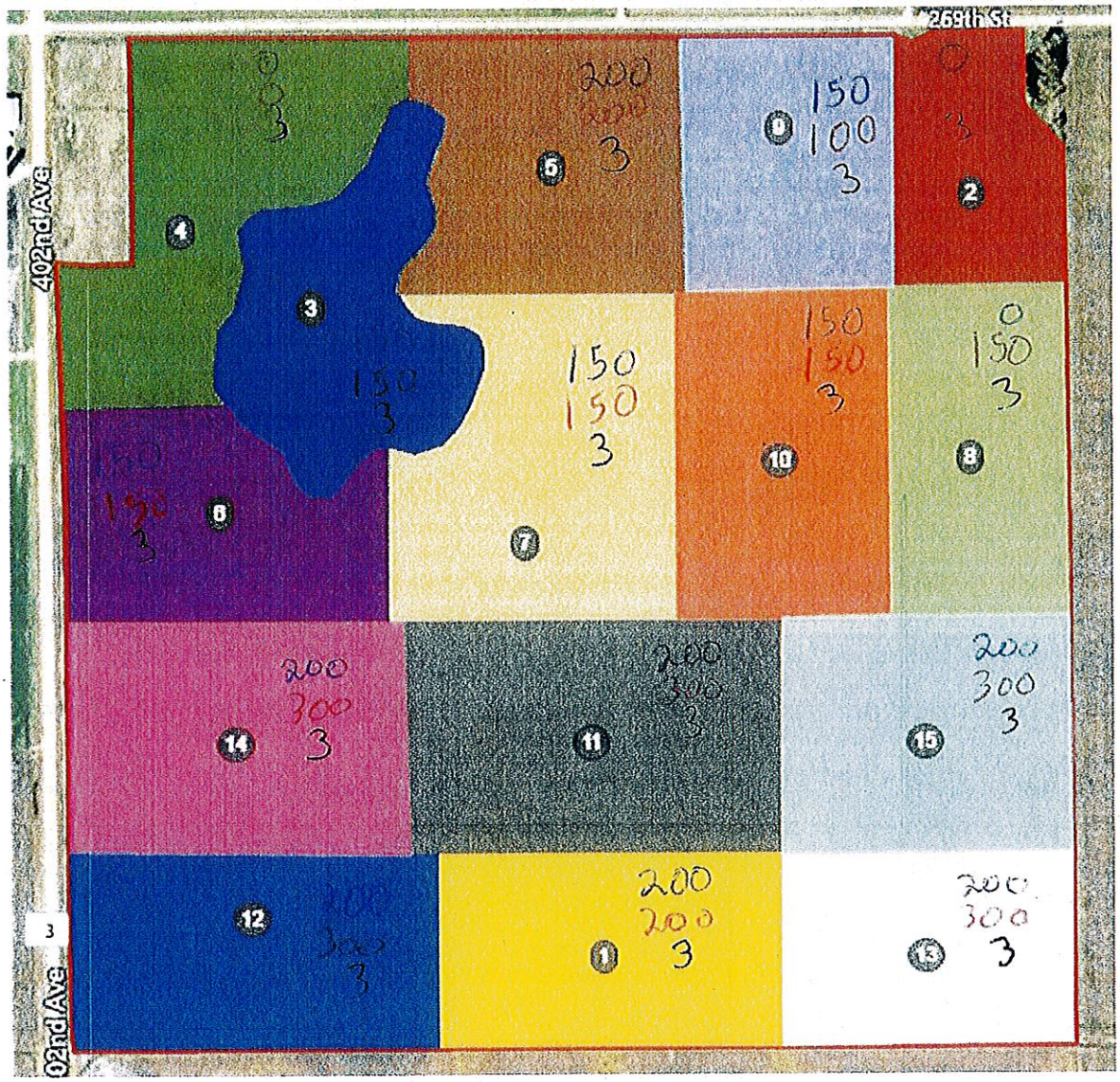
Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NW¼ 14-100-62

SOILRIGHT
A FAMILYFARMS COMPANY

South Branch
LuebkeKlumbs – 151 acres



lb/A

BROOKSIDE LABORATORIES, INC.

77099-42

SOIL AUDIT AND INVENTORY REPORT

Name Family Farms SR City Brighton State IL

Independent Consultant SoilRight, LLC Date 12/1/2016

NW¼ 14-100-42

Sample Location LuebkeKlumbs				1	ZN2	ZN3	ZN4	ZN5
Sample Identification								
Lab Number				0077-1	0078-1	0079-1	0080-1	0081-1
Total Exchange Capacity (ME/100 g)				21.58	22.69	30.93	24.04	23.15
pH (H_2O 1:1)				5.6	6.7	5.1	5.8	5.3
Organic Matter (humus) %				3.56	4.00	4.61	3.99	4.25
Estimated Nitrogen Release			lb/A	86	90	96	90	92
ANIONS	SOLUBLE SULFUR*		ppm	14	286	54	11	164
	PHOSPHORUS MEHLICH III	lb/A	P as P_2O_5	78	376	142	261	137
			ppm of P	17	82	31	57	30
	PHOSPHORUS BRAY II	lb/A	P as P_2O_5	92	623	142	353	174
			ppm of P	20	136	31	77	38
	PHOSPHORUS OLSEN	lb/A	P as P_2O_5					
			ppm of P					
EXCHANGEABLE CATIONS	CALCIUM*		lb/A	3796	4304	3946	4130	3034
			ppm	1898	2152	1973	2065	1517
	MAGNESIUM*		lb/A	1076	1862	1216	1436	1136
			ppm	538	931	608	718	568
	POTASSIUM*		lb/A	226	722	390	888	268
			ppm	113	361	195	444	134
	SODIUM*		lb/A	70	534	130	68	266
			ppm	35	267	65	34	133
BASE SATURATION PERCENT								
	Calcium	%		43.98	47.42	31.89	42.95	32.76
	Magnesium	%		20.78	34.19	16.38	24.89	20.45
	Potassium	%		1.34	4.08	1.62	4.74	1.48
	Sodium	%		0.71	5.12	0.91	0.61	2.50
	Other Bases	%		6.20	4.70	7.20	5.80	6.80
	Hydrogen	%		27.00	4.50	42.00	21.00	36.00
EXTRACTABLE MINORS								
	Boron* (ppm)			0.38	0.75	0.60	0.81	0.78
	Iron* (ppm)			122	133	182	179	153
	Manganese* (ppm)			51	110	76	85	79
	Copper* (ppm)			1.87	2.42	2.01	2.44	1.77
	Zinc* (ppm)			1.19	4.91	1.80	4.27	1.92
	Aluminum* (ppm)			715	469	757	663	593
OTHER TESTS	Soluble Salts (mmhos/cm)							
	Chlorides (ppm)							

* Mehlich III Extractable

lb/A

BROOKSIDE LABORATORIES, INC.

77099-42

SOIL AUDIT AND INVENTORY REPORT

Name Family Farms SR City Brighton State IL

Independent Consultant SoilRight, LLC Date 12/1/2016

NW 1/4 14-100-62

Sample Location LuebkeKlumbs				ZN6	ZN7	ZN8	ZN9	ZN10
Sample Identification								
Lab Number				0082-1	0083-1	0084-1	0085-1	0086-1
Total Exchange Capacity (ME/100 g)				23.95	23.18	27.67	29.55	27.53
pH (H_2O 1:1)				5.8	5.3	5.2	5.4	5.3
Organic Matter (humus) %				4.17	4.27	4.01	4.22	3.64
Estimated Nitrogen Release			lb/A	92	93	90	92	86
ANIONS	SOLUBLE SULFUR*		ppm	31	35	87	41	39
	PHOSPHORUS MEHLICH III	lb/A	P as P_2O_5	133	124	211	160	142
			ppm of P	29	27	46	35	31
	PHOSPHORUS BRAY II	lb/A	P as P_2O_5	142	169	234	197	183
			ppm of P	31	37	51	43	40
	PHOSPHORUS OLSEN	lb/A	P as P_2O_5					
			ppm of P					
EXCHANGEABLE CATIONS	CALCIUM*		lb/A	4390	3124	3314	4332	3828
			ppm	2195	1562	1657	2166	1914
	MAGNESIUM*		lb/A	1390	1134	1374	1482	1326
			ppm	695	567	687	741	663
	POTASSIUM*		lb/A	414	378	362	438	314
			ppm	207	189	181	219	157
	SODIUM*		lb/A	106	110	216	130	114
			ppm	53	55	108	65	57
BASE SATURATION PERCENT								
Calcium		%		45.82	33.69	29.94	36.65	34.76
Magnesium		%		24.18	20.38	20.69	20.90	20.07
Potassium		%		2.22	2.09	1.68	1.90	1.46
Sodium		%		0.96	1.03	1.70	0.96	0.90
Other Bases		%		5.80	6.80	7.00	6.60	6.80
Hydrogen		%		21.00	36.00	39.00	33.00	36.00
EXTRACTABLE MINORS								
Boron* (ppm)				0.97	0.61	0.75	0.57	0.53
Iron* (ppm)				149	140	165	180	156
Manganese* (ppm)				129	79	109	93	95
Copper* (ppm)				2.28	1.58	1.77	2.21	2.12
Zinc* (ppm)				2.64	2.15	2.30	2.03	1.79
Aluminum* (ppm)				704	624	706	775	747
OTHER TESTS	Soluble Salts (mmhos/cm)							
	Chlorides (ppm)							

* Mehlich III Extractable

lb/A

BROOKSIDE LABORATORIES, INC.

77099-42

SOIL AUDIT AND INVENTORY REPORT

Name Family Farms SR City Brighton State IL

Independent Consultant SoilRight, LLC Date 12/1/2016

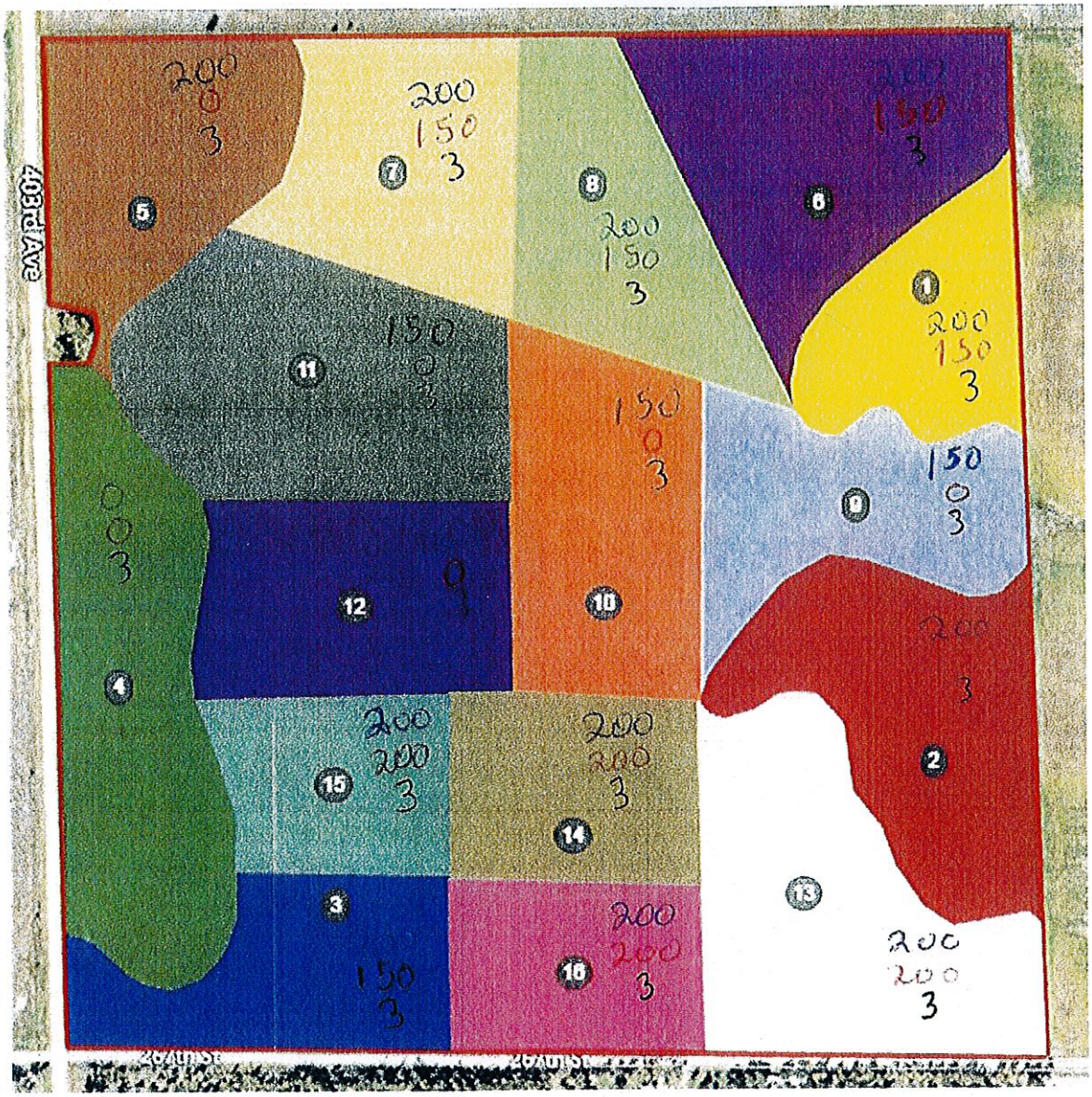
NW¼ 14-100-62

Sample Location LuebkeKlumbs						
Sample Identification		11	12	13	14	15
Lab Number		0087-1	0088-1	0089-1	0090-1	0091-1
Total Exchange Capacity (ME/100 g)		23.02	12.07	22.75	21.39	19.56
pH (H_2O 1:1)		5.5	5.6	5.8	5.8	5.7
Organic Matter (humus) %		3.81	3.48	3.72	3.61	3.59
Estimated Nitrogen Release	lb/A	88	85	87	86	86
ANIONS — SOLUBLE SULFUR*	ppm	107	13	46	34	19
ANIONS — PHOSPHORUS — MEHLICH III	lb/A P as P_2O_5	87	115	96	82	73
	ppm of P	19	25	21	18	16
ANIONS — PHOSPHORUS — BRAY II	lb/A P as P_2O_5	101	147	110	92	82
	ppm of P	22	32	24	20	18
ANIONS — PHOSPHORUS — OLSEN	lb/A P as P_2O_5					
	ppm of P					
EXCHANGEABLE CATIONS — CALCIUM*	lb/A	3374	2108	4074	3842	3326
	ppm	1687	1054	2037	1921	1663
EXCHANGEABLE CATIONS — MAGNESIUM*	lb/A	1310	612	1418	1308	1170
	ppm	655	306	709	654	585
EXCHANGEABLE CATIONS — POTASSIUM*	lb/A	188	134	218	234	222
	ppm	94	67	109	117	111
EXCHANGEABLE CATIONS — SODIUM*	lb/A	232	32	130	140	100
	ppm	116	16	65	70	50
BASE SATURATION PERCENT						
Calcium	%	36.64	43.66	44.77	44.90	42.51
Magnesium	%	23.71	21.13	25.97	25.48	24.92
Potassium	%	1.05	1.42	1.23	1.40	1.46
Sodium	%	2.19	0.58	1.24	1.42	1.11
Other Bases	%	6.40	6.20	5.80	5.80	6.00
Hydrogen	%	30.00	27.00	21.00	21.00	24.00
EXTRACTABLE MINORS						
Boron* (ppm)		0.37	0.23	0.58	0.48	0.57
Iron* (ppm)		116	65	122	103	119
Manganese* (ppm)		59	39	81	72	64
Copper* (ppm)		1.72	0.91	2.07	1.62	1.69
Zinc* (ppm)		1.47	1.24	1.20	1.47	1.17
Aluminum* (ppm)		654	368	722	632	625
OTHER TESTS — Soluble Salts (mmhos/cm)						
Chlorides (ppm)						

* Mehlich III Extractable

SOILRIGHT
A FAMILYFARMS COMPANY

South Branch
LuebkesDavisonNE – 153 acres SW¼ 27-101-61



lb/A

BROOKSIDE LABORATORIES, INC.

77099-21

SOIL AUDIT AND INVENTORY REPORT

Name Family Farms SR City Brighton State IL

Independent Consultant SoilRight, LLC Date 11/30/2016

NE SW 330-004-01 SW 1/4 27-101-6|

Sample Location	LuebkesDavisonNE	ZN1	ZN2	ZN3	ZN4	ZN5
Sample Identification						
Lab Number		1808-1	1809-1	1810-1	1811-1	1812-1
Total Exchange Capacity (ME/100 g)		26.28	24.17	28.18	26.37	21.73
pH (H_2O 1:1)		5.2	5.6	5.7	6.9	5.9
Organic Matter (humus) %		3.66	3.20	3.30	3.88	3.76
Estimated Nitrogen Release	lb/A	87	82	83	89	88
ANIONS — SOLUBLE SULFUR*	ppm	10	7	307	212	18
ANIONS — PHOSPHORUS — MEHLICH III	lb/A P as P_2O_5	137	64	147	266	96
	ppm of P	30	14	32	58	21
ANIONS — PHOSPHORUS — BRAY II	lb/A P as P_2O_5	156	92	192	431	115
	ppm of P	34	20	42	94	25
ANIONS — PHOSPHORUS — OLSEN	lb/A P as P_2O_5					
	ppm of P					
EXCHANGEABLE CATIONS — CALCIUM*	lb/A	3732	4056	3188	6478	4058
	ppm	1866	2028	1594	3239	2029
EXCHANGEABLE CATIONS — MAGNESIUM*	lb/A	1018	1296	2272	1648	1348
	ppm	509	648	1136	824	674
EXCHANGEABLE CATIONS — POTASSIUM*	lb/A	408	400	360	818	464
	ppm	204	200	180	409	232
EXCHANGEABLE CATIONS — SODIUM*	lb/A	44	44	842	310	114
	ppm	22	22	421	155	57
BASE SATURATION PERCENT						
Calcium	%	35.50	41.95	28.28	61.41	46.69
Magnesium	%	16.14	22.34	33.59	26.04	25.85
Potassium	%	1.99	2.12	1.64	3.98	2.74
Sodium	%	0.36	0.40	6.50	2.56	1.14
Other Bases	%	7.00	6.20	6.00	4.50	5.60
Hydrogen	%	39.00	27.00	24.00	1.50	18.00
EXTRACTABLE MINORS						
Boron* (ppm)		0.34	0.49	0.61	1.09	0.83
Iron* (ppm)		144	112	129	106	123
Manganese* (ppm)		85	72	92	145	76
Copper* (ppm)		1.79	1.91	1.81	2.73	1.91
Zinc* (ppm)		1.86	1.17	2.62	7.27	2.20
Aluminum* (ppm)		735	675	569	488	582
OTHER TESTS — Soluble Salts (mmhos/cm)						
Chlorides (ppm)						

* Mehlich III Extractable

lb/A

BROOKSIDE LABORATORIES, INC.

77099-21

SOIL AUDIT AND INVENTORY REPORT

Name Family Farms SR City Brighton State IL

Independent Consultant SoilRight, LLC Date 11/30/2016

[illegible] SW 1/4 27-101-41

Sample Location			LuebkesDavisonNE	ZN6	ZN7	ZN8	ZN9	ZN10
Sample Identification								
Lab Number				1813-1	1814-1	1815-1	1816-1	1817-1
Total Exchange Capacity (ME/100 g)				28.46	29.56	28.52	28.40	29.34
pH (H_2O 1:1)				5.2	5.3	5.3	5.1	5.2
Organic Matter (humus) %				3.76	3.73	3.85	3.81	3.78
Estimated Nitrogen Release			lb/A	88	87	88	88	88
ANIONS	SOLUBLE SULFUR*		ppm	9	32	12	11	20
ANIONS	PHOSPHORUS	MEHLICH III lb/A	P as P_2O_5	119	82	87	192	156
			ppm of P	26	18	19	42	34
		BRAY II lb/A	P as P_2O_5	165	101	110	197	156
			ppm of P	36	22	24	43	34
		OLSEN lb/A	P as P_2O_5					
			ppm of P					
EXCHANGEABLE CATIONS	CALCIUM*		lb/A	4034	4158	4120	3886	3936
			ppm	2017	2079	2060	1943	1968
	MAGNESIUM*		lb/A	1106	1376	1286	940	1222
			ppm	553	688	643	470	611
	POTASSIUM*		lb/A	448	456	424	550	560
			ppm	224	228	212	275	280
	SODIUM*		lb/A	46	90	52	42	88
			ppm	23	45	26	21	44
BASE SATURATION PERCENT								
	Calcium		%	35.44	35.17	36.12	34.21	33.54
	Magnesium		%	16.19	19.40	18.79	13.79	17.35
	Potassium		%	2.02	1.98	1.91	2.48	2.45
	Sodium		%	0.35	0.66	0.40	0.32	0.65
	Other Bases		%	7.00	6.80	6.80	7.20	7.00
	Hydrogen		%	39.00	36.00	36.00	42.00	39.00
EXTRACTABLE MINORS								
	Boron* (ppm)			0.47	0.57	0.45	0.48	0.50
	Iron* (ppm)			136	145	142	171	177
	Manganese* (ppm)			91	76	88	86	106
	Copper* (ppm)			1.76	2.10	2.04	2.07	2.08
	Zinc* (ppm)			2.04	1.86	1.80	2.08	2.90
	Aluminum* (ppm)			659	732	729	809	769
OTHER TESTS	Soluble Salts (mmhos/cm)							
	Chlorides (ppm)							

* Mehlich III Extractable

lb/A

BROOKSIDE LABORATORIES, INC.

77099-21

SOIL AUDIT AND INVENTORY REPORT

Name Family Farms SR City Brighton State IL

Independent Consultant SoilRight, LLC Date 11/30/2016

NE 1/4 of SW 1/4 27-101-6|

Sample Location	LuebkesDavisonNE	ZN11	ZN12	ZN13	ZN14	ZN15
Sample Identification						
Lab Number		1818-1	1819-1	1820-1	1821-1	1822-1
Total Exchange Capacity (ME/100 g)		28.15	24.22	24.90	25.73	27.41
pH (H_2O 1:1)		5.5	5.7	5.7	5.3	5.5
Organic Matter (humus) %		3.62	3.40	3.29	3.49	3.57
Estimated Nitrogen Release	lb/A	86	84	83	85	86
ANIONS — SOLUBLE SULFUR*	ppm	41	15	65	49	139
ANIONS — PHOSPHORUS — MEHLICH III	lb/A P as P_2O_5	119	275	60	82	119
	ppm of P	26	60	13	18	26
ANIONS — PHOSPHORUS — BRAY II	lb/A P as P_2O_5	124	412	87	105	179
	ppm of P	27	90	19	23	39
ANIONS — PHOSPHORUS — OLSEN	lb/A P as P_2O_5					
	ppm of P					
EXCHANGEABLE CATIONS — CALCIUM*	lb/A	3990	4250	4408	3396	3766
	ppm	1995	2125	2204	1698	1883
MAGNESIUM*	lb/A	1636	1262	1362	1336	1672
	ppm	818	631	681	668	836
POTASSIUM*	lb/A	590	706	304	314	384
	ppm	295	353	152	157	192
SODIUM*	lb/A	162	76	160	118	256
	ppm	81	38	80	59	128
BASE SATURATION PERCENT						
Calcium	%	35.44	43.87	44.26	33.00	34.35
Magnesium	%	24.22	21.71	22.79	21.63	25.42
Potassium	%	2.69	3.74	1.57	1.56	1.80
Sodium	%	1.25	0.68	1.40	1.00	2.03
Other Bases	%	6.40	6.00	6.00	6.80	6.40
Hydrogen	%	30.00	24.00	24.00	36.00	30.00
EXTRACTABLE MINORS						
Boron* (ppm)		0.75	0.64	0.66	0.49	0.64
Iron* (ppm)		155	171	107	122	131
Manganese* (ppm)		104	65	68	80	81
Copper* (ppm)		2.26	2.16	1.99	1.65	1.71
Zinc* (ppm)		2.33	2.10	1.45	1.86	1.94
Aluminum* (ppm)		714	654	563	644	606
OTHER TESTS — Soluble Salts (mmhos/cm)						
Chlorides (ppm)						

* Mehlich III Extractable

lb/A

BROOKSIDE LABORATORIES, INC.

77099-21

SOIL AUDIT AND INVENTORY REPORT

Name Family Farms SR City Brighton State IL

Independent Consultant SoilRight, LLC Date 11/30/2016

NE 1/4 SW 1/4 27-10-1E

Sample Location LuebkesDavisonNE		ZN16				
Sample Identification						
Lab Number		1823-1				
Total Exchange Capacity (ME/100 g)		28.20				
pH (H_2O 1:1)		5.4				
Organic Matter (humus) %		3.56				
Estimated Nitrogen Release	lb/A	86				
ANIONS — SOLUBLE SULFUR*	ppm	17				
ANIONS — PHOSPHORUS — MEHLICH III	lb/A P as P_2O_5	119				
	ppm of P	26				
ANIONS — PHOSPHORUS — BRAY II	lb/A P as P_2O_5	128				
	ppm of P	28				
ANIONS — PHOSPHORUS — OLSEN	lb/A P as P_2O_5					
	ppm of P					
EXCHANGEABLE CATIONS — CALCIUM*	lb/A	4294				
	ppm	2147				
EXCHANGEABLE CATIONS — MAGNESIUM*	lb/A	1358				
	ppm	679				
EXCHANGEABLE CATIONS — POTASSIUM*	lb/A	378				
	ppm	189				
EXCHANGEABLE CATIONS — SODIUM*	lb/A	72				
	ppm	36				
BASE SATURATION PERCENT						
Calcium	%	38.07				
Magnesium	%	20.07				
Potassium	%	1.72				
Sodium	%	0.56				
Other Bases	%	6.60				
Hydrogen	%	33.00				
EXTRACTABLE MINORS						
Boron* (ppm)		0.52				
Iron* (ppm)		135				
Manganese* (ppm)		80				
Copper* (ppm)		2.14				
Zinc* (ppm)		1.78				
Aluminum* (ppm)		749				
OTHER TESTS — Soluble Salts (mmhos/cm)						
OTHER TESTS — Chlorides (ppm)						

* Mehlich III Extractable

NW 14-100-62		SW 27-101-61	
P	K	P	K
20	113	34	204
136	631	20	200
31	195	42	180
77	444	94	409
38	134	25	323
31	207	36	224
37	189	22	228
51	181	24	212
43	219	43	275
40	157	34	280
22	94	27	295
32	67	90	353
24	109	19	152
20	117	23	157
18	11	39	192
		28	189
41	**191**	**38**	**242**

REPORT NUMBER
17-147-0013
COMPLETED DATE
Jun 1, 2017
RECEIVED DATE
May 27, 2017
ACCOUNT
5138

Midwest Laboratories®

13611 B Street • Omaha, Nebraska 68144-3693 • (402) 334-7770
www.midwestlabs.com

TODAY'S DATE
Jun 01, 2017

IDENTIFICATION
CAL LUEBKE

KAYLOR GRAIN
PO BOX 66
KAYLOR SD 57354-

SOIL ANALYSIS REPORT

INFO SHEET: 909146

LAB NUMBER *314*	SAMPLE IDENTIFICATION	ORGANIC MATTER (MODIFIED LOI)	PHOSPHORUS			NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)				pH		CATION EXCHANGE CAPACITY	PERCENT BASE SATURATION (COMPUTED)				
			P_1 (WEAK BRAY) 1:7	P_2 (STRONG BRAY) 1:7	BICARBONATE P	POTASSIUM K	MAGNESIUM Mg	CALCIUM Ca	SODIUM Na	SOIL pH 1:1	BUFFER INDEX	C.E.C. meq/100g	% K	% Mg	% Ca	% H	% Na
		percent RATE	ppm RATE	ppm RATE	ppm RATE	ppm RATE	ppm RATE	ppm RATE	ppm RATE								
12149	E GEIDEL Sec 14-100-62	2.8 M	20 M	31 M		231 H	805 VH	3090 M	74	6.8		23.1	2.6	29.0	67.0	0.0	1.4
12151	W BETTS	2.3 L	16 M	25 M	13 M	236 M	1094 VH	4015 M	237 VH	7.3		30.8	2.0	29.6	65.1	0.0	3.3

LAB NUMBER	NITRATE-N (FIA)										SULFUR S	ZINC Zn	MANGANESE Mn	IRON Fe	COPPER Cu	BORON B	EXCESS LIME RATE	SOLUBLE SALTS 1:1	
	SURFACE			SUBSOIL 1			SUBSOIL 2			Total lbs/A									
314	ppm	lbs/A	depth (in)	ppm	lbs/A	depth (in)	ppm	lbs/A	depth (in)		ppm RATE	ppm RATE	ppm RATE	ppm RATE	ppm RATE	ppm RATE		mmhos/cm RATE	
12149	9	16	0-6	9	49	6-24				65	48 VH	2.6 M	18 H	87 VH	1.8 H	0.8 M	L	0.1 L	
12151	10	18	0-6	11	59	6-24				77	696 VH	1.5 M	10 M	70 VH	1.7 H	1.2 M	M	2.1 M	

REV. 12/03

The above analytical results apply only to the sample(s) submitted. Samples are retained a maximum of 30 days.

Our reports and letters are for the exclusive and confidential use of our clients and may not be reproduced in whole or in part, nor may any reference be made to the work, the results, or the company in any advertising, news release, or other public announcements without obtaining our prior written authorization.

REPORT NUMBER
17-147-0013
COMPLETED DATE
Jun 1, 2017
RECEIVED DATE
May 27, 2017
ACCOUNT
5138

Midwest Laboratories®

13611 B Street • Omaha, Nebraska 68144-3693 • (402) 334-7770
www.midwestlabs.com

TODAY'S DATE
Jun 01, 2017

IDENTIFICATION
CAL LUEBKE

KAYLOR GRAIN
PO BOX 66
KAYLOR SD 57354-

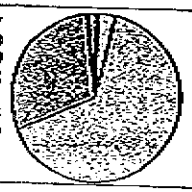
FIRST FORM

ANALYTICAL LABORATORY FINDINGS

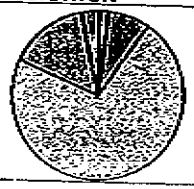
SAMPLE IDENTIFICATION: W BETTS
LABORATORY NUMBER: 31412151

ANALYTE	UNITS	RESULTS	LOW	MEDIUM	OPTIMUM	V. HIGH
ORGANIC MATTER	%	2.3				
EST N RELEASE	lbs/A					
NITRATE-N	ppm	10				
SUB-SOIL NO_3-N 1	ppm	11				
SUB-SOIL NO_3-N 2	ppm					
P_1 PHOSPHORUS	ppm	16				
P_2 PHOSPHORUS	ppm	25				
BCARB-P	ppm	13				
POTASSIUM	ppm	236				
MAGNESIUM	ppm	1094				
SULFUR	ppm	696				
ZINC	ppm	1.5				
MANGANESE	ppm	10				
IRON	ppm	70				
COPPER	ppm	1.7				
BORON	ppm	1.2				
CALCIUM	ppm	4015				
SODIUM	ppm	237				
SOLUBLE SALTS	mmhos/cm	2.1				
EXCESS LIME RATE		M				
pH		7.3				
BUFFER INDEX						
C.E.C.	meq/100g	30.8				

PERCENT BASE SATURATION



K	2.0 %
Mg	29.6 %
Ca	65.1 %
Na	3.3 %



K	2 - 5%
Mg	12 - 18%
Ca	65 - 75%
H	0-12%
Na	< 1.5%

APPLICATION GUIDELINES

INTENDED CROP: SOYBEANS - bu
YIELD GOAL: 60.0
PREVIOUS CROP: CORN - bu

SUGGESTED FERTILITY GUIDELINES (lbs/Acre)

FERTILITY ELEMENT	CROP REMOVAL	MIDWEST SUGGESTS	CROP REMOVAL	MIDWEST SUGGESTS	CROP REMOVAL	MIDWEST SUGGESTS
NITROGEN (N)	247	–				
CARRYOVER N		(77) lbs				
PHOSPHATE (P_2O_5)	54	75				
POTASH (K_2O)	84	50				
MAGNESIUM (Mg)	13.5	--				
SULFUR (S)	10.8	--				
ZINC (Zn)	0.3	1.8				
MANGANESE (Mn)		1.1				
IRON (Fe)		--				
COPPER (Cu)		--				
BORON (B)		--				

SUGGESTED AMENDMENT GUIDELINES

AMENDMENT	MIDWEST SUGGESTS	MIDWEST SUGGESTS	MIDWEST SUGGESTS
LIME POUNDS			
LIME TON			
ELEMENTAL SULFUR	70		
GYPSUM TONS			

COMMENTS

Surface Nitrate Depth: 0-6 *Sub-Soil 1 Nitrate Depth: 6-24*

The above analytical results apply only to the sample(s) submitted.
Samples are retained a maximum of 30 days.

Our reports and letters are for the exclusive and confidential use of our clients and may not be reproduced in whole or in part, nor may any reference be made to the work, the results, or the company in any advertising, news release, or other public announcements without obtaining our prior written authorization.

REPORT NUMBER
17-147-0013
COMPLETED DATE
Jun 1, 2017
RECEIVED DATE
May 27, 2017
ACCOUNT
5138

Midwest Laboratories®

13611 B Street • Omaha, Nebraska 68144-3693 • (402) 334-7770
www.midwestlabs.com

TODAY'S DATE
Jun 01, 2017

IDENTIFICATION
CAL LUEBKE

KAYLOR GRAIN
PO BOX 66
KAYLOR SD 57354-

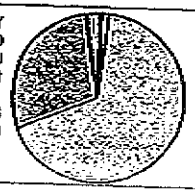
FIRST FORM

ANALYTICAL LABORATORY FINDINGS

SAMPLE IDENTIFICATION	E GEIDEL
LABORATORY NUMBER	31412149

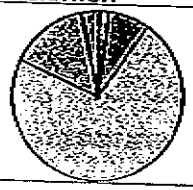
ANALYTE	UNITS	RESULTS	LOW MEDIUM OPTIMUM V. HIGH
ORGANIC MATTER	%	2.8	
EST N RELEASE	lbs/A		
NITRATE-N	ppm	9	
SUB-SOIL NO_3-N 1	ppm	9	
SUB-SOIL NO_3-N 2	ppm		
P_1 PHOSPHORUS	ppm	20	
P_1 PHOSPHORUS	ppm	31	
BICARB-P	ppm		
POTASSIUM	ppm	231	
MAGNESIUM	ppm	805	
SULFUR	ppm	48	
ZINC	ppm	2.6	
MANGANESE	ppm	18	
IRON	ppm	87	
COPPER	ppm	1.8	
BORON	ppm	0.8	
CALCIUM	ppm	3090	
SODIUM	ppm	74	
SOLUBLE SALTS	mmhos/cm	0.1	
EXCESS LIME RATE		L	
pH		6.8	
BUFFER INDEX			
C.E.C.	meq/100g	23.1	

PERCENT BASE SATURATION



K	A	2.6 %
Mg	B	29.0 %
Ca	C	67.0 %
Na	D	1.4 %

YOUR SOIL



K	G	2 - 5%
Mg	E	12 - 18%
Ca	F	65 - 75%
H	H	0-12%
Na	D	< 1.5%

OPTIMUM

APPLICATION GUIDELINES

INTENDED CROP	SOYBEANS - bu
YIELD GOAL	60.0
PREVIOUS CROP	CORN - bu

SUGGESTED FERTILITY GUIDELINES (lbs/Acre)

FERTILITY ELEMENT	CROP REMOVAL	MIDWEST SUGGESTS	CROP REMOVAL	MIDWEST SUGGESTS	CROP REMOVAL	MIDWEST SUGGESTS
NITROGEN (N)	247	--				
CARRYOVER N		(65) lbs				
PHOSPHATE (P_2O_5)	54	65				
POTASH (K_2O)	84	50				
MAGNESIUM (Mg)	13.5	--				
SULFUR (S)	10.8	--				
ZINC (Zn)	0.3	--				
MANGANESE (Mn)		--				
IRON (Fe)		--				
COPPER (Cu)		--				
BORON (B)		--				

SUGGESTED AMENDMENT GUIDELINES

AMENDMENT	MIDWEST SUGGESTS	MIDWEST SUGGESTS	MIDWEST SUGGESTS
LIME POUNDS			
LIME TON			
ELEMENTAL SULFUR			
GYPSUM TONS			

COMMENTS

Surface Nitrate Depth: 0-6 *Sub-Soil 1 Nitrate Depth: 6-24*

The above analytical results apply only to the sample(s) submitted.
Samples are retained a maximum of 30 days.

Our reports and letters are for the exclusive and confidential use of our clients and may not be reproduced in whole or in part, nor may any reference be made to the work, the results, or the company in any advertising, news release, or other public announcements without obtaining our prior written authorization.

MANURE APPLICATION LEASE AGREEMENT

This Lease Agreement, made and entered into this 22nd **day of** February **, 20**17
between Luebbe Farms Inc / Luebbe Bros. LLC **hereinafter described as Landowner, and** Matt Leischner / South Branch Farms **hereinafter described as Tenant, agree as follows:**

1. Landowner leases to the Tenant the following described real property situated in Davison County, South Dakota for the sole purpose of spreading solid and/or liquid animal manure on the said premises.

Field Location (1/4 Section, Township, Range)	Acres Available	Landuse
NE ¼ 33 - 101 - 61	155	Cropland
SW ¼ 27 - 101 - 61	152	Cropland

Total Acres (more or less) 307

2. Tenant shall be allowed to spread manure on the property owned by the Landowner described above at such regular intervals as are mutually agreeable by both parties. The spreading of manure, however, shall not interfere with the productivity, planting, growing and harvesting of crops on the above described premises.

3. Tenant and Landowner jointly agree to apply manure and/or commercial fertilizer at rates not to exceed crop nutrient needs using current soil and manure test results.

4. Tenant further agrees to comply with all local ordinances and state and federal environmental laws in the hauling and spreading of said animal manure.

5. This lease shall commence March 1 , 2017 and terminate in 2 years on March 1 , 2019. Upon expiration this lease shall automatically renew from year-to-year, upon the same terms and conditions, unless either party gives written notice to the other on or before Sept. 1 of any given year of an election not to renew this Lease.

6. It is agreed that the Tenant listed above has sole authorization of spreading manure on the above described premises.

7. Other Conditions (Describe):

LANDOWNER Luebbe Farms Inc / Luebbe Bros. LLC **TENANT**
(Signature) (Signature)
Address: 27433 462nd Ave **Address:**
City State Zip: Parkston, SD 57366 **City State Zip:**

Manure Application On Frozen Ground

Liquid manure handling systems. Liquid manure is not to be applied to saturated, snow covered or frozen soil except in emergency situations, resulting from natural disaster, extraordinary weather events, or catastrophic equipment or structural failure.

Solid manure handling systems. Solid manure is not to be applied to saturated, snow covered or frozen soils, except in the following situations:

1. When incidental amounts of manure is collected during feedlot snow removal or cleaning of feed bunks or enclosed pens to facilitate livestock feeding and handling.
2. When a natural disaster or extraordinary weather (ie. excessive precipitation) prevent manure application during planned application periods.

General requirements for manure application on saturated, snow covered or frozen soil.

a. If a permitted facility, the producer is responsible to contact SD DENR prior to applying on saturated, snow-covered, or frozen soil.
b. The producer is required to provide documentation and updates to the existing nutrient management plan with dates, location(s), and volume of any emergency liquid manure or solid manure winter applications.
c. Application rates cannot exceed recommended rates based on fall soil test results.
d. Winter applications of nutrients must be set back a minimum of 300 feet from surface waters or water conveyances and a minimum of 1,000 feet from named lakes, rivers, and perennial streams.
e. No winter nutrient applications on floodplain soils classified as frequently or occasionally flooded on National Cooperative Soil Survey.
f. Winter applications only allowed on fields with slopes less than four percent.
g. Fields with lowest predicted soil loss (water erosion) will generally have the highest priority for winter applications.
h. Manure will be uniformly spread.
i. A manure nutrient test is recommended (if not available), to determine nutrient content.

Management Considerations for Nitrogen

Groundwater Concerns

The groundwater concern comes primarily from nitrogen. If not captured by plant roots, it can move down below the root zone and may enter the groundwater. The speed at which nitrate moves depends on the amount of precipitation and soil texture. Water moves through sandy soil much more rapidly than a clay soil.

Because nitrate moves through soil with water, it is extremely important that the rate applied, either as manure or fertilizer, does not exceed that which can be used by crops. Any nitrate remaining in the soil profile at the end of the season is subject to leaching.

Water Quality Risk Assessment Maps will be labeled with the symbol "L" on fields that are Vulnerable to N leaching.

If a field is determined highly vulnerable for nitrate leaching to an aquifer, all of the following management activities will be implemented:

1. Prior to the application of nitrogen above starter application rates, a nitrate nitrogen test **(zero to two foot and two to four foot sample)** will be taken and analyzed. **Or** an acceptable alternative to the zero to four feet sampling method would be to take a **zero to two foot sample every year within four weeks after crop harvest** prior to nitrogen applications above starter rates as recommended by SDSU.
2. Soil samples (zero to six inches) should also be included and analyzed for P and K. Soil samples will be taken as per land grant university recommendations found on the back of the SDSU Soil Testing Laboratory Soil Sample Information Sheet, or SDSU-FS935, "Recommended Soil Sampling Methods for South Dakota."

Nitrogen Best Management Practices

- Match manure nutrient applications to crop needs.
- Apply manure as close to the time of crop utilization as possible. If fields are located on soils that have a high leaching potential then no commercial fertilizer application is allowed more than 45 days prior to planting.
- Whenever possible try to split apply nitrogen.
- Use nitrification inhibitors if applicable.
- Delay fall manure applications until soil temperatures drop below 50°F to minimize nitrate leaching and ammonia volatilization.
- Avoid applying manure on wet soils to minimize soil compaction, runoff, nitrate leaching and denitrification.
- Inject or incorporate the manure into the soil preferably within 24 hours for maximum nutrient-use efficiency and to reduce odor and runoff problems. Significant volatilization losses will occur when manure is left on the surface for several days.

Nitrogen Recommendations Using Manure

Crops can contain large amounts of nitrogen (Table 4-1). In most cases only the grain is removed and the straw is returned to the soil, supplying nitrogen through mineralization in subsequent years. Because of this and the other sources of N such as nitrate N already in soil, soil organic matter, precipitation and legumes, crop removal alone is not a good estimate of the amount of N to apply.

Table 4-1 Nitrogen Contained in Crops

Crop	Plant Part		
	Grain	Straw	Total
	----------pounds N----------		
Corn (bu)	0.9	0.5	1.4
Soybeans (bu)	3.7	0.8	4.5
Wheat (bu)	1.6	0.8	2.6
Oats (bu)	0.9	0.4	1.3
Barley (bu)	1.1	0.4	1.5
Sunflowers (cwt)	2.8	2.4	5.2
Alfalfa (ton)	----	----	55
Grass (ton)	----	----	30

Table 4.2 Nitrogen Requirements of Crops

Crop	Unit	Nitrogen Required[1/]
Wheat	bu	2.5 x yield[2/]
Oats	bu	1.3 x yield
Barley		
malting	bu	1.5 x yield
feed	bu	1.7 x yield
Rye	bu	2.5 x yield
Flax	bu	3.0 x yield
Corn (grain)	bu	1.2 x yield
Corn (silage)	ton	10.4 x yield
Sorghum (grain)	bu	1.1 x yield
Sorghum, sudan (hay)	ton	25 x yield
Grass hay	ton	25 x yield
Sunflowers	lb	0.05 x yield
Edible beans	lb	0.05 x yield
Millet	lb	0.035 x yield
Rape	cwt	6.5 x yield
Mustard	cwt	6.5 x yield
Safflower	lb	0.05 x yield
Buckwheat	bu	2.2 x yield
Potatoes	cwt	0.4 x yield

1/ Available manure nitrogen or fertilizer nitrogen to apply is equal to the nitrogen requirement minus soil NO3-N to a 2-ft depth minus any legume credits.
2/ Yield goal

Management Considerations for Phosphorus

Surface Water Concerns
Surface water concerns focus primarily on Phosphorus. Phosphorus acts very differently in soils than nitrogen. It attaches tightly to soils and does not generally move down through the soil profile. This lack of movement through soils results in accumulations of phosphorus in soil if phosphorus rates, either from manure or fertilizer, are greater than crop removal.

Increases in phosphorus concentrations in soil can result in more phosphorus moving off the field either attached to soil particles lost by erosion or dissolved in the runoff water. In some situations phosphorus could move into surface waters with manure itself if the manure is applied in such a manner that it moves directly into waterways.

Water Quality Risk Assessment Maps will be labeled with the symbol "R" on fields that are vulnerable to Phosphorus runoff.

1. In no case shall manure or organic byproduct applications (broadcast or incorporated/injected) be made within 100 feet of a surface water or conveyance; 35 feet if a perennial grass filter strip is established and maintained.
2. A minimum of a 35-foot wide perennial grass filter strip is required in all cases on the edges of fields that border a lake, river, or intermittent/perennial stream.
3. In selected cases based on **SD Phosphorus Loss Risk Assessment**, depending on soil test phosphorus and estimated soil loss in a field, a perennial grass filter strip may be required within 100 feet of surface water or conveyance if manure is applied based on nitrogen needs of a crop and not crop removal of phosphorus.

Phosphorus Based Manure Application
If the manure application is required to be based on phosphorus crop removal, the application rate shall be based on phosphorus removed in the harvested portion of the crop.

Application can be based on multi-year phosphorus crop removal, but cannot exceed the one year nitrogen crop need, and no manure may be applied to that field again until the applied phosphorus has been removed from the field via harvest and crop removal.
***(See SD Phosphorus Loss Risk Assessment* for additional information)**
Usually fields with High soil test P and/or high runoff potential.

Phosphorus Best Management Practices

- Establish and maintain grass filter strips at the point where water leaves the field to trap sediment and nutrients.
- Control sheet and rill erosion by installing conservation practices including conservation tillage, contour farming, strip cropping, terraces and cover crops.
- Control ephemeral erosion by installing grassed waterways, diversions and sediment retention structures.
- Incorporate or inject manure and commercial fertilizer where possible while maintaining sufficient crop residue levels for erosion control.
- Grow high yielding, high phosphorus removing crops on fields with already high soil test phosphorus to reduce test levels.

How Phosphorus affects Soils Tests

Phosphorus rate recommendations are based on the phosphorus soil test. This test is an index of availability of phosphorus to plants. It is not a measure of total available phosphorus or total phosphorus in soil. However, as total phosphorus levels increase in soils, the soil test index usually increases also. These categories represent a decreasing probability of a yield response to broadcast fertilizer or manure. The probability of response is from about 80 percent at the very low soil test level to less than a 20 percent chance when soil tests are in the very high range.

Table 4.3 Soil Test Calibration Levels Used for Phosphorus and Potassium in SD

Nutrient	Name of Soil Test	Categories				
		Very Low	Low	Medium	High	Very High
		----------ppm extractable (0-6 inch sample)----------				
Phosphorus	Bray P-1	0 - 5	6 - 10	11 - 15	16 - 20	21+
Phosphorus	Olsen	0 – 3	4 – 7	8 – 11	12 – 15	16+
Potassium	NH_4Ac	0 – 40	41 – 80	81 – 120	121 – 160	161+

If phosphorus is applied at rates greater than crop removal (Table 4-4), phosphorus soil test levels will increase. As a very general rule of thumb, **for every 20 pounds of phosphorus (P_2O_2) applied and not removed by crops, the soil test index will increase by 1 part per million (ppm).**

Following a good nitrogen application plan with manure in South Dakota can often result in a one to three ppm increase per year in the phosphorus soil test.

As the phosphorus soil test index increases, the possibility of moving significant amounts of phosphorus off the field to surface water usually increases. The movement is both phosphorus attached to soil particles lost with erosion and phosphorus dissolved in the runoff water.

From 60 to 80 percent of the phosphorus in most manure is available to plants within the first year of application. After several years of application, the amount of phosphorus available to plants from manure is equal to that applied with the manure each year.

1/ Source: Jim Gerwing, Extension Soil Specialist Ron Gelderman, Director, Soil Testing Lab, South Dakota State University

Table 4-4 Phosphorus Content of the Harvest Portion of Crops

Crop	P2O2 (lbs)
Alfalfa (per ton)	12
Buckwheat (per bu)	0.53
Canola (per cwt)	1.5
Corn Grain (per bu)	0.35
Corn Silage (per ton)	4.3
Edible Beans (per cwt)	1.25
Feed Barley (per bu)	0.41
Flax (per bu)	0.7
Forage Sorghum (per ton)	5.8
Grass (per ton)	10
Malting Barley (per bu)	0.41
Millet (per cwt)	0.83
Mustard (per cwt)	1.5
Oats (per bu)	0.25
Potatoes (per cwt)	0.09
Rapeseed (per cwt)	1.5
Rye (per bu)	0.48
Safflower (per cwt)	1.14
Sorghum (per bu)	0.27
Soybean (per bu)	0.77
Sudan Grass (per ton)	5.8
Sunflowers (per cwt)	1.14
Wheat (per bu)	0.56

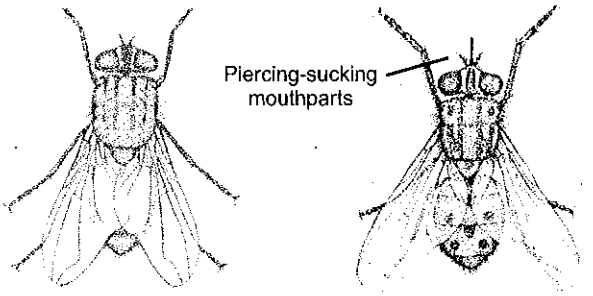
A2118

Identifying and Controlling Flies

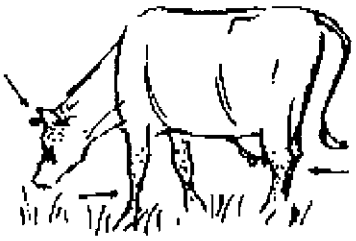
On dairy, beef, other livestock and pets

W.L. Gojmerac

Among the more common flies associated with livestock are the house, face, stable, horn, deer and horsefly. Before starting control procedures, it is important to accurately identify them since their behavior, life cycle, and sites where larvae develop are different. For example, horn and face fly larvae develop only in fresh cow manure in the pasture, deer and horsefly larvae in swamps, and house and stable fly larvae in decaying organic matter. The following descriptions will enable you to identify the type of fly which is causing problems.



House Fly Stable Fly



Stable Fly
Attack points

Identification

House Fly

Description: The house fly is well known because it is generally near human and animal habitations. The fly is gray in color with four dark stripes down its back and the face is slightly straw colored. It feeds with a swabbing type mouth rather than a blood-sucking type. The house fly is about 1/4 inch long. While most important as a disease carrier, house flies also disturb cattle. They are most active on hot, sunny days.

Life History: Adult flies become active in April and May and lay eggs in batches of 100–150 in manure and garbage. Up to four layings have been noted. Eggs hatch in about 24 hours. Maggots have fully grown in about 7–10 days and then pupate. At the end of the pupation period, flies emerge and in several days lay eggs. In hot weather, populations increase rapidly because the life cycle requires only 10–14 days; but during cooler periods, the life cycle may be as long as 2–3 months. Normally the maggots or pupae overwinter, but often adults survive in heated buildings or barns.

Stable Fly

Description: The stable fly is similar in appearance and size to the house fly except that it has well-developed black, piercing-sucking mouth parts. The back and abdomen have several large spots on them. When not on cattle, the stable fly likes to rest in the shade on wooden posts, trees, and buildings. The stable fly prefers to attack active animals rather than those at rest. Ears and legs of cattle are the parts most often fed upon, and without control, numbers of flies are particularly noticeable on the legs of cattle. The stable fly generally feeds upwards, and attacks cattle only during the day.

Life History: Stable flies lay their eggs in manure and decaying vegetation. Egg laying is started only after the female has consumed three blood meals which may be as soon as 9 days after the fly emerges. The cycle from egg to adult takes about a month and there may be several generations per year. Maggots and pupae overwinter in strawy manure.

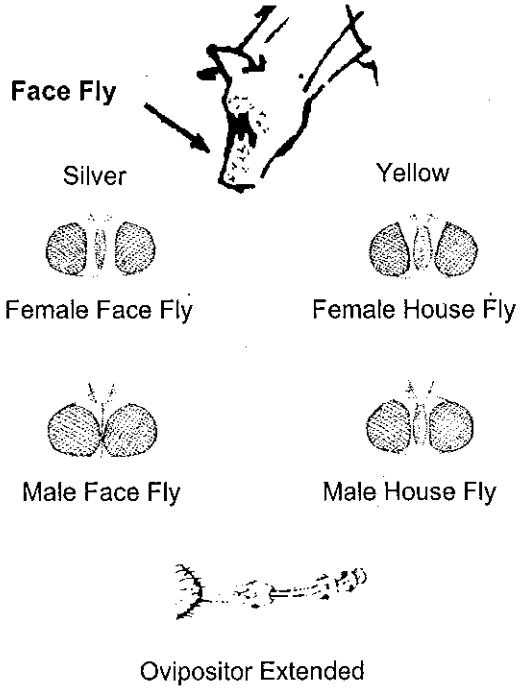
Face Fly

Description: In size and appearance the face fly is nearly identical to the house fly and it takes an expert to distinguish between them; however, the face fly can usually be identified by its location on the cow. Face flies congregate in large numbers around the heads of cattle, particularly those moist areas caused by tears and saliva. This is very annoying to a cow and can cause reductions in weight gains or milk production. Pink eye and blindness in cattle are believed to be spread by this fly as it swabs up mucus and moisture about the eyes. In summer the face fly often rests in the sunlight on wooden posts and feed bunkers where cattle are kept.

There is a positive method for distinguishing between face flies and house flies, but it is necessary to catch the fly. The female face fly has a silvery face; the female house fly has a yellowish face. Females can be distinguished by squeezing their abdomen. This causes the ovipositor or egg laying structure to extend from the tip of the abdomen. No similar structure is present in males. The eyes of male face flies almost meet in the center of the head but the eyes of the male house fly are well separated. With a little practice, it becomes unnecessary to capture the fly to make such distinctions.

Life History: The life cycle of the face fly is nearly identical with that of the house fly, except that a face fly can lay as many as 1500 eggs in its life span. Eggs are laid and

larvae develop in fresh cow manure in pastures. The fly often overwinters in houses and when numerous become a household pest on warm winter and spring days.



Horn Fly

Description: The horn fly is about half the size of a house fly (slightly more than 1/8 inch), dark gray in color, and has piercing-sucking mouth parts. The horn fly remains on cattle day and night, leaving only to lay eggs in freshly dropped cow manure. Horn flies feed primarily on withers, around the horns, and along the back. They generally feed facing downwards. During hot weather or rains, the flies may move to the belly and on cool nights may cluster around the udder. The adults live about 3 weeks and feed exclusively on cattle blood. The annoyance caused by horn flies causes milk production and weight gains to be reduced.

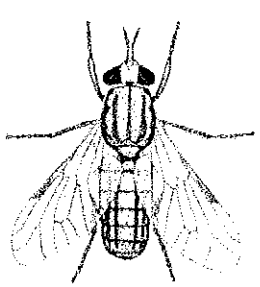
Life History: Horn flies lay their eggs in fresh cow manure where the maggots can feed. The eggs hatch in about 20 hours and maggots develop for about 5 days before pupating. At the end of a 5-day pupation period, the flies emerge and within 3 hours begin feeding on a cow. By the third day the females can begin laying eggs. Only about 20 eggs are produced per batch, but a female may lay up to 400 eggs in her lifetime. Maggots and pupae overwinter in manure.

Horn Fly

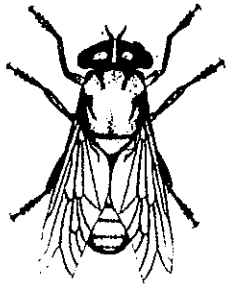
Deer Fly

Description: Deer flies are a little larger than house flies and the body is yellow with brown stripes. The wings have conspicuous brown bands and the mouth parts are the piercing-sucking type. Deer flies are heavy feeders, and wounds they make by feeding may bleed after an attack. They are daytime feeders and most active on hot days.

Life History: Eggs are usually attached to vegetation above water or moist ground. Upon hatching, the larvae drop into the soil and spend one to several winters here, before maturing in pupae and finally emerging as adults.



Deer Fly



Horse Fly

Horse Fly

Description: Horse flies are the largest and most easily recognized cattle pests in Wisconsin. There are several species of horse flies in Wisconsin; however, all can be recognized as horse flies by their large size, their large rounded eyes, and the loud buzzing they make while in flight. The females have large, piercing-sucking mouth parts which inflict painful wounds. The males are harmless flower feeders. Biting is usually confined to the back with only a few flies on a cow at one time. They attack cattle only during the day and are most active on hot days.

Life History: See deer fly.

Control

Livestock Operations

Good sanitation is required if house and stable fly population are to be kept at a minimum. Weekly cleanout of calf pens, hutches and box stalls is a must. Don't forget the accumulated feed, especially under drinking cups.

Flies can and will breed in manure that accumulates in exercise yards around feed bunks, fence lines and any place not trampled by cattle. If cattle are kept in the exercise yard during the summer, you will have more fly problems than if cattle are pastured away from farm buildings—manure handling and feed storage facilities will require special attention.

Health and milk quality control officials specify how often gutters should be cleaned. But remember, flies also breed in decaying feed, in manure that accumulates around sprockets of the barn cleaner and in recesses, corners and crevices where manure has accumulated longer than one week.

Dairy Cattle

The selection of fly sprays for use on dairy cattle is important. Using the wrong product could not only injure the animal, but might contaminate its milk with an illegal residue. Products approved for use on dairy cattle by state and federal authorities are safe and will not contaminate milk when used properly. Be sure the label states this approval and follow directions exactly.

Several coumaphos (CO-RAL), dichlorvos (Vapona), permethrin (Ectiban, Atroban), pyrethrins and tetrachlorvinphos (Rabon) products are available and registered for use on dairy cattle. They can be purchased as a ready-to-use mixture or as a concentrate to be mixed with water. Naled (Dibrom) can be used in the dairy barn but not in the milk room or milk house. Coumaphos (CO-RAL), malathion, methoxychlor, permethrin (Ectiban, Atroban) and tetrachlorvinphos (Rabon) dusts are also registered.

Although dusts are available and registered for use on dairy cattle, some milk-marketing organizations object to their use. Check with your local fieldmen before using them. Dusts applied directly to cattle have been effective only on horn flies.

Cattle can be self-treated as they enter or leave the barn, hand sprayed, or the barn can be mist- or fog-treated while the cattle are inside. Do not individually treat cattle and mist/fog barn at the same time. Follow directions on the container exactly. Observe all safety precautions. If face flies are a problem, give special attention to spraying head and shoulders.

Back rubbers are an effective way to treat cattle not regularly coming into the barn. Use only those products approved for backrubber use on dairy cattle, such as permethrin or coumaphos (CO-RAL). Follow mixing directions on the label.

DO NOT MAKE YOUR OWN COMBINATION PRODUCTS BY MIXING INSECTICIDES.

Milkhouse and Egg Handling Room

Hand spray or fog with dichlorvos (Vapona) or pyrethrins when necessary. Use the same dosage listed for dairy cattle. Do not contaminate food handling utensils. The dichlorvos (Vapona) strip can be used. But do not use it in kitchens or in food handling and processing establishments where there is exposed food. Sticky fly strips or papers can also be used where appropriate.

Electronic ultrasonic repellers are supposed to "drive away" pests and not harm the good animals. These devices simply don't work.

Electrocutors and light traps will kill insects when employed properly. Some are designed to intercept night-flying insects entering a food plant that are attracted to light. Others are designed to monitor insect populations. This is far different than trying to control insects, such as flies, which are not hightly attracted to light. There is no question that some flies will be electrocuted when they contact the exposed wires, but the number killed is a very low percentage of flies in the area. So for practical purposes, electrocutors and light traps are of no value.

Buying and releasing beneficial, parasitic or predator insects is an excellent way to control pests, but this technique works only in a very limited number of situations, and managing this process is a highly complex operation. The U.S.D.A. studied fly populations on feedlots and dairies. Researchers reported no differences in adult populations of flies on those farms releasing parasites when compared to the other farms.

Livestock Barns

Diazinon (WP), dimethoate, fenthion (Baytex), malathion, naled (Dibrom) permethrin (Ectiban, Atroban) and tetrachlorvinphos (Rabon) can be used in livestock housing.

As a routine precaution, remove all livestock from the building being sprayed. Spray the walls and ceilings with insecticide. Repeat when flies no longer drop from the surface because insecticide has lost its toxicity. Insecticides are generally non-toxic or useless if applied to a concrete or brick surface—improved performance is obtained by painting or whitewashing before spraying. Some insecticides can be mixed and applied with whitewash. Do not spray exposed Styrofoam insulation with the insecticide mixture.

Feed Additives to Control Flies

Several products are approved for use as a feed or mineral additive or in a bolus to control flies. They are diflubenzuron, phenothiazine, methroprene (Altosid) and tetrachlorvinphos (Rabon). These chemicals pass through the digestive tract without harm to the animal and leave no illegal residues in the meat and/or milk when mixed and fed according to manufacturer's directions. Enough insecticide remains in the manure to kill or prevent flies from completing their development.

Tetrachlorvinphos (Rabon) is registered for use in dairy as well as beef animals, while phenothiazene is approved only for beef animals.

The insecticide must be mixed with either the feed concentrate or mineral mixture. The animal must consume a specific amount of feed-insecticide or mineral-insecticide mixture daily. For example, tetrachlorvinphos is registered to be fed at 70 milligrams per 100 lbs. of body weight per day. You need to know the weight of the animal being fed and the amount of feed consumed each day by this animal. Based on this information your feed dealer and/or chemical supplier can determine the quantity of stirofos to be mixed into your feed.

Bolus

To control developing flies (maggots) in manure, uniform quantities of insecticide must be present at all times. A bolus containing diflubenzuron (Vigilante), when placed in the animal's stomach, will constantly release insecticide all season, at concentrations adequate to kill developing flies. The bolus can be administered with a standard balling gun. Small animals require 1/2 bolus; medium animals, 1 bolus; and large animals, 1 1/2 boluses. This product is approved for beef as well as dairy animals.

Ear Tags

Insecticide-impregnated ear tags have been approved for use on dairy and beef animals. Be sure tags are attached correctly. They are very effective in controlling horn flies, only moderately effective in reducing numbers of face flies, and are much less effective against house and stable flies.

Beef Cattle

Primary pests on beef cattle are horn, face, deer and horse flies; and mosquitoes. Currently there is no practical control for deer and horse flies or mosquitoes. Face flies are also difficult to control. However, the horn fly is easy to control, and the farmer has a choice of insecticides. Use the proper dosage; follow all safety precautions; and if cattle are to be sold for slaughter, observe the proper withdrawal periods. These products can be applied by spray, backrubber or self-treating dust bags.

Other Animals

While flies generally do not bother hogs, chickens, and rabbits, and horses and dogs are not involved in human food production, fly control is still important. Flies are considered a public health nuisance and health authorities can force you to take action.

If you are involved with these animals, recognize your responsibilities. Decaying organic matter such as manure, unconsumed food, spilled food, or wet bedding can help produce large quantities of flies. Do not rely on insecticides. **Sanitation can replace insecticides, but insecticides will not replace sanitation.** Generally the most practical solution is a compromise.

When using insecticides near and around animals:

a. Read and follow label directions exactly.

b. Do not apply any insecticide directly on an animal unless the label specifically states the animal can be safely treated.

c. When using any insecticide near the animals, be aware of the animals' normal or natural behavior. Horses can be frightened by a spray; cats, by their normal grooming, might ingest chemicals applied to their fur; and birds might pick up fly or roach bait, or they may try to alight on a suspended dichlorvos (Vapona) strip.

Recent Changes

Under current federal regulations, insecticides are not permanently registered. The Environmental Protection Agency reviews the current research data base, and if it is incomplete, the EPA can require the manufacturer to provide additional data to support the registration claims. If there is evidence that the insecticide causes an unreasonable adverse effect on the applicator, animal, food product or environment, the EPA can require modified directions on the label.

The manufacturer has several options: 1) provide the required data to support registration; 2) withdraw certain uses; or 3) withdraw the registration and stop making and selling the product.

Unless there are questions of safety and/or serious illegal residues, existing supplies of the product may be used.

Several popular insecticides are now being phased out or having uses withdrawn because the manufacturers believe the cost of supplying the data won't be recovered from product sales. You may find that your favorite product is no longer available, or that you may no longer use it to control a specific pest.

Therefore, it's important to 1) buy only reasonable quantities of any insecticide at one time, and 2) deal with responsible suppliers handling only currently registered products.

Resistance

In some parts of the United States, flies have developed a high degree of resistance to the pyrethroid insecticides such as cyfluthrin, cypermethrin, cyhalothrin, fenvalerate and permethrin. If you have fly-control failures with pyrethroid insecticides, consider using phosphate products (a different class) such as coumaphos, diazinon, dichlorvos or tetrachlorvinphos.

Buying an Insecticide

Consult a knowledgeable person when buying insecticides—mistakes can be costly. When in doubt, contact the State Department of Agriculture, Trade and Consumer Protection. It is responsible for administering and enforcing Wisconsin insecticide laws.

See publication A1991, Controlling Mosquitoes for recommendations for mosquito control; and publication A1235, Spider Control in Homes and Barns, for spider control.

University of Wisconsin-Extension, Cooperative Extension, in cooperation with the U.S. Department of Agriculture andWisconsin counties, publishes this information to further the purpose of the May 8 and June 30, 1914 Acts of Congress; and provides equal opportunities in employment and programming including Title IX requirements.

W.L. Gojmerac is professor of entomology, College of Agricultural and Life Sciences, University of Wisconsin–Madison and University of Wisconsin–Extension, Cooperative Extension. *We extend appreciation to O.L. Lovett and Wisconsin State Department of Agriculture, Trade and Consumer Protection for the illustrations and descriptions of flies.*
Produced by Extension Publications, University of Wisconsin–Madison.
This publication is available from your Wisconsin county Extension office or from:
Extension Publications, Rm. 245
30 N. Murray St.
Madison, Wisconsin 53715
Phone 608-262-3346
Editors, before publicizing, contact Agricultural Bulletin to determine availability.

A2118 Identifying and Controlling Flies: On dairy, beef, other livestock and pets R-08-91-1M-45-E

RECOMMENDED STRATEGIES FOR ODOR CONTROL IN CONFINEMENT SWINE OPERATIONS

Hans Stein[1], Alvaro Garcia[2], Kent Tjardes[1], Charles Ullery[3], Stephen Pohl[3], and Christopher Schmit[4]

[1]Animal and Range Sciences Department, [2]Dairy Science Department,
[3]Agricultural and Biosystems Engineering Department, and
[4] Civil and Environmental Engineering Department,
South Dakota State University, Brookings S.D.

Summary:

Odors coming off a swine facility are generated from three different sources: the unit itself, from the storage facility, or the land on which the manure is applied.

To reduce the total amount of odor generated from a swine facility, odor generation and emission by each of these three sources needs to be reduced. Within each area, several options for odor reduction are available. Practices that have been proven to be effective and that can be immediately implemented are listed in Table 1. Other options are being developed or tested. Research into these practices will reveal whether or not they can be successfully implemented in the future.

Table 1 is organized in four sections covering practices that:

1. reduce odor generation in barns,
2. reduce odor emission from facilities and storage units,
3. increase odor dispersion, and
4. reduce odor emission from manure application.

For each practice, advantages and disadvantages are listed. The effectiveness and the cost of implementing each practice is indicated using odor generation from a standard swine facility as a base line. This unit is assumed to be constructed using state-of-the-art recommendations including deep pits or an uncovered manure storage facility, curtain sidings or mechanical ventilation, and no dietary modifications to reduce odor generation.

To obtain an overall reduction in odors from a facility, reductions need to be made in odor generated by the unit itself, the storage facility, and from land application.

Some practices listed in Table 1 are best management practices (BMP). These are practices with well-documented beneficial effects on sustainability of a production system. Their implementation should be encouraged even without considering their potential for odor reduction.

The cost of each practice is indicated. A "low" cost is assumed to be less than $0.50 per GF pig produced ($1.25/Animal Unit); "moderate" is assumed to add $0.50-$1.50 per GF pig produced ($1.25-3.75/Animal Unit), and "high" is assumed to add more than $1.50 per GF pig produced ($3.75/Animal Unit) to total production costs, as compared to the base line unit.

Conclusions and Recommendations

A number of practices are available to reduce odor from swine facilities. A reduction in odor coming off a swine facility is achieved only if the odors emitted by the unit itself, from the storage facility, and from the land application of the manure are reduced.

At this time, the following practices are recommended:

1. The odor from the unit itself can be reduced by a combination of dietary practices and the installation of a biofilter.
2. The odor from the storage facility can be reduced by installing an effective lagoon cover. In larger units this may be combined with a manure separator and (or) a methane digester.
3. The odor from the land application of manure can be reduced by injecting the manure into the soil.

Research into odor reduction is ongoing, and many new technologies are being developed. As independent research using these technologies becomes available, some of these technologies may prove to be even more effective than the ones listed in the table. SDSU swine research being conducted at the Southeast Research Farm near Beresford has demonstrated that biofilters reduce odor emissions from confined buildings by 96%.

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the USDA. Larry Tidemann, director of CES, associate dean, College of Agriculture & Biological Sciences, South Dakota State University, Brookings. South Dakota State University is an Affirmative Action/Equal Opportunity Employer and offers all benefits, services, education, and employment without regard for race, color, creed, religion, national origin, ancestry, citizenship, age, gender, sexual orientation, disability, or Vietnam Era veteran status. SZZ803-B: Printed at cost of $.16 each.

Table 1: Odor Reduction Practices for Swine Operations

Section 1: Reduce generation of odor						
Practice	Description	Advantages	Disadvantages	Effectiveness	Cost	Comments
a. Low protein diets	Diets are lowered 3-4% in CP compared to NRC rec. Crystalline AA are added to diets so that AA levels follows NRC rec	Avoid overfeeding CP. Fewer problems with enteric diseases in pigs. Reduced N in manure, reduced ammonia emission	Reduced consumption of byproducts and alternative ingredients	Moderate	Low. (Sometimes the cost of LP diets are actually lower than regular diets)	Cost offset by increased productivity and more efficient nutrient use. Should be considered a BMP
b. Low sulfur diets	Diets using no micro-minerals on sulfate form and no excess sulfur containing AA	Reduced production of H_2S	Some restrictions apply to the mineral sources that can be used	Moderate	Low	Should be considered a BMP
c. Phase feeding	Diets are changed frequently during the production phases to match the nutrient requirement of the pigs	Overfeeding and underfeeding with nutrients can be reduced	More diets are required on the farm	Low	Low	Should be considered a BMP
d. Precision diet formulation	Diets are formulated based on digestible contents of amino acids and minerals and the net energy content of the diets. Also, the ideal protein concept is used in diet formulation	Diets that more precisely match the requirement of the animals can be formulated. Reduction of excess nutrients in diets and thus in manure	Research is needed to establish digestible contents of nutrients in feed ingredients and the animals requirements for digestible nutrients	Low	Low	At least 3-5 years of research needed before concept can be implemented
e. Pelleting diets	All diets used in the operation are pelleted prior to use	Reduces dust generation and decreases amount of feed wasted in the manure pit	None	Low	Low ($10/ton for mixing, this cost offset by increased nutrient digestibility)	

Table 1. Odor reduction practices for swine operations (cont.)

Section 2: Decrease Emission of Odor						
Practice	Description	Advantages	Disadvantages	Effectiveness	Cost	Comments
a. Flush systems for manure removal	Removes manure frequently by flushing all the pits	Effective in reducing emission from pit	Increased labor, need for outside storage	Moderate	Moderate	
b. Pit systems w/ reduced manure surface	Sloped bottom of pits make sure manure surface is reduced	Reduces emission from pits	None	Moderate	Moderate	Usually combined with increased flushing
c. Oil spraying	Vegetable oil sprayed in facilities at regular intervals	Bound dust also odors present in the dust	More slicky surface	Moderate	Moderate	Reduces health risk for human workers in barns
d. Biofilters	Air exhausted through a biofilter made from organic material that captures the odors. Clean, odorless air is released.	Very effective. Simple to construct. Environmentally friendly	Building design. Aesthetics	High	Low to moderate	Odor reduced by 96% in SDSU research. Cannot be used with curtain-sided barns
e. Storage additives	Additives added to manure storage facility	Supposed to reduce odor generation	Not a proven technique	Low	High	Questionable technique
f. Rigid manure storage covers	Mechanical cover is applied to the manure storage unit	Very effective	Can be costly	High	High	
g. Flexible manure storage cover	Flexible material applied on top of storage facility. May be textile or plastic membrane or floating clay balls		Can cause problems when agitating manure, support structure may be needed	High	Moderate	Several different materials can be used
h. Biodegradable manure storage cover	Straw is applied on top of storage facilities	Inexpensive	Needs to be filled every three months. More difficult to agitate storage unit	Moderate	Low	Effectiveness highly dependent on how the cover is managed
i. Manure separators	Separates manure into a solid and a liquid fraction	Decreases odor generation from storage	Relatively expensive, only applicable to large operations	Moderate	High	More effective separators are available in Europe
k. Methane digesters	Treat waste with 3 to 10% total solids. Biogas methane production from manure	Manure treatment can decrease odor at application time. Generation of electricity can help pay for treatment costs	Costs: $250,000 O + M = $7,500/year Cost effectiveness dependent on contract with electrical company.	High	High	May be combined with manure separators

Table 1. Odor reduction practices for swine operations (cont.)

Section 3: Increase Dispersion of Odor						
Practice	Description	Advantages	Disadvantages	Effectiveness	Cost	Comments
a. Shelterbelts	Create a vegetation barrier for dust and odorous compounds emitted from the building exhaust	Cost. Environment. Aesthetics	Requires planning and time	Low	Low	
b. Windbreak walls	Solid or porous wall constructed 10 to 15 feet from the exhaust fans will cause dust to settle	Rapid implementation	Cost. Aesthetics	Low	Low to moderate	
c. Setback distances	Optimize distance between odor emission sources and urban areas.	Cost.	Not applicable for facilities currently in operation	High	Variable	Effectiveness can be calculated through the OFFSET model (Univ. of Minn.)

Section 4: Land Application of Manure						
Practice	Description	Advantages	Disadvantages	Effectiveness	Cost	Comments
a. Manure injection or incorporation	Manure injected directly into soil. Can be done in pasture or bare soil or into a growing crop	No emission of odors from manure when applied to soil	Takes more horsepower and more sophisticated equipment	Very high	Low	Should be considered a BMP

Manure Application On Frozen Ground

Liquid manure handling systems. Liquid manure is not to be applied to saturated, snow covered or frozen soil except in emergency situations, resulting from natural disaster, extraordinary weather events, or catastrophic equipment or structural failure.

Solid manure handling systems. Solid manure is not to be applied to saturated, snow covered or frozen soils, except in the following situations:

1. When incidental amounts of manure is collected during feedlot snow removal or cleaning of feed bunks or enclosed pens to facilitate livestock feeding and handling.
2. When a natural disaster or extraordinary weather (ie. excessive precipitation) prevent manure application during planned application periods.

General requirements for manure application on saturated, snow covered or frozen soil.

a. If a permitted facility, the producer is responsible to contact SD DENR prior to applying on saturated, snow-covered, or frozen soil.
b. The producer is required to provide documentation and updates to the existing nutrient management plan with dates, location(s), and volume of any emergency liquid manure or solid manure winter applications.
c. Application rates cannot exceed recommended rates based on fall soil test results.
d. Winter applications of nutrients must be set back a minimum of 300 feet from surface waters or water conveyances and a minimum of 1,000 feet from named lakes, rivers, and perennial streams.
e. No winter nutrient applications on floodplain soils classified as frequently or occasionally flooded on National Cooperative Soil Survey.
f. Winter applications only allowed on fields with slopes less than four percent.
g. Fields with lowest predicted soil loss (water erosion) will generally have the highest priority for winter applications.
h. Manure will be uniformly spread.
i. A manure nutrient test is recommended (if not available), to determine nutrient content.

UNIVERSITY LABS

Iowa State Soil Testing Laboratory
G501 Agronomy Hall
Iowa State University
Ames, IA 50011-1010
Phone: (515) 294-3076
Fax: (515) 294-5567
Email: soiltest@iastate.edu
Web: http://www.agron.iastate.edu/soiltesting/

University of MN Soil Testing Laboratory
1902 Dudley Ave.
Rm. 135 Crops Research Bldg.
St. Paul, MN 55108-6089
Phone: (612) 625-3101
Fax: (612) 624-3420
Email: soiltest@umn.edu
Web: http://soiltest.cfans.umn.edu/index.htm

NDSU Soil Testing Laboratory (North Dakota)
Waldron Hall, NDSU
1360 Bolley Drive, PO Box 5575
Fargo, ND 58102
Phone: (701) 231-8942
Email: NDSU.STL@ndsu.edu
Web: http://www.ndsu.edu/soils/services/soil_testing_lab/

PRIVATE LABS

AgLab Express
Anthony Bly
3600 S. Minnesota Ave.
Sioux Falls, SD 57105
Phone: (605) 271-9237
Fax: (605) 271-9238
Email: anthonybly@aglabexpress.com
Web: http://www.aglabexpress.com

AgSource Laboratories
300 Speedway Circle
Lincoln, NE 68502
Phone: (402) 476-0300
Fax: (402) 476-0302
Email: cibsen@agsource.com
Web: http://agsource.crinet.com/

Agvise Laboratory
902 13th St. North, PO Box 187
Benson, MN 56215
Phone: (320) 843-4109
Fax: (320) 843-2074
Email: Agvise@polarcomm.com
Web: http://www.agvise.com

Midwest Laboratories
13611 B Street
Omaha, NE 68144
Phone: (402) 334-7770
Fax: (402) 334-9121
Web: https://www.midwestlabs.com/

Minnesota Valley Testing Laboratory
326 Center Street
New Ulm, MN 56073
Phone: (800) 782-3557
Fax: (507) 233-7127
Email: mnsoil@mvtl.com
Web: http://www.mvtl.com/

SGS Soil Testing Laboratories
236 32nd Ave.
Brookings, SD 57006
Phone: (605) 696-7611 Ext. 5
Fax: (605) 692-7617
Email: Angela.Carlson@sgs.com
Web: http://www.cropservices.sgs.com

South Dakota Agricultural Laboratories
Brookings Biospace
1006 32nd Ave., Suites 103 & 105
Brookings, SD 57006-4728
Phone: (605) 692-7325
Fax: (605) 692-7326
Web: www.sdaglabs.com

Stearns DHIA Laboratories
825 12th St. South, PO Box 227
Sauk Centre, MN 56378-0227
Phone: (320) 352-2028
Fax: (320) 352-6163
Email: stearnsdhialab@stearnsdhialab.com
Web: http://www.stearnsdhialab.com/index.html

Ward Laboratories
4007 Cherry Ave., PO Box 788
Kearney, NE 68848-0788
Phone: (308) 234-2418
Fax: (308) 234-1940
Email: customerrep@wardlab.com
Web: http://www.wardlab.com

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

INITIAL NUTRIENT MANAGEMENT PLAN
FOR
SOUTH DAKOTA ANIMAL FEEDING OPERATIONS

SD-CPA-63A
Rev. 4/17

1. **Operator:** Chris Derocher 2. **County:** Davison 3. **Prepared By:** Jason Gilb 4. **Date:** 10-May-17

Total Nitrogen And Phosphorus Produced From Livestock Operation(s)

5.	6.	7.	8.	9.		10.		11.	12.	13.		14.	15.		16.	
Animal Type:	No. of animals	Avg. weight (lbs.)	Days of Confine-ment	N	P_2O_5 Total solid/liquid Manure as Excreted (lbs.)	N retained Handling/Storage	%	Total N available for application (lbs.)	Time of applic-ation	N Retained Application Method	%	Total N retained in field (lbs.)	3-Yr. Mineralization Rate Manure Handling	%	N	P_2O_5 Available for the crop (lbs.)
Finishing pig	2,400	150	365	52,560	43,888	Liquid - anaerobic pit	78	40,997	Spring/Fall/Summer	Injection	98	40,177	Pits beneath slatted floor	83	33,347	43,888
Other Animals																

Total Manure as Excreted: 22,800 **OR** 8,322,000 **lbs/year** **Total lbs. of N and P2O5 available for the crop:** 33,347 43,888

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

NUTRIENT MANAGEMENT PLAN
FOR
SOUTH DAKOTA ANIMAL FEEDING OPERATIONS

SD-CPA-63B
Rev. 4/17

Field Information

Operator: Chris Derocher **County:** Davison **Date:** 05/10/17

Line #	17. Field ID (Include maps to illustrate location) Name or Tract	Field #	18. Date added to Plan	19. Beginning acres in field	20. County	21. Soil map unit symbol	22. Field Location: (1/4 Section, Township, Range)					23. Predicted soil loss - RUSLE2 (T/ac/yr)	24. Control of Land	25. 100' Vegetated Buffer	25. Excluded acres	26. Irrigated	27. Winter Application	28. No-Till	29. Current Soil Test Levels: N lb/ac 0-2'	N lb/ac 2-4'	Phosphorus (ppm) 0-6"	Phosphorus (ppm) P Test	K (ppm)	Organic Matter	Soil PH	Electric Conductivity (EC) Surface	Electric Conductivity (EC) Sub-surface	Soil Sample Date
1	Luebke	1	5/10/17	152.0	Davison	HsA	SW 1/4	Sec. 27	T 101	R 61		0.2	Leased		13.8			X			38	Bray1	242					11/30/16
2	W Betts	2	5/10/17	153.9	Davison	HpA	NE 1/4	Sec. 33	T 101	R 61		0.2	Leased		0.8			X			25	Bray1	236					04/27/16
3	Luebke	3	5/10/17	151.3	Douglas	CpA	NW 1/4	Sec. 14	T 100	R 62		0.2	Leased		1.8			X			41	Bray1	191					12/01/16
4	Geidel	4	5/10/17	142.4	Douglas	CpA	SE 1/4	Sec. 14	T 100	R 62		0.2	Leased		0.0			X	65		31	Bray1	231					04/27/17
5								Sec.	T	R																		
6								Sec.	T	R																		
7								Sec.	T	R																		
8								Sec.	T	R																		
9								Sec.	T	R																		
10								Sec.	T	R																		
11								Sec.	T	R																		
12								Sec.	T	R																		
13								Sec.	T	R																		
14								Sec.	T	R																		
15								Sec.	T	R																		
16								Sec.	T	R																		
17								Sec.	T	R																		
18								Sec.	T	R																		
19								Sec.	T	R																		
20								Sec.	T	R																		
21								Sec.	T	R																		
22								Sec.	T	R																		
23								Sec.	T	R																		
24								Sec.	T	R																		
25								Sec.	T	R																		
26								Sec.	T	R																		
27								Sec.	T	R																		
			Total:	599.6																								

Comments:

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

NUTRIENT MANAGEMENT PLAN
FOR
SOUTH DAKOTA ANIMAL FEEDING OPERATIONS

SD-CPA-63B
Rev. 4/17

Estimated Nutrient Requirement

17. 30.

○ Actual or Yield Goal
◉ Yields indexed by soil productivity (Productivity Index)
○ County Average Yields (SD Agricultural Statistics Service)

Line #	Field ID (Include maps to illustrate location)		Previous Year			Year 1			Year 2			Year 3			Year 4			Year 5		
	Name or Tract	Field #	Crop	PI Yield	Actual Yield	Crop	PI Yield	Yield Goal	Crop	PI Yield	Yield Goal	Crop	PI Yield	Yield Goal	Crop	PI Yield	Yield Goal	Crop	PI Yield	Yield Goal
1	Luebke	1	Corn (bu)	140		Soybean (bu)	43		Corn (bu)	140		Soybean (bu)	43		Corn (bu)	140		Soybean (bu)	43	
2	W Betts	2	Soybean (bu)	43		Corn (bu)	142		Soybean (bu)	43		Corn (bu)	142		Soybean (bu)	43		Corn (bu)	142	
3	Luebke	3	Corn (bu)	147		Soybean (bu)	47		Corn (bu)	147		Soybean (bu)	47		Corn (bu)	147		Soybean (bu)	47	
4	Geidel	4	Soybean (bu)	47		Corn (bu)	147		Soybean (bu)	47		Corn (bu)	147		Soybean (bu)	47		Corn (bu)	147	
5																				
6																				
7																				
8																				
9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				
21																				
22																				
23																				
24																				
25																				
26																				
27																				

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

NUTRIENT MANAGEMENT PLAN
FOR
SOUTH DAKOTA ANIMAL FEEDING OPERATIONS

SD-CPA-63B
Rev. 4/17

Part 3: Planned Nutrient Application

Date: 05/10/17 **Operator:** **County:** Davison **Date:** 05/10/17

Line #	17. Field ID (Include maps to illustrate location) Name or Tract	Field #	Alternative crops for years 1 through 5	31. Initial Nutrient Mgt. Plan - N based fields (acres)	32. Nutrient Recommendation - *SDSU Extension Service EC-750* N	P_2O_5	K_2O	33. Manure application based on:	34. Phosporus Risk Assessment	35. Nitrogen Risk Assessment	36. Nutrients Applied: Commercial lbs/acre N	P_2O_5	K_2O	Manure lbs/acre N	P_2O_5	K_2O	Total lbs/acre N	P_2O_5	K_2O	37. Estimated years to reapplication based on P_2O_5 rate
1	Luebke	1	Oats, 60 bu; W.Wheat, 60 bu; Alf., 4 ton; Sunflower, 1200 cwt; S.Wheat, 50 bu	138.2		0	0	Nitrogen need	Low	Low	0	0	0	0	0	0	0	0	0	N/A
2	W Betts	2	Oats, 60 bu; W.Wheat, 60 bu; Alf., 4 ton; Sunflower, 1200 cwt; S.Wheat, 50 bu	153.1		0	0	Nitrogen need	Low	Low	0	0	0	0	0	0	0	0	0	N/A
3	Luebke	3	Oats, 60 bu; W.Wheat, 60 bu; Alf., 4 ton; Sunflower, 1200 cwt; S.Wheat, 50 bu	149.5		0	0	Nitrogen need	Low	Low	0	0	0	0	0	0	0	0	0	N/A
4	Geidel	4	Oats, 60 bu; W.Wheat, 60 bu; Alf., 4 ton; Sunflower, 1200 cwt; S.Wheat, 50 bu	142.4	101	0	0	Nitrogen need	Low	Low	0	0	0	0	0	0	0	0	0	
5											0	0	0	0	0	0	0	0	0	
6											0	0	0	0	0	0	0	0	0	
7											0	0	0	0	0	0	0	0	0	
8											0	0	0	0	0	0	0	0	0	
9											0	0	0	0	0	0	0	0	0	
10											0	0	0	0	0	0	0	0	0	
11											0	0	0	0	0	0	0	0	0	
12											0	0	0	0	0	0	0	0	0	
13											0	0	0	0	0	0	0	0	0	
14											0	0	0	0	0	0	0	0	0	
15											0	0	0	0	0	0	0	0	0	
16											0	0	0	0	0	0	0	0	0	
17											0	0	0	0	0	0	0	0	0	
18											0	0	0	0	0	0	0	0	0	
19											0	0	0	0	0	0	0	0	0	
20											0	0	0	0	0	0	0	0	0	
21											0	0	0	0	0	0	0	0	0	
22											0	0	0	0	0	0	0	0	0	
23											0	0	0	0	0	0	0	0	0	
24											0	0	0	0	0	0	0	0	0	
25											0	0	0	0	0	0	0	0	0	
26											0	0	0	0	0	0	0	0	0	
27											0	0	0	0	0	0	0	0	0	
				583.2																

	N	P_2O_5
Total lbs of N and P2O5 available for crops:	33,347	43,888
Total lbs of N and P2O5 required by fields:	88,286	24,828

Adequate acres are available based on Nitrogen analysis

However, P2O5 is in excess of removal. At this rate, it will take approximately 16 year(s) to build all listed fields up to 50 ppm P (Olsen).

Comments: