

## BROOKINGS COUNTY PLANNING & ZONING COMMISSION

BROOKINGS CITY & COUNTY GOVERNMENT CENTER  
520 3rd St, 310 Chambers, Brookings, SD 57006

### AGENDA

1. **7:00 PM: Call to Order**
2. **Items to be Added to Agenda by Commission Members or Staff**
3. **Invitation for Citizens to Schedule Time on the Commission Agenda for an Item Not Listed**  
*(Time limited to 5-minutes per person to address the commission.)*

4. **Approval of Agenda**

5. **Convene as Brookings County Board of Adjustment**  
*(The Board of Adjustment needs 2/3 approval of the full board to approve any agenda item.)*

6. **2016var021**  
Killeskillen LLC by Michael Crinion has made an application 2016var021 to the Brookings County Board of Adjustment, for a variance. Article 22: Concentrated Animal Feeding Operation, Section 22.01: Concentrated Animal Feeding Operation Regulations: Concentrated Animal Feeding Operation Control Requirements: # 6) Required Setback and Separation Distance. The property is described as: "NE1/4 of Section 10, T112N, R48W (Oak Lake Township)" ~~ located at 48187 197<sup>th</sup> St, Astoria, SD 57213.

Documents:

[2016var021 Staff Report.pdf](#)  
[Dakota Environmental, Inc Letter - 11-18-2016 \(2016var021\).pdf](#)

7. **Convene as Brookings County Planning and Zoning Commission**  
*(The Planning and Zoning Commission needs 2/3 approval of the full board to approve any agenda item.)*

8. **2016cu022**  
Killeskillen LLC by Michael Crinion has made an application 2016cu022 to the Brookings County Planning and Zoning Commission for a conditional use. Article 11: Section 11.01: "A" Agricultural District: Conditional Use Permit #11: Class A, B, C and D Concentrated Animal Feeding Operation. The property is described as: "NE1/4 of Section 10, T112N, R48W (Oak Lake Township)" ~~ located at 48187 197<sup>th</sup> St, Astoria, SD 57213.

Documents:

[2016cu022 Staff Report.pdf](#)  
[Engineer Report\\_Plans 11-14-2016 \(2016cu022\).pdf](#)

- A. **Comments received**

Documents:

Chuck Nygaard 11-28-2016.pdf  
Joe Beech 11-28-2016.pdf  
IMG\_20141029\_161414802[1].jpg  
IMG\_20141029\_161402074[1].jpg  
IMG\_20141029\_161402074.jpg  
IMG\_20141029\_161348375[1].jpg  
Hill-reply regarding date.pdf  
Cindie McCutcheon Email 12-1-2016.pdf  
Cindie McCutcheon emailed photo 12-1-2016.pdf  
Brookings Economic Development Corporation 12-4-2016.pdf  
Friends of Oak Lake and Lake Hendricks- rcvd 12-5-2016.pdf  
SDDP rcvd 12-5-2016.pdf  
Brookings Area Chamber of Commerce and Convention Bureau -12-5-2016.pdf  
Estelline Community Oil 12-5-2016.pdf  
Valley Queen Cheese Factory 12-5-2016.pdf  
Snodgrass, Dan 12-5-2016.pdf  
Rastani, Robin 12-5-2016.pdf  
Novita 12-5-2016.pdf

**9. Department Reports**

**10. Adjourn**

**11. Public Notices**

**Brookings County Zoning Office \* Brookings City & County Government Center \* 520 3rd Street, Suite 200 \* (605) 696-8350 \* [www.brookingscountysd.gov](http://www.brookingscountysd.gov)**

# 2016var021 – December 5<sup>th</sup>, 2016

Prepared by Richard Haugen

Applicant: Killeskillen LLC by Michael Crinion, 126 Pine Ridge Rd, Brookings, SD 57006

Land Owners: LC Olson LLP, 2315 E St George Dr, Sioux Falls, SD 57103

Legal Description: NE1/4 of Section 10, T112N, R48W

2016var021: Killeskillen LLC by Michael Crinion has applied for a variance to build a Class "A" Concentrated Animal Feeding Operation (CAFO), 1,400 feet from a private well. A variance of 1,240 feet. Brookings County Zoning Ordinance Article 22: Concentrated Animal Feeding Operation: Section 22.01: Concentrated Animal Feeding Operation Regulations: Concentrated Animal Feeding Operation and Control Requirements: # 6 Required Setback and Separation Distance: Private Wells other than the operator is 2,640 feet. (Brookings County Zoning Ordinance page 22-14)

The well is not on record with the South Dakota Department of Environment and Natural Resources – Water Well Completion Reports, meaning the well was dug before well completion records were required.(page-4) The well is located below an old windmill tower that does not have the windmill wheel or windmill head on top of the tower to enable it to pump water.(page-8)Beacon maps dated April 15, 2010, May 3, 2013 and May 6, 2016 all show the windmill tower and the land immediately around the tower as being farmed for crop production.(pages 5-7) Photos of the well show the: pump head, well casing, a partially rusted out well casing cover and vegetation growing in the area under the tower and tilled farm land on all sides of the tower.(page-8) Jay Gilbertson with East Dakota Water Development District reviewed the above materials and viewed this as an abandoned well and should be properly sealed.

Letters were sent to the adjoining landowners, Oak Lake Township Chairman and clerk, Brookings County Highway Department, Brookings-Deuel Rural Water and the current landowner.

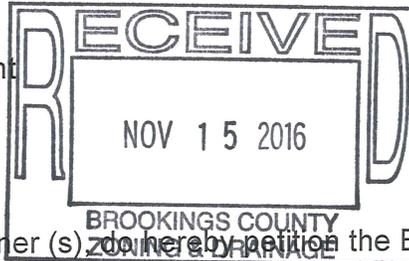
The public notices were published in the Brookings Register on November 22<sup>nd</sup> and 29<sup>th</sup>, 2016, White Tri-City Star on November 24<sup>th</sup> and December 1<sup>st</sup>, 2016 and Hendricks Pioneer on November 23<sup>rd</sup> and 30<sup>th</sup>, 2016.

APPLICATION FOR VARIANCE  
TO  
ZONING REGULATIONS

Date of Application: 11/15/16

Variance Number: 20160AR 021

To: Brookings County Board of Adjustment  
520 3<sup>rd</sup> St, Suite 200  
Brookings, South Dakota 57006



A.) I/We, the undersigned property owner (s) do hereby petition the Board of Adjustment of Brookings County, South Dakota, to grant a Variance to the Brookings County Zoning Regulations for the purpose of:

BUILDING A CLASS A DAIRY CAFO FOR 5,500 ANIMAL UNITS.

B.) Section(s) of Zoning Regulations to be exempted:

Article 22.00 Concentrated Animal Feeding Operation, Section 22.01:  
Concentrated Animal Feeding Operation Control Requirements:  
#6: Required Setbacks and Separation Distance.

C.) Special conditions and circumstances that exist which are peculiar to the land, structure, or buildings in the same district: that literal interpretation of the provisions of this regulation would deprive the applicant of rights commonly enjoyed by other properties in the same district under terms of this regulation: that the special conditions and circumstances do not result from the actions of the applicant, and that granting the variance requested will not confer on the applicant, and privilege that is denied by this regulation to other lands, structures, or buildings in the same district.

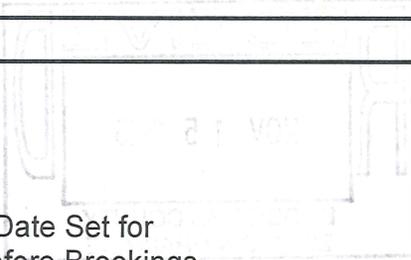
1400 FEET TO THE NE OF THE NE CORNER OF  
OUR PROPOSED BUILDING IS AN OLD WINDMILL WHICH IS  
PROBABLY OVER A WELL. IF THERE IS A WELL IT IS NOT RECORDED  
ON ANY STATE RECORDS. IT IS MY UNDERSTANDING THAT IT  
HASNT BEEN USED FOR MULTIPLE YEARS AND ONE CAN THAT IT  
HAS BEEN FARMED ALL AROUND THE STRUCTURE FOR A NUMBER OF YEARS.

D.) Legal Description of Property:

NE 1/4 Section 10, T112N, R48W

Parcel # 130001124810100 (Oaklake Twp)

site addr - 48187 197th St, Astoria, SD 57213



E.) Time and Date Set for Hearing before Brookings County Board of Adjustment.

December 5<sup>th</sup>, 2016 (Monday)

Date

7:00 pm

Time

Approved

Rejected

Date

Chairman of Brookings County Board of Adjustment

KILLESKILLEN LLC

MICHAEL CRINION

Person filing petition - print

Person filing petition - sign

126 PINE RIDGE RD

Address

BROOKINGS

City

SD

State

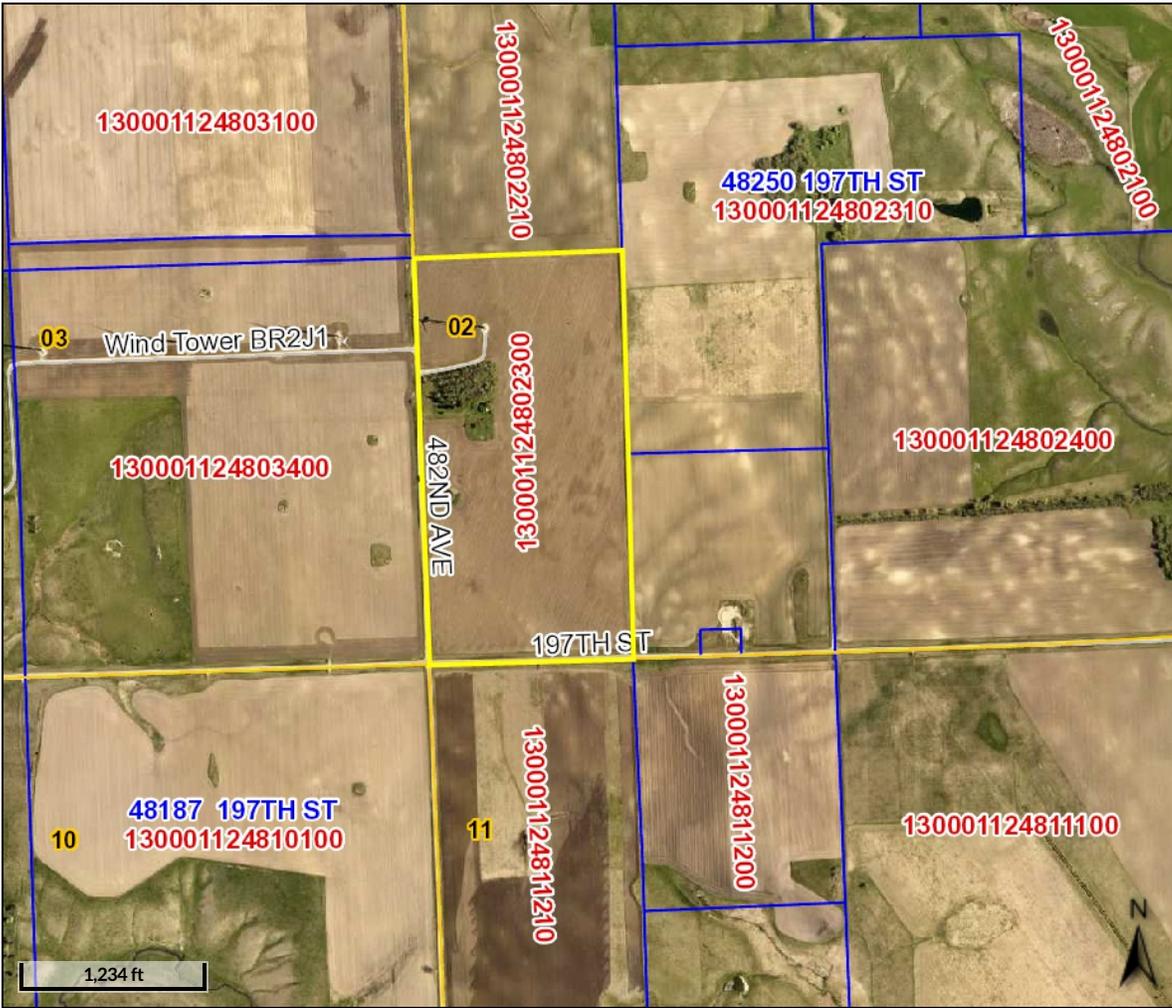
57006

Zip Code

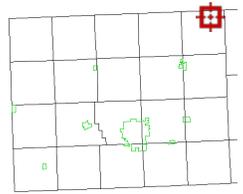
605-691-1045

Telephone

A variance that is granted and not used within three (3) years will be considered invalid.



**Overview**



**Legend**

-  Brookings City Limits
-  City Limits
-  Township Boundar
-  Sections
-  Parcels
-  Roads

<b>Parcel ID</b>	130001124802300	<b>Alternate ID</b>	n/a	<b>Owner Address</b>	SNODGRESS, DARRELL D ET UX
<b>Sec/Twp/Rng</b>	2-112-48	<b>Class</b>	AGA		PO BOX 656
<b>Property Address</b>		<b>Acreage</b>	80		SOLDOTNAK 99669
<b>District</b>	1310 - OAKLAKE TWP/DEUBROOK SCH				
<b>Brief Tax Description</b>	W 1/2 SW 1/4 SEC 2-112-48 80.0 AC				
	<i>(Note: Not to be used on legal documents)</i>				

Date created: 11/16/2016  
 Last Data Uploaded: 2/18/2014 4:02:57 AM

 **Developed by**  
 The Schneider Corporation

# Water Well Completion Reports

SOUTH DAKOTA DEPARTMENT OF ENVIRONMENT & NATURAL RESOURCES

[SEARCH WELLS](#)   [DRILLERS](#)   [PUMP](#)  
[INSTALLERS](#)   [Disclaimer](#)   [Help](#)   [Tools](#)

[Zoom To](#)

**LOCATION**

Twn-Rng-Sec:

County:

**OWNERSHIP**

Last Name:

Business:

**WELL INFO**

Depth:    between  =  <  >

Date Completed:    between  =  <  >

Well Type:

Driller:

**BUFFER SEARCH**

Radius in miles

Lower Left- XMin: -106.48 YMin: 40.94 Upper Right-: XMax: -91.34 YMax: 47.01

  
    
    
 Email To:

*No well logs were found that match your search parameters. Please adjust your search and try again.*

**4-15-2010 Pictometry Photo - W1/2 SW1/4-Sec. 2, T112N,  
R48W - south photo**



04/15/2010

# 5-3-2013 Pictometry Photo - W1/2 SW1/4-Sec.2, T112N, R48W - east view



05/03/2013

# 5-6-2016 Pictometry Photo - W1/2 SW1/4, Sec 2, T112N, R48W - East View



05/06/2016

Looking east.



2016var022: Killeskillen LLC





# DAKOTA ENVIRONMENTAL, INC.

Engineers...Hydrogeologists...Geologists...Remedial Specialists

November 18, 2016

Robert Hill  
Brookings County Zoning & Drainage Dept.  
520 3<sup>rd</sup> Street, Suite 200  
Brookings, SD 57006

Re: Proposed Variance  
Oak Lake Dairy AWMS, Brookings County, SD  
DEC Project No. 1419

Dear Mr. Hill:

Please find included with this letter information regarding the variance application for the above referenced facility. These materials are provided on behalf of the applicant for consideration by the Board.

During preparation of the application materials for this site in 2014, a search of DENR, DENR Water Rights, and US Geological Survey databases containing registered and/or logged wells was performed, which revealed no recorded wells within the required setback distance of the proposed site.

During the 2014 hearing, the presence of an abandoned well in the southwest quarter of section 2 was stated. Subsequent to the hearing, DE personnel stated that if desired, we would be willing to survey the well location if permission were arranged for us to enter the property.

When DE was recently informed that a new Conditional Use application would be required, we were also informed a variance from this well would be required. Since these would be handled as separate agenda items, the materials recently submitted for the Conditional Use application do not include information regarding the well setback or variance application.

With the assistance of the Planning office, the location of the well was plotted on aerial photographs and transferred to the map included with this letter. The location of the well is roughly 1200 feet north-northeast of the northeast corner of section 10, as shown. This location is roughly 1625 feet from the nearest structure of the proposed CAFO facility, and roughly 2335 feet from the nearest component of the proposed CAFO where manure or wastewater would be stored. It is our understanding that the applicant has requested a reduction of the setback distance from the well to 1400 feet. These distances are shown on the included map.

To our knowledge, the depth and configuration of the well have not been verified, and it is our understanding that it is not in use. Given the inactive status of the well, and the distance to the nearest proposed manure storage, it is our opinion that the variance would not be likely to result in substantial detriment to the adjacent property (the well).

11/18/16

2

We hope you will find the included information helpful as you evaluate this application. Please feel free to contact me if there are any questions, or if further information is required.

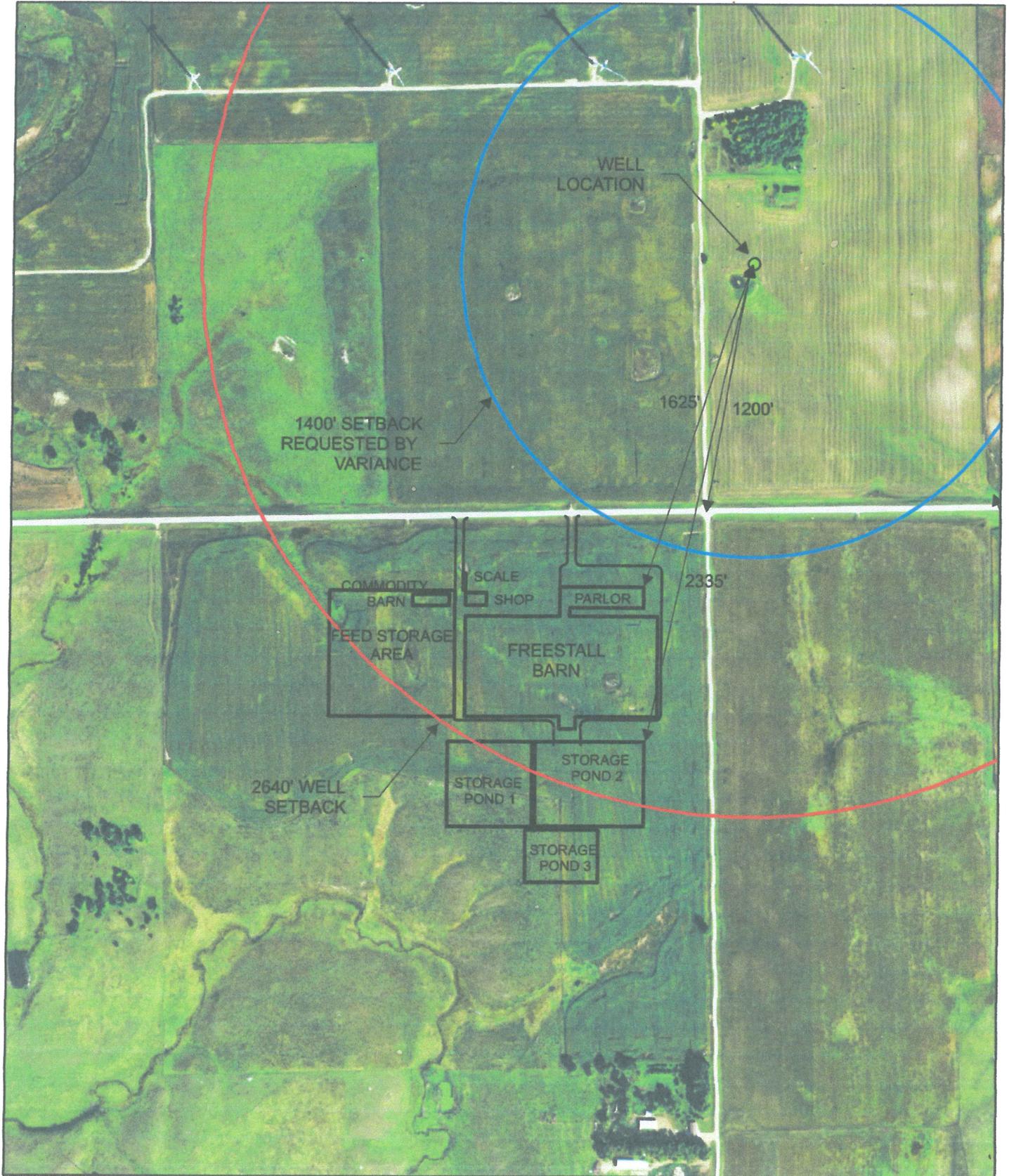
Sincerely,

A handwritten signature in cursive script, appearing to read "Brian Friedrichsen".

Brian Friedrichsen, PE  
Senior Engineer

# OAK LAKE DAIRY

## REQUESTED VARIANCE



1 inch = 600 feet

# 2016cu022 – December 5<sup>th</sup>, 2016

Prepared by Richard Haugen

Applicant: Killeskillen LLC by Michael Crinion, 126 Pine Ridge Rd, Brookings, SD 57006

Land Owners: LC Olson LLP, 2315 E St George Dr, Sioux Falls, SD 57103

Legal Description: NE1/4 of Section 10, T112N, R48W

2016cu022: Killeskillen LLC by Michael Crinion has applied for a conditional use to build a Class "A" Concentrated Animal Feeding Operation (CAFO) for 5,500 animal units of dairy cattle. Brookings County Zoning Ordinance Article 11.00 Agricultural Districts: Section 11.01 "A" Agricultural District: Conditional Use # 11: Class A, B, C, and D Concentrated Animal Feeding Operations. See Section 22.00: Concentrated Animal Feeding Operation: Section 22.01: Concentrated Animal Feeding Operation Regulations. (Brookings County Zoning Ordinance page 22.00-1)

The applicant has an agreement to purchase in the NE1/4 (160 acres) of Section 10, T112N, R48W, Brookings County, SD from the current owner. He also has an agreement to purchase the adjoining building site to the south, with a legal description of "Mersbergan Addtn Lot 1 in the SE1/4 of Section 10, T112N, R48W", (5.7 acres) from the current owner. The building site will be part of the CAFO operation.

The proposed site will border Brookings County Highway 42 (197<sup>th</sup> St) on the north side and 482nd Ave (Oak Lake Township road) on the east side. The site is located on a crest of a hill with rolling terrain on the north half and the east 800 feet of the quarter that currently being cropped farmed. The southwest portion of the quarter is pasture/grass land with steep terrain and natural drainage.

The main driveway access for the proposed facility will be located off Brookings County Highway 42 (197<sup>th</sup> St) at the top of the hill at an existing driveway approximately 600 feet to the west of the intersection of 197<sup>th</sup> St and 482nd Ave.

The proposed site will have trees planted on the north and east sides of the property that will meet the setback requirements.

The location of the proposed site is not located in the Zone "A" (Wellhead Protection Areas) or Zone "B" (remainder of the mapped shallow/surficial aquifer not included in Zone "A"), according to the "First Occurrence of Aquifer Materials in Brookings County, South Dakota" map (Article 16.00 Aquifer Protection) and is noted in the engineer's report. The site is not located in the floodplain, but a portion of the pasture/grassland in the southwest corner of the quarter is within the floodplain.

The engineer's report completed by Brian Friedrichsen with Dakota Environmental Inc. and the conditional use application are enclosed and contains the information required per "Article 22: Section: 22.01: Concentrated Animal Feeding Operation Control Requirements # 8. Information Required for Class A and B Concentrated Feeding Operation Permit,"

- A. Owner's name, address and telephone number.
- B. Legal descriptions of site and site plan.
- C. Number and type of animals.
- D. Nutrient management plan.
- E. Manure management and operation plan.
- F. Management Plan for Fly and Odor Control.
- G. Information on ability to meet designated setback requirements including site plan to scale.
- H. General permits from South Dakota Department of Environment & Natural Resources if available for animal species.
- I. Review of Plans and Specifications and Nutrient Management Plan by the South Dakota Department of Environment & Natural Resources.
- J. Information on soils, shallow aquifers, designated wellhead protection areas, and 100-year flood plain designation.
- K. Notification of whoever maintains the access road (township, county and state). Notification of public water supply officials
- L. Any other information as contained in the application and requested by the County Zoning Officer.

The site is within the required setback distance 2,640 feet for a well that is located to the northeast of the proposed site. The applicant has applied for a variance of 1,240 feet for the location of the well. We will be hearing the variance request 2016var021 also on the night of the meeting.

The Zoning Office has reviewed the above documents and made a site visit to the proposed location.

Letters were sent to the adjoining landowners, Oak Lake Township Chairman and Clerk, Brookings County Highway Department, Brookings-Deuel Rural Water and the current landowner.

The public notices were published in the Brookings Register on November 22<sup>nd</sup> and 29<sup>th</sup>, 2016, White Tri-City Star on November 24<sup>th</sup> and December 1<sup>st</sup>, 2016 and Hendricks Pioneer on November 23<sup>rd</sup> and 30<sup>th</sup>, 2016.

The Planning and Zoning Board has considered and incorporates in these findings: # 7: Standards for Conditional Uses, found on page 22.00-17 of the Brookings County Zoning Ordinance, for all permitted CAFO's in Brookings County.

Granting the conditional use would be an additional agricultural livestock use in rural Brookings County.

Denying the conditional use request allows the current use of the land to continue.

APPLICATION FOR CONDITIONAL USE PERMIT

Date of Application: 11/14/2016

Permit Number: 2016 cu 022

To: Brookings County Planning Commission  
520 3<sup>rd</sup> St, Suite 200  
Brookings, South Dakota 57006

A.) I/We, the undersigned property owner (s), do hereby petition the Brookings County Planning & Zoning Commission of Brookings County, South Dakota, to grant a Conditional Use to the Brookings County Zoning Regulations for the purpose of:

CLASS A CAFO 5,500 ANIMAL UNITS  
DAIRY PERMIT.

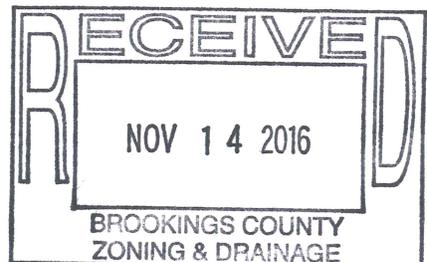
B.) Section(s) of Zoning Regulations authorizing Conditional Use:

Article 11: Section 11.01; "A" Agricultural District; Conditional  
Use Permit # 11: Class A, B, C and D Concentrated Animal Feeding  
Operation.

C.) Legal Description of Property:

NE 1/4 of Section 10, T112 N, R48 W  
Parcel # 1300011248 10100 (Oaklake Twp)  
site address - 48187 191<sup>th</sup> St, Astoria, SD 57213

Form continued on page 2



D.) Time and Date Set for  
Hearing before Brookings  
County Planning Commission.

Dec. 5<sup>th</sup>, 2016 (Mon.)  
Date

7:00 PM  
Time

\_\_\_\_\_  
Approved

\_\_\_\_\_  
Rejected

\_\_\_\_\_  
Date

\_\_\_\_\_  
Chairman of Brookings County Planning  
and Zoning Commission

KILLESKILLEN LLC

MICHAEL CRINION  
Person filing petition – print

[Signature]  
Person filing petition – sign

126 PINE RIDGE RD  
Address

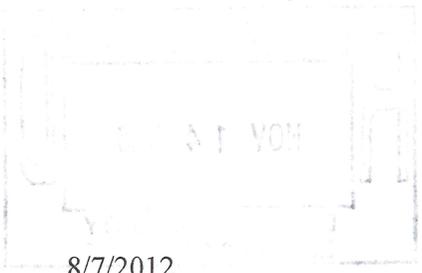
BROOKINGS  
City

SD  
State

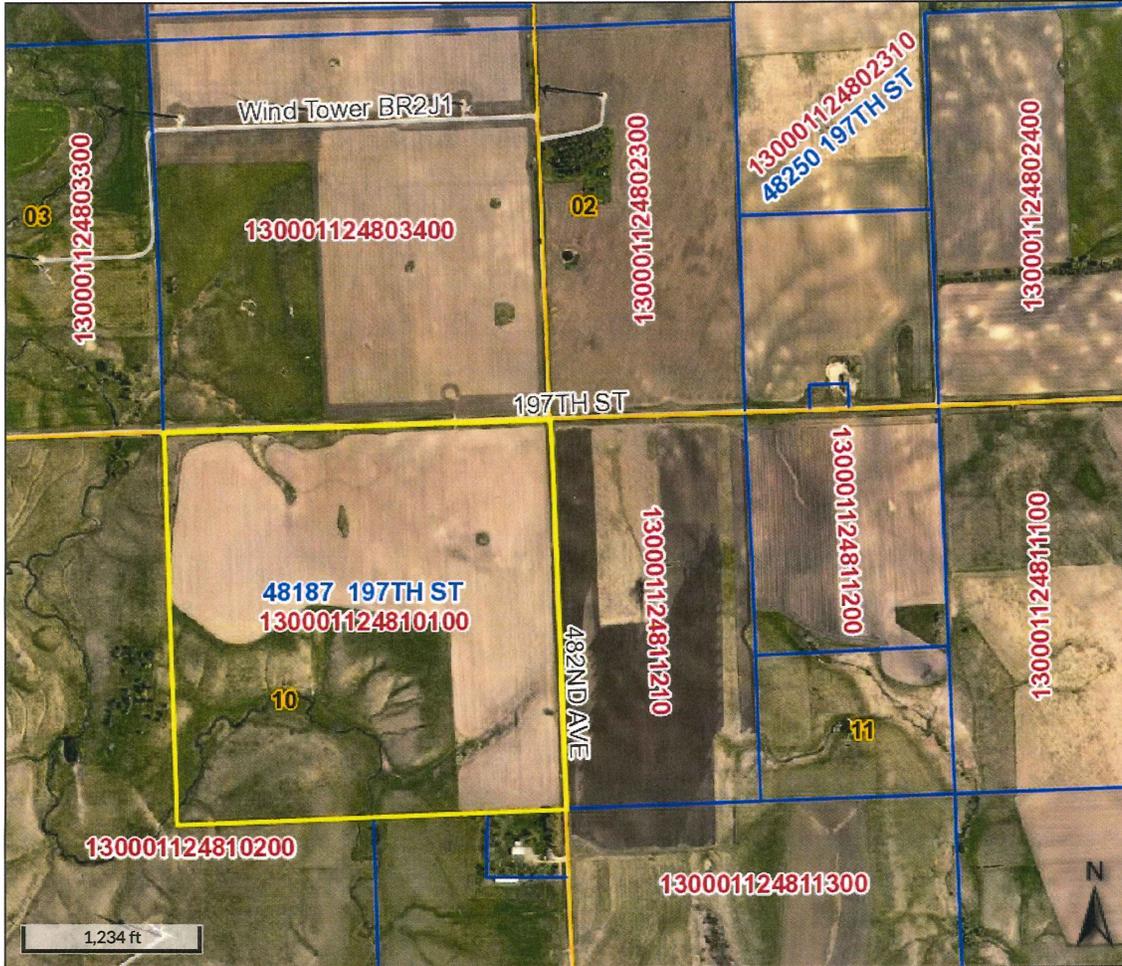
57006  
Zip Code

605-691-1045  
Telephone

**A conditional use that is granted and not used within three (3) years will be considered invalid.**



2016 CU 022



Overview



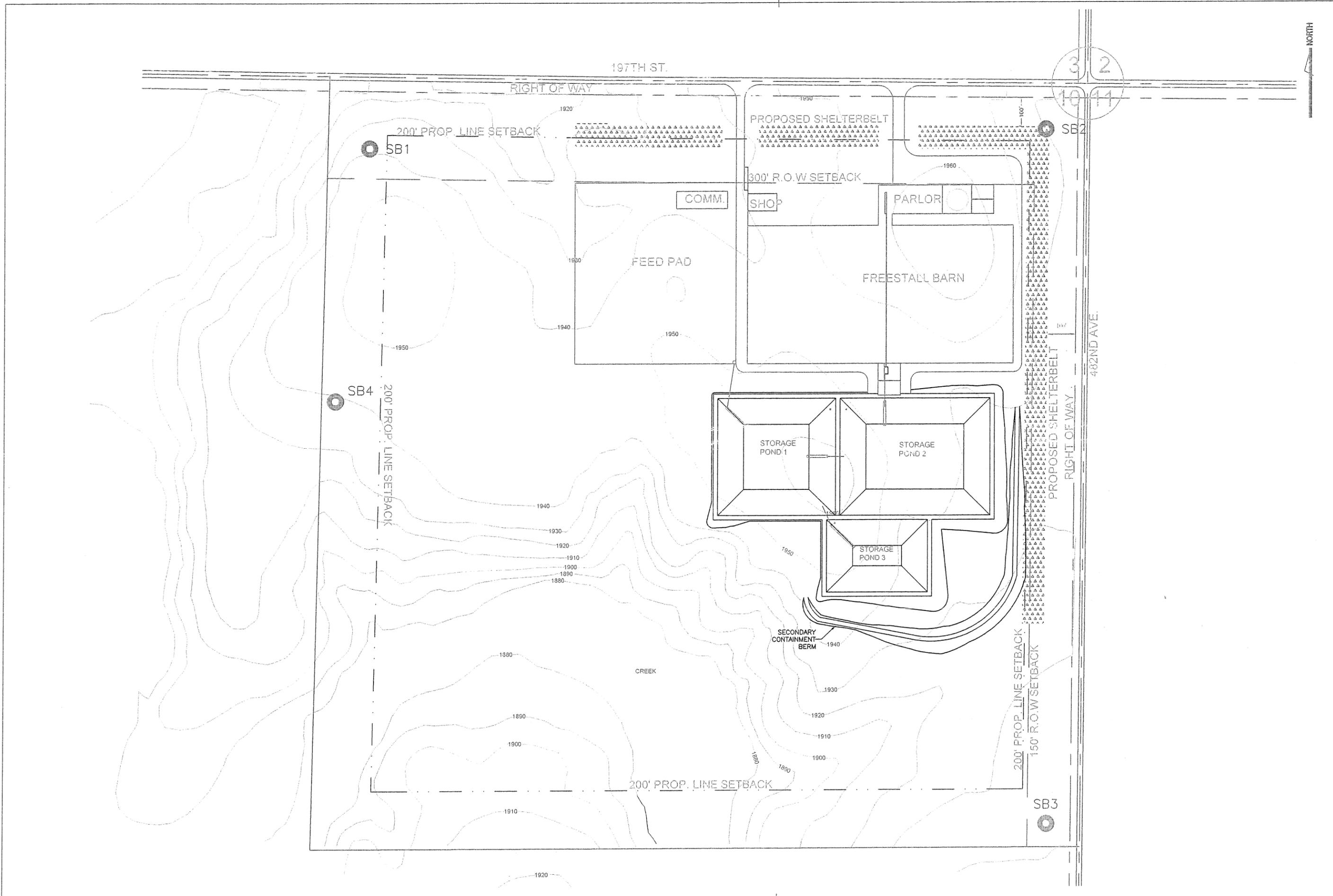
Legend

-  Brookings City Limits
-  City Limits
-  Township Boundar
-  Sections
-  Parcels
-  Roads

Parcel ID	130001124810100	Alternate ID	n/a	Owner Address	LC OLSON LLP
Sec/Twp/Rng	10-112-48	Class	AGA		2315 E ST GEORGE DR
Property Address	48187 197TH ST ASTORIA	Acreage	160		SIOUX FALLS SD 57103
District	13102 - OAKLAKE TWP/DEUBROOKSCH/UP DR				
Brief Tax Description	NE 1/4 SEC 10-112-48 160.0 AC <i>(Note: Not to be used on legal documents)</i>				

Date created: 11/16/2016  
Last Data Uploaded: 2/18/2014 4:02:57 AM

2016 CU 022



REV.	DATE	DESCRIPTION	BY	CHKD
	DATE:	11/14/16	TB	BF

SITE PLAN

OAK LAKE DAIRY AWMS

DAKOTA ENVIRONMENTAL CONSULTANTS INCORPORATED



JOB NO:	1419
SCALE:	1"=300'
DWG:	1

P.O. BOX 636 HURON, SD 57350 605-352-5610

Looking southeast from 197<sup>th</sup> St.



Looking east on 197<sup>th</sup> St.



2016cu022: Killeskillen LLC

Looking south from 197<sup>th</sup> St at east driveway.



Looking south from 197<sup>th</sup> St.



Looking west on 197<sup>th</sup> St from intersection of 482<sup>nd</sup> Ave.



Looking south on 482<sup>nd</sup> Ave from intersection with 197<sup>th</sup> St.



Looking west from 482<sup>nd</sup> Ave.



Looking north on 482<sup>nd</sup> Ave.





# DAKOTA ENVIRONMENTAL, INC.

Engineers...Hydrogeologists...Geologists...Remedial Specialists

November 14, 2016

Robert Hill  
Brookings County Zoning & Drainage Dept.  
520 3<sup>rd</sup> Street, Suite 200  
Brookings, SD 57006

Re: Proposed Animal Waste Management System  
Oak Lake Dairy AWMS, Brookings County, SD  
DEC Project No. 1419

Dear Mr. Hill:

Please find included with this letter information regarding the conditional use application for the above referenced facility. These materials are provided on behalf of the applicant with the intent of addressing the required items listed in Article 22.00 page 19 of the ordinance.

**Appendix I** includes the design calculations summarizing the volume of manure produced by the proposed population, as well as the storage capacity available in the proposed storage structures. Manure will be collected from the manure alleys in the barn by vacuum trucks, which will transport it to a solids separation system. The barn will utilize separated manure solids as bedding. With the exception of a small concrete pad for temporary storage of excess separated solids, all waste at the facility will be handled as a liquid. The storage volume available exceeds 365 days of manure and wastewater production for the proposed population. Additional volume is also provided in the ponds for residual volume, stormwater events, annual precipitation, and freeboard of two feet.

**Appendix II** consists of an abbreviated Nutrient Management Plan for the proposed facility. The SD-CPA-7 spreadsheet contains details of the proposed population, storage and application methods, and land available for application. The spreadsheet indicates adequate land has been secured to apply manure from the facility in accordance with General Permit requirements. A map showing the current land parcels is included, though more may be added after the creation of this map. Copies of manure land application agreements allowing manure from the facility to be applied to nearby fields are also included. The section of the DENR General Permit listing the Nutrient Management Plan requirements is included for reference.

**Appendix III** contains the Operation and Maintenance Manual for the facility, which details the operational, upkeep, and inspection requirements for the facility, as well as best management practices for operation.

**Appendix IV** is the Management Plan for Fly and Odor Control, which was developed to summarize best management practices for dealing with these issues, as well as disposal of

mortalities. Any existing and proposed shelterbelts, which are recommended for odor reduction, are also shown on the site plan in Appendix VII.

**Appendix V** contains an aerial map showing the required setback of 2,640 feet from all nearby residences. No setbacks are indicated from the residence immediately south of the site, as the owner is aware of the potential development and has voiced no objection. It is believed all other required setbacks are met, as we are unaware of any listed features being present within the prescribed distances. A database search of the surrounding area indicated no documented wells within the required setback distance. The required setbacks from property lines and rights of way are shown, and are also shown on the site plan. The proposed structures are also placed to be in accordance with all yard requirements for the agricultural district.

**Appendix VI** contains information regarding soils at the site, aquifers, wellhead protection zones, and flood zones.

A copy of the soils map from the Brookings County Soil Survey is included, which shows the predominant surface soil types at the proposed site. A summary page is included identifying the individual groups, which are mostly clay loams.

Information is also included regarding preliminary soil borings performed at the site, including a map showing the boring locations, the boring logs, laboratory testing of a representative sample, and a copy of the United Soil Classification System chart. Initial borings were placed at the widest corners of the potential area of development in order to provide the greatest coverage of the site. The findings of these borings were consistent, with thick layers of lean clay beneath the topsoil, followed by darker clays at depth. Unweathered clay was encountered at depth in borings 2 through 4, and is suspected to be present slightly below the termination depth of boring 1.

The origin of these soils is glacial till (glacially deposited soils), which typically consist of thick deposits of mainly clay soils, though areas of sand, gravel, boulders, and silts can also be encountered. Till deposits often have good qualities for resisting the passage of water due to the high percentage of clay in the mixture. The till deposits in the area of the site are up to 700 feet thick and overlie the impermeable Pierre Shale. Permeability testing performed on samples obtained from the clays in the elevation range of the pond bottoms was favorable for meeting the permeability requirements of the DENR General Permit, and therefore adequate for use as liner material.

Water was encountered only in boring 3, where a thin wet gravel layer was encountered between 11 and 14 feet in depth. This deposit is believed to be a small deposit within the till and is not believed to represent an aquifer. Additionally, boring 3 is located well south of the proposed storage ponds. All initial borings performed at the proposed site were advanced to meet the deep boring requirements of the General Permit for proving separation from shallow aquifers. Additional borings will be required before submittal of the General Permit application at the rate of one boring per acre of storage structure.

Maps from the study titled "Water Resources of Brookings and Kingsbury Counties" (US Geological Survey, 1989) are included showing the site location relative to the Big Sioux, Rutland, Howard, and Altamont aquifers, which are the glacial aquifers potentially present in the surrounding area. The Big Sioux Aquifer is usually present at the surface or slightly below, and in this part of Brookings County consists of alluvial soils in creekbeds, such as to the west of the

site. The main body of the Big Sioux aquifer is not mapped as present beneath the site. The Rutland Aquifer is mapped as present beneath the site, but is separated from the surface by in excess of 200 feet of glacial till soils, well exceeding the requirement of the DENR General Permit. The Howard and Altamont aquifers, typically found at greater depths, are not mapped as present beneath the site.

The above corresponds with the map titled "First Occurrence of Aquifer Materials in Brookings County, South Dakota" (SD DENR, 2004), which indicates the site to be located in an area where no aquifers are encountered within 100 feet of the ground surface. The map titled "Brookings County Groundwater Protection Zones" also indicates the site is not located within the wellhead protection area or the shallow aquifer boundary. Copies of these maps are included.

A copy of the FEMA Flood Rate Insurance Map for the area is also included, which indicates the site is not located within the mapped flood plain (Zone A).

**Appendix VII** includes the site plan for the proposed facility, as well as additional drawings showing details of the proposed construction.

We hope you will find the included information helpful as you evaluate this application. Based on our initial research and findings to date, it is our opinion that the proposed facility can be constructed to meet the requirements of Brookings County and the South Dakota DENR General Permit. Please feel free to contact me if there are any questions, or if further information is required.

Sincerely,



Brian Friedrichsen, PE  
Senior Engineer

**APPENDIX I**  
**DESIGN CALCULATIONS**



11/14/16

**OAK LAKE DAIRY AWMS  
DAIRY WASTE VOLUME CALCULATIONS SUMMARY**

**Dairy Waste - Milking Herd**

Number	Weight	Manure, cf/day/cow	Manure, total cf/day	Storage Period, days	Manure Volume over Storage Period
3,900	1,000	2.4	9,360	365	<b>3,416,400</b>

**Dairy Washwater & Flushwater - Milking Herd**

Number	Weight	Wash water, cf/day/1000#	Wash water, total cf/day	Storage Period, days	Wash water Volume over Storage Period
3,900	1,000	0.6	2,340	365	<b>854,100</b>

**Annual Precipitation on Contributing Areas**

Annual precipitation runoff from solids stockpiling area, cf:	<b>6,922</b>
Annual precipitation runoff from feed storage area, cf:	<b>371,783</b>

**Total Volume of Manure, Wastewater, and Precipitation to Ponds, cubic feet** **4,649,205**

**Total Storage Pond Volume Available, cubic feet:** **6,601,365**

11/14/16

**OAK LAKE DAIRY AWMS  
SOLIDS STORAGE AREA  
VOLUME CALCULATIONS**

<b>SOLIDS STORAGE PAD RUNOFF VOLUME</b>	
Length of stockpile area, ft	80
Width of stockpile area, ft	80
25 year 24 hour storm depth, ft	0.38
25 year 24 hour volume, cubic ft	<b>2,451</b>
Annual precipitation, ft	2.23
Runoff - percent of mean annual precipitation, % @ CN 97	48.5%
Annual precipitation volume, cubic ft	<b>6,922</b>

**Dakota Environmental, Inc.**

P.O. Box 636, 1122 21st Street SW Huron, SD 57350 Phone: (605) 352-5610 Fax: (605) 352-0951

11/14/16

**OAK LAKE DAIRY AWMS  
FEED STORAGE AREA  
RUNOFF VOLUME CALCULATIONS**

<b>FEED STORAGE PAD RUNOFF VOLUME</b>	
Length of stockpile area, ft	625
Width of stockpile area, ft	550
25 year 24 hour storm depth, ft	0.38
25 year 24 hour volume, cubic ft	<b>131,656</b>
Annual precipitation, ft	2.23
Runoff - percent of mean annual precipitation, % @ CN 97	48.5%
Annual precipitation volume, cubic ft	<b>371,783</b>

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OAK LAKE DAIRY AWMS  
REQUIRED POND CAPACITY CALCULATIONS

**Storage Pond Capacity Balance**

<b>25 year / 24 hour storm volumes reporting to Pond 1</b>		Volume, cf
Solids storage pad and drainage area		2,451
Feed storage pad and drainage area		131,656
<b>Total, cubic feet</b>		<b>134,107</b>

<b>Volumes reporting to ponds for storage</b>		Volume, cf
Manure, washwater, and bedding volume from herd		4,270,500
Annual precipitation from solids storage pad and drainage area		6,922
Annual precipitation from feed storage pad and drainage area		371,783
<b>Total, cubic feet</b>		<b>4,649,205</b>

<b>Storage Volumes Available</b>		Volume, cf
Storage Pond 1		2,377,625
Storage Pond 2		3,276,338
Storage Pond 3		947,402
<b>Total pond storage volume provided, cubic feet</b>		<b>6,601,365</b>

Balance 1,952,160

**OAK LAKE DAIRY AWMS  
POND 1 VOLUME CALCULATIONS**

**POND DESIGN VOLUME AND ELEVATION SUMMARY**

DESCRIPTION	EQN.		DEPTH (FT)	ELEV.	ACTUAL DESIGN USED
Existing Grade	G			1945.00	
Inside Top of Berm Width (ft)	W	405			
Inside Width Slope, horizontal feet per foot drop	SW	3			
Inside Top of Berm Length (ft)	L	405			
Inside Length Slope, horizontal feet per foot drop	SL	3			
Constructed Top of Berm, including settlement	E+S			1950.00	1950.0
Settlement, % of embankment height	S=%(E-G)	0%	0.00		
Reference Elevation, operational top of berm (acres & elev. - ft.)	E	3.77		1950.00	
Freeboard (in)	F	24	2.00		
Surface Area at Top of 24hr/25yr storm (acres/elev)	AS=E-F	3.55		1948.00	
25yr/24hr Rainfall (in)	R	4.6			
Surface Area at Inside Top of Berm, incl. Contributing area (ac)	OB	3.77			
Volume of 25yr/24hr Rainfall (cf)	VR=R*OB	196,984			
Volume Provided for 25yr/24hr Rainfall (cf)	avg(AS,O)*(AS-O)	204,253	1.35		
Maximum Surface Area and Operating Level (acres/elev)	O=E-F-R	3.40		1946.65	1946.65
Mean Annual Rainfall (in)	MAR	26.74			
Direct Mean Annual Rainfall within berms (cf)	DM=OB*MAR	365,502			
Mean Annual Lake Evaporation (in)	ME	33			
Evaporation Midpoint (elev)				1933.83	
Surface Area at Evaporation Midpoint (ac)	ESA	2.18			
Net Evaporation at Midpoint (cf)	NE=ME*ESA	260,791			
Net Moisture used for design (evap[-] or rain[+]) (cf)	M	104,711	0.72		
Apparent Operation Level considering Net Moisture adj.	A=O-M	3.33		1945.93	
Volume Provided for Net Moisture (cf)	avg(O,A)*(O-A)	105,476			
Waste Storage Depth (ft) excluding residual depth	D	25.65			
Surface area at top of residual layer (acres/elev)	SS=O-D	1.23		1921.00	
Net Storage Depth provided	D-M	24.9	24.9		
Total Storage Volume from Net Storage Depth (cf)		<b>2,377,625</b>			
Residual Layer Depth (in)	SD	12	1.00		
Top of Liner, surface area, acres	SS-SD	1.16		1920.00	1920.0

OAK LAKE DAIRY AWMS  
POND 2 VOLUME CALCULATIONS

POND DESIGN VOLUME AND ELEVATION SUMMARY

DESCRIPTION	EQN.		DEPTH (FT)	ELEV.	ACTUAL DESIGN USED
Existing Grade	G			1945.00	
Inside Top of Berm Width (ft)	W	405			
Inside Width Slope, horizontal feet per foot drop	SW	3			
Inside Top of Berm Length (ft)	L	520			
Inside Length Slope, horizontal feet per foot drop	SL	3			
Constructed Top of Berm, including settlement	E+S			1950.00	1950.0
Settlement, % of embankment height	S=%(E-G)	0%	0.00		
Reference Elevation, operational top of berm (acres & elev. - ft.)	E	4.83		1950.00	
Freeboard (in)	F	24	2.00		
Surface Area at Top of 24hr/25yr storm (acres/elev)	AS=E-F	4.58		1948.00	
25yr/24hr Rainfall (in)	R	4.6			
Surface Area at Inside Top of Berm, incl. Contributing area (ac)	OB	4.83			
Volume of 25yr/24hr Rainfall (cf)	VR=R*OB	80,730			
Volume Provided for 25yr/24hr Rainfall (cf)	avg(AS,O)*(AS-O)	264,637	1.35		
Maximum Surface Area and Operating Level (acres/elev)	O=E-F-R	4.42		1946.65	1946.65
Mean Annual Rainfall (in)	MAR	26.74			
Direct Mean Annual Rainfall within berms (cf)	DM=OB*MAR	469,287			
Mean Annual Lake Evaporation (in)	ME	33			
Evaporation Midpoint (elev)				1933.83	
Surface Area at Evaporation Midpoint (ac)	ESA	2.99			
Net Evaporation at Midpoint (cf)	NE=ME*ESA	358,180			
Net Moisture used for design (evap[-] or rain[+]) (cf)	M	111,107	0.59		
Apparent Operation Level considering Net Moisture adj.	A=O-M	4.35		1946.06	
Volume Provided for Net Moisture (cf)	avg(O,A)*(O-A)	112,602			
Waste Storage Depth (ft) excluding residual depth	D	25.65			
Surface area at top of residual layer (acres/elev)	SS=O-D	1.83		1921.00	
Net Storage Depth provided	D-M	25.1	25.1		
Total Storage Volume from Net Storage Depth (cf)		<b>3,276,338</b>			
Residual Layer Depth (in)	SD	12	1.00		
Top of Liner, surface area, acres	SS-SD	1.76		1920.00	1920.0

**OAK LAKE DAIRY AWMS  
POND 3 VOLUME CALCULATIONS**

**POND DESIGN VOLUME AND ELEVATION SUMMARY**

DESCRIPTION	EQN.		DEPTH (FT)	ELEV.	ACTUAL DESIGN USED
Existing Grade	G			1945.00	
Inside Top of Berm Width (ft)	W	250			
Inside Width Slope, horizontal feet per foot drop	SW	3			
Inside Top of Berm Length (ft)	L	350			
Inside Length Slope, horizontal feet per foot drop	SL	3			
Constructed Top of Berm, including settlement	E+S			1950.00	1950.0
Settlement, % of embankment height	S=%(E-G)	0%	0.00		
Reference Elevation, operational top of berm (acres & elev. - ft.)	E	2.01		1950.00	
Freeboard (in)	F	24	2.00		
Surface Area at Top of 24hr/25yr storm (acres/elev)	AS=E-F	1.85		1948.00	
25yr/24hr Rainfall (in)	R	4.6			
Surface Area at Inside Top of Berm, incl. Contributing area (ac)	OB	2.01			
Volume of 25yr/24hr Rainfall (cf)	VR=R*OB	33,542			
Volume Provided for 25yr/24hr Rainfall (cf)	avg(AS,O)*(AS-O)	105,494	1.35		
Maximum Surface Area and Operating Level (acres/elev)	O=E-F-R	1.74		1946.65	1946.65
Mean Annual Rainfall (in)	MAR	26.74			
Direct Mean Annual Rainfall within berms (cf)	DM=OB*MAR	194,979			
Mean Annual Lake Evaporation (in)	ME	33			
Evaporation Midpoint (elev)				1933.83	
Surface Area at Evaporation Midpoint (ac)	ESA	0.89			
Net Evaporation at Midpoint (cf)	NE=ME*ESA	106,394			
Net Moisture used for design (evap[-] or rain[+]) (cf)	M	88,585	1.20		
Apparent Operation Level considering Net Moisture adj.	A=O-M	1.65		1945.45	
Volume Provided for Net Moisture (cf)	avg(O,A)*(O-A)	88,626			
Waste Storage Depth (ft) excluding residual depth	D	25.65			
Surface area at top of residual layer (acres/elev)	SS=O-D	0.31		1921.00	
Net Storage Depth provided	D-M	24.5	24.5		
Total Storage Volume from Net Storage Depth (cf)		<b>947,402</b>			
Residual Layer Depth (in)	SD	12	1.00		
Top of Liner, surface area, acres	SS-SD	0.27		1920.00	1920.0

***APPENDIX II***

***NUTRIENT MANAGEMENT PLAN***

# INITIAL NUTRIENT MANAGEMENT PLAN FOR SOUTH DAKOTA ANIMAL FEEDING OPERATIONS

1. Operator: Oak Lake Dairy		2. County: Brookings		3. Prepared By: Dakota Environmental Inc.		4. Date: November 14, 2016	
<b>Spreadsheet A.) Total Nitrogen And Phosphorus Produced From Operation</b>							
5. Animal Type:	6. No. of animals	7. Ave. weight (lbs.)	8. Days of Confinement		9. Total Manure as Excreted (lbs.)		16. Available for the crop (lbs.)
			N	P <sub>2</sub> O <sub>5</sub>	N	P <sub>2</sub> O <sub>5</sub>	
			10. N retained		11. Total N available for application (lbs.)		13. N Retained
			Handling/Storage	%		%	
			12. Time of application		14. Total N retained in field (lbs.)		15. 3-Yr. Mineralization Rate
			Liquid - earth storage	%	Application Method	%	
<b>CATTLE</b>							
- Dairy (system 1)	3,900	1,000	0.450	0.16	365	640,575	227,760
- Dairy (system 2)							
- Dairy (system 3)							
- Dairy (system 4)							
- Beef (system 1)							
- Beef (system 2)							
- Beef (system 3)							
- Beef (system 4)							
<b>SWINE</b>							
- Nursery pig							
- Growing pig							
- Finishing pig							
- Gestating sow							
- Replacement Gilt							
- Sow and litter							
<b>SHEEP</b>							
- Sheep							
<b>POULTRY</b>							
- Layers							
- Broilers							
- Turkey							
<b>HORSE</b>							
- Horse							
<b>FWL</b>							
- Ducks							
- Geese							
			Total Manure as Excreted:		312,000 lbs/day		OR
			Total lbs. of N and P <sub>2</sub> O <sub>5</sub> available for the crop:		113,880,000 lbs/year		285,632
							227,760

INITIAL NUTRIENT MANAGEMENT PLAN  
FOR  
SOUTH DAKOTA ANIMAL FEEDING OPERATIONS

Spreadsheet B1.) Field Information

Operator: *Oak Lake Dairy*

Date: *11/14/16*

Spreadsheet line #	17.	18.	19.	20.	21.	22.	23.										24.	
Field ID (Include maps to illustrate location)	Field Name or Tract	Field #	Soil map unit symbol	County	Field Location: (1/4 Section, Township, Range)	Owned	Total acres in field	Acres Excluded from Manure Application:										Irrigated
							Minimum Buffer Zones (Drainages & Wetlands)			Excluded Acres			Total acres Excluded					
							35' Vegetated	100' Un-vegetated	100' Vegetated	Drainages	Wetlands	Wells	Slope	Other	Total acres Excluded			
1	2014	1		Brookings	NE 1/4 Sec 10, T 112, R 48	<input type="checkbox"/>	34.9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5.2	5.2	<input type="checkbox"/>	
2	2014	2		Brookings	SW 1/4 Sec 3, T 112, R 48	<input type="checkbox"/>	104.7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	15.7	15.7	<input type="checkbox"/>	
3	2014	3		Deuel	SW 1/4 Sec 33, T 113, R 48	<input type="checkbox"/>	122.8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	18.42	18.4	<input type="checkbox"/>	
4	2014	4		Brookings	SW 1/4 Sec 12, T 112, R 49	<input type="checkbox"/>	141.8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	21.3	21.3	<input type="checkbox"/>	
5	2014	5		Brookings	SE 1/4 Sec 19, T 112, R 48	<input type="checkbox"/>	116.0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	17.4	17.4	<input type="checkbox"/>	
6	2014	6		Brookings	SW 1/4 Sec 20, T 112, R 48	<input type="checkbox"/>	106.1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	15.92	15.9	<input type="checkbox"/>	
7	2014	7		Brookings	E 1/2 Sec 7, T 112, R 48	<input type="checkbox"/>	258.9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	38.84	38.8	<input type="checkbox"/>	
8	2014	8		Brookings	NW 1/4 Sec 19, T 112, R 48	<input type="checkbox"/>	107.0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	16.05	16.1	<input type="checkbox"/>	
9	2014	9		Brookings	E 1/2 Sec 1, T 112, R 49	<input type="checkbox"/>	295.0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	29.25	29.3	<input type="checkbox"/>	
10	2014	10		Brookings	NW 1/4 Sec 4, T 112, R 48	<input type="checkbox"/>	168.4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	25.26	25.3	<input type="checkbox"/>	
11	2014	11		Brookings	W1/2 SW Sec 6, T 112, R 48	<input type="checkbox"/>	59.1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8.87	8.9	<input type="checkbox"/>	
12	2014	12		Deuel	SW 1/4 Sec 32, T 113, R 48	<input type="checkbox"/>	141.4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	21.21	21.2	<input type="checkbox"/>	
13	2014	13		Brookings	SE 1/4 Sec 6, T 112, R 48	<input type="checkbox"/>	123.7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	18.56	18.6	<input type="checkbox"/>	
14	2014	14		Brookings	SW 1/4 Sec 8, T 112, R 48	<input type="checkbox"/>	131.6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	19.74	19.7	<input type="checkbox"/>	
15	2014	15		Brookings	SE 1/4 Sec 20, T 112, R 48	<input type="checkbox"/>	139.2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	20.88	20.9	<input type="checkbox"/>	
16	2014	16		Deuel	E 1/2 Sec 30, T 113, R 48	<input type="checkbox"/>	266.9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	40.03	40.0	<input type="checkbox"/>	
17	2014	17		Deuel	SW 1/4 Sec 25, T 113, R 48	<input type="checkbox"/>	72.7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	10.91	10.9	<input type="checkbox"/>	
18	2014	18		Brookings	E 1/2 Sec 12, T 112, R 49	<input type="checkbox"/>	290.8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	43.62	43.6	<input type="checkbox"/>	
19	2014	19		Brookings	NW 1/4 Sec 12, T 112, R 49	<input type="checkbox"/>	136.3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	20.45	20.5	<input type="checkbox"/>	
20	2014	20		Brookings	SW 1/4 Sec 7, T 112, R 48	<input type="checkbox"/>	95.2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	14.28	14.3	<input type="checkbox"/>	
21	2014	21		Brookings	N 1/2 Sec 8, T 112, R 48	<input type="checkbox"/>	303.9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	45.59	45.6	<input type="checkbox"/>	
22	2014	22		Brookings	NE 1/4 Sec 6, T 112, R 48	<input type="checkbox"/>	160.9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	24.14	24.1	<input type="checkbox"/>	
23	2014	23		Brookings	N1/2 NW Sec 4, T 112, R 48	<input type="checkbox"/>	79.7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	11.96	12.0	<input type="checkbox"/>	
24	2014	24		Brookings	E1/2 SW Sec 6, T 112, R 48	<input type="checkbox"/>	71.1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	10.67	10.7	<input type="checkbox"/>	
25						<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>			<input type="checkbox"/>	
							<b>Total Acres:</b>										3,527.9	

**INITIAL NUTRIENT MANAGEMENT PLAN  
FOR  
SOUTH DAKOTA ANIMAL FEEDING OPERATIONS**

**Spreadsheet B2.) Estimated Nutrient Requirement**

Spreadsheet line #	Operator: <i>Onk Lake Dairy</i>		Date: <i>11/14/16</i>		26.		27.		28.		29.			30.		
	Field ID (Include maps to illustrate location)		Crops in Rotation and Average Yield:				Estimated Nitrogen requirements		Legume N credits		Additional N needed for crops:			Total manure N allowed per field		
	Name or Tract	Field #	Prior year	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3	(lbs.)
1	2014	1	Corn (bu)	166	Soybean (bu)	44	Corn (bu)	166	199	166	40	0	126	119	126	3,671
2	2014	2	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	199	166	40	0	126	119	126	10,992
3	2014	3	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	199	166	40	0	126	119	126	12,892
4	2014	4	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	199	166	40	0	126	119	126	14,894
5	2014	5	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	199	166	40	0	126	119	126	12,184
6	2014	6	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	199	166	40	0	126	119	126	11,143
7	2014	7	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	199	166	40	0	126	119	126	27,198
8	2014	8	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	199	166	40	0	126	119	126	11,244
9	2014	9	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	199	166	40	0	126	119	126	32,840
10	2014	10	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	199	166	40	0	126	119	126	17,685
11	2014	11	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	199	166	40	0	126	119	126	6,208
12	2014	12	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	199	166	40	0	126	119	126	14,852
13	2014	13	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	199	166	40	0	126	119	126	12,986
14	2014	14	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	199	166	40	0	126	119	126	13,822
15	2014	15	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	199	166	40	0	126	119	126	14,621
16	2014	16	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	199	166	40	0	126	119	126	28,033
17	2014	17	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	199	166	40	0	126	119	126	7,634
18	2014	18	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	199	166	40	0	126	119	126	30,545
19	2014	19	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	199	166	40	0	126	119	126	14,312
20	2014	20	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	199	166	40	0	126	119	126	10,000
21	2014	21	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	199	166	40	0	126	119	126	31,920
22	2014	22	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	199	166	40	0	126	119	126	16,897
23	2014	23	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	199	166	40	0	126	119	126	8,367
24	2014	24	Corn (bu)	167	Soybean (bu)	44	Corn (bu)	166	199	166	40	0	126	119	126	7,468
25																

Total N recommendation: 372,409

**INITIAL NUTRIENT MANAGEMENT PLAN  
FOR  
SOUTH DAKOTA ANIMAL FEEDING OPERATIONS**

Spreadsheet line #	Field ID (Include maps to illustrate location)	Name or Tract	Field #	Predicted soil loss using RUSLE2 (T/ac/yr)	Phosphorus Soil Test			Date (M/Y)	Phosphorus removal estimate (lbs.)				Estimated time to raise P soil test level to 50 ppm Olsen or 75 ppm Bray (years)	Manure application based on:	Initial Nutrient Mgt. Plan - N based fields (acres)
					ppm	Olsen	Bray-1		Year 1	Year 2	Year 3	Avg.			
1	2014	1		0.5	20	●	○	assumed	34	58	34	42	1,240	Nitrogen need	29.7
2	2014	2		0.5	20	●	○	assumed	34	58	34	42	3,713	Nitrogen need	89.0
3	2014	3		0.5	20	●	○	assumed	34	58	34	42	4,355	Nitrogen need	104.3
4	2014	4		0.5	20	●	○	assumed	34	58	34	42	5,031	Nitrogen need	120.5
5	2014	5		0.5	20	●	○	assumed	34	58	34	42	4,116	Nitrogen need	98.6
6	2014	6		0.5	20	●	○	assumed	34	58	34	42	3,764	Nitrogen need	90.2
7	2014	7		0.5	20	●	○	assumed	34	58	34	42	9,187	Nitrogen need	220.1
8	2014	8		0.5	20	●	○	assumed	34	58	34	42	3,798	Nitrogen need	91.0
9	2014	9		0.5	20	●	○	assumed	34	58	34	42	11,093	Nitrogen need	265.8
10	2014	10		0.5	20	●	○	assumed	34	58	34	42	5,974	Nitrogen need	143.1
11	2014	11		0.5	20	●	○	assumed	34	58	34	42	2,097	Nitrogen need	50.2
12	2014	12		0.5	20	●	○	assumed	34	58	34	42	5,017	Nitrogen need	120.2
13	2014	13		0.5	20	●	○	assumed	34	58	34	42	4,387	Nitrogen need	105.1
14	2014	14		0.5	20	●	○	assumed	34	58	34	42	4,669	Nitrogen need	111.9
15	2014	15		0.5	20	●	○	assumed	34	58	34	42	4,939	Nitrogen need	118.3
16	2014	16		0.5	20	●	○	assumed	34	58	34	42	9,469	Nitrogen need	226.9
17	2014	17		0.5	20	●	○	assumed	34	58	34	42	2,579	Nitrogen need	61.8
18	2014	18		0.5	20	●	○	assumed	34	58	34	42	10,318	Nitrogen need	247.2
19	2014	19		0.5	20	●	○	assumed	34	58	34	42	4,834	Nitrogen need	115.8
20	2014	20		0.5	20	●	○	assumed	34	58	34	42	3,378	Nitrogen need	80.9
21	2014	21		0.5	20	●	○	assumed	34	58	34	42	10,782	Nitrogen need	258.3
22	2014	22		0.5	20	●	○	assumed	34	58	34	42	5,708	Nitrogen need	136.7
23	2014	23		0.5	20	●	○	assumed	34	58	34	42	2,826	Nitrogen need	67.7
24	2014	24		0.5	20	●	○	assumed	34	58	34	42	2,522	Nitrogen need	60.4
25															

Operator: Oak Lake Dairy		Date: 11/14/16	
17.		33.	
31.		35.	
36.		36.	
<b>Total lbs of N and P205 available for crops:</b>	<b>N</b>	<b>P205</b>	<b>Total Acres</b>
<b>Total lbs of N and P205 required by fields:</b>	285,632	227,760	3,013.7
	372,409	125,794	

Adequate acres are available based on Nitrogen analysis  
However, P205 is in excess of removal. At this rate, it will take approximately 17 year(s) to build all listed fields up to 50 ppm P (Olsen).

# OAK LAKE DAIRY

## NMP FIELDS



1 inch = 5,000 feet



# Manure Application Agreement

Field Number	Legal Description	Acres Available for Application
<i>(Example: Field 6      W 1/2 of the NW 1/4 of Section 7, T 97 N, R 52 W, Hanson County, SD      125.8)</i>		
	<i>SW 1/4 of Section 12, T112 N, R 49 W, BROOKINGS COUNTY SD</i>	<i>160 ACRES</i>
	<i>SE 1/4 of Section 19, T112 N, R 48 W, BROOKINGS COUNTY SD</i>	<i>120 ACRES</i>
	<i>SW 1/4 of Section 20, T112 N, R 48 W, BROOKINGS COUNTY, SD</i>	<i>119 ACRES</i>
		<i>399 ACRES</i>

The undersigned hereby authorizes KILLESKILLEN LLC to spread manure on the above referenced land for a period of 5 year(s). This agreement will renew year to year unless canceled 30 days prior to the anniversary date of the agreement. Cancellation of this agreement will be made in writing to the above listed person.

*HOME*

Land Owner (Printed): CAROL TRUST  
*KE OLSON*

(Signature): *Carol Olson*

Date: *9/17/14*



# Manure Application Agreement

Field Number	Legal Description	Acres Available for Application
<i>(Example: Field 6      W 1/2 of the NW 1/4 of Section 7, T 97 N, R 52 W, Hanson County, SD      125.8)</i>		
	<i>E 1/2 of Section 1, T 112 N, R 49 W, BROOKINGS COUNTY SD</i>	<i>314 ACRE</i>
	<i>NW 1/4 of Section 4, T 112 N, R 48 W, BROOKINGS COUNTY SD</i>	<i>170 ACRE</i>
	<i>E 1/2 of SW 1/4 of Section 6, T 112 N, R 48 W, BROOKINGS COUNTY SD</i>	<i>77 ACRE</i>
	<i>SW 1/4 of Section 32, T 113 N, R 48 W, DEUEL COUNTY, SD</i>	<i>146 ACRE</i>
		<i>706 ACRES</i>

The undersigned hereby authorizes KILLESKILLEN LLC to spread manure on the above referenced land for a period of 5 year(s). This agreement will renew year to year unless canceled 30 days prior to the anniversary date of the agreement. Cancellation of this agreement will be made in writing to the above listed person.

Land Owner (Printed): WALTER IVERSON  
 (Signature): Walt Iverson  
 Date: 9/23/14



Field Number	Legal Description	Acres Available for Application
(Example: Field 6	W 1/2 of the NW 1/4 of Section 7, T 97 N, R 52 W, Hanson County, SD	125.8)
	SW 1/4 of Section 8, T 112 N, R 48 W, BROOKINGS COUNTY, SD	150 ACRES
	SE 1/4 of Section 20, T 112 N, R 48 W, BROOKINGS COUNTY, SD	160 ACRES
	E 1/2 of Section 30, T 113 N, R 48 W, Deuel County, SD	267 ACRES
	N 1/2 SW 1/4 & SW 1/4 SW 1/4 25-113-48 Deuel Co S.P.	120 Acres

The undersigned hereby authorizes KILLESKILLEN LLC to spread manure on the above referenced land for a period of 5 year(s). This agreement will renew year to year unless canceled 30 days prior to the anniversary date of the agreement. Cancellation of this agreement will be made in writing to the above listed person.

Land Owner (Printed): James Heimann James Heimann  
 (Signature): [Signature] Gary Grave  
 Date: 8-24-14



# Manure Application Agreement

Field Number	Legal Description	Acres Available for Application
(Example: Field 6	W 1/2 of the NW 1/4 of Section 7, T 97 N, R 52 W, Hanson County, SD	125.8)

<del>4.0</del>		
	N 1/2 of Section 8, T 112 N, R 48 W, BROOKINGS COUNTY, SD	320 ACRES
	NE 1/4 of Section 6, T 112 N, R 48 W, BROOKINGS COUNTY, SD	171 ACRES
	N 1/2 of SW 1/4 of Section 4, T 112 N, R 48 W, BROOKINGS COUNTY, SD	91 ACRES
	E 1/2 of SW 1/4 of Section 6, T 112 N, R 48 W, BROOKINGS COUNTY, SD	80 ACRES
		662

The undersigned hereby authorizes \_\_\_\_\_ to spread manure on the above referenced land for a period of \_\_\_\_ year(s). This agreement will renew year to year unless canceled 30 days prior to the anniversary date of the agreement. Cancellation of this agreement will be made in writing to the above listed person.

RENTER  
 Land Owner (Printed): DAVID IVERSON  
 (Signature): David Iverson  
 Date: 9/23/14

- 4) A total depth of 100 feet.

#### 1.4.4. Nutrient Management Requirements.

##### 1. Applicability.

- a. New and expanding operations with construction starting on or after February 12, 2003, must follow the nutrient management requirements in Section 1.4.4. and submit a nutrient management plan with the permit application for department review and approval.
- b. Operations existing prior to February 12, 2003, without previous permit coverage must follow the nutrient management requirements in Section 1.4.4. and submit a nutrient management plan with the permit application for department review and approval. However, these operations may use a nitrogen based nutrient management plan until December 31, 2006, when the phosphorus based portion of the nutrient management plan will become effective.
- c. Operations existing prior to February 12, 2003, with previously approved nitrogen-based nutrient management plans, may continue to implement the approved plan using the buffer zone requirements in Section 1.4.4. A revised nutrient management plan, in accordance with Section 1.4.4., must be submitted to the department for review and approval by July 1, 2006. This plan shall be implemented by December 31, 2006.

##### 2. Best Management Practices for Land Application of Manure. The producer is responsible for the safe land application of manure and process wastewater generated at the animal feeding operation. The producer shall comply with all mandatory best management practices listed below, and may use any or all of the recommended best management practices to ensure compliance with this permit and prevent pollution.

- a. The producer may apply manure for the purpose of growing crops.
- b. The producer shall develop, maintain, and follow a nutrient management plan to ensure safe disposal of manure and process wastewater and protection of surface and ground water.
- c. The Secretary must approve the nutrient management plan submitted with the permit application before land application of any manure and process wastewater.
- d. The initial nutrient management plan is a planning document to ensure the producer has enough land available to apply generated manure and process wastewater.
- e. The Department of Environment and Natural Resources and the Natural Resources Conservation Service have a Microsoft Excel spreadsheet available to assist with developing an initial nutrient management plan. The producer may use other initial planning tools provided the alternate plan contains all the information necessary to determine compliance with conditions of this general permit.
- f. Containment structures shall be equipped with irrigation, evaporation, liquid removal systems, a combination of these systems or the producer shall provide documentation pumping equipment will always be available if needed. These systems shall be capable of dewatering the containment structures for proper land application. The producer shall maintain freeboard in the manure containment structure at all times as required by Section 1.4.3.2.a. on page 16 of this permit. The producer shall restore the storage capacity necessary

applied to that field again until the applied phosphorus has been removed from the field via harvest and crop removal.

- b. Each producer must maintain on-site a copy of its site-specific nutrient management plan. Each producer must maintain on-site for a period of five years from the date they are created a complete copy of the nutrient management plan for their operation and the records specified below. The producer must make these records available to the Secretary upon request.
  - 1) Initial nutrient management plan;
  - 2) Expected crop yields;
  - 3) The date(s) manure, litter, or process waste water is applied to each field;
  - 4) Weather conditions at time of application and for 24 hours prior to and following application;
  - 5) Test methods used to sample and analyze manure, litter, process waste water, and soil;
  - 6) Results from manure, litter, process waste water, and soil sampling;
  - 7) Explanation of the basis for determining manure application rates, as provided in the technical standards established by this permit;
  - 8) Calculations showing the total nitrogen and phosphorus (if required) to be applied to each field, including sources other than manure, litter, or process wastewater;
  - 9) Total amount of nitrogen and phosphorus (if required) actually applied to each field, including documentation of calculations for the total amount applied;
  - 10) The method used to apply the manure, litter, or process wastewater; and
  - 11) Date(s) of manure application equipment inspection.

1.4.5. Inspection requirements. At a minimum, the following must be visually inspected:

1. Weekly inspections of all storm water diversion devices, runoff diversion structures, and devices channelling contaminated storm water to the wastewater and manure storage and containment structure;
2. Daily inspection of water lines, including drinking water or cooling water lines;
3. Weekly inspections of the manure, litter, and process wastewater impoundments; the inspection will note the level in liquid impoundments as indicated by the depth marker;
4. The producer, or agent acting on behalf of the producer, shall inspect the land application equipment, land application site and irrigation equipment, if used, on a daily basis while land application of process wastewater or manure is occurring. This inspection is to ensure that the land application equipment is not leaking and runoff from the land application site and irrigation system is not occurring. If a discharge or leaks are found where process wastewater or manure is reaching any surface waters of the state or flowing onto property not owned by the producer or not included in the nutrient management plan, the producer is responsible for taking immediate steps to stop the discharge or leaks and follow the reporting requirements of this permit. The

- a) The total nitrogen necessary to meet the expected yield goals in pounds of nitrogen per acre shall be determined using the most recent version of SDSU Extension Publication EC750, Fertilizer Recommendation Guide. This value is determined by the crop to be grown and the expected yield. In addition to the manure nitrogen allowed in the nutrient management plan, other nitrogen may be applied up to the amounts as indicated by soil nitrogen test results that are necessary to obtain the realistic yield goal.
  - b) Nitrogen credits must be subtracted from the total nitrogen value determined in item a) above. The following credits must be subtracted from this value.
    - i. The results from the two-foot nitrate soil test conducted in accordance with item a. on page 29. If a two to four-foot-deep nitrate test is required and the result of the test is greater than 30 pounds of nitrogen, then reduce the nitrogen recommendation an additional four pounds of nitrogen for each five pound increment above 30 pounds (for example, if there are 50 pounds of nitrate nitrogen in the 2-4 foot depth, 16 pounds of nitrogen in addition to the 0-2-foot-deep test must be subtracted).
    - ii. Any legume credits. For legume credits, please see the most recent SDSU Extension Publication EC 750, Fertilizer Recommendation Guide.
    - iii. Sampling date adjustment. Breakdown of organic material continues to release nitrates until soils cool in the fall. Therefore, the nitrogen requirement must be adjusted if the soil samples are taken between August 1 and September 15. To make this adjustment, reduce the nitrogen requirement by 0.5 pounds of nitrogen per day prior to September 15. The maximum adjustment would be 23 pounds (August 1 sampling). Samples taken in July should receive the same adjustments as those taken on August 1. Soil samples from fallow fields do not need to be adjusted for time of sampling because most of the residue from the previous crop should have mineralized during the fallow period.
    - iv. Any other sources of nitrogen used.
    - v. The resulting value in pounds of nitrogen per acre is the application rate of the additional nitrogen that may be applied to the field.
  - c) Based on the results of the manure testing required in item 3) on page 30, the producer shall apply manure to each field at a rate not to exceed the rate calculated in item 4)b)v. above. NOTE: If the yields that are used to calculate the application rate are not consistently attained, residual nitrogen will increase in subsequent years and will decrease the amount of manure that can be applied to that field. This nitrogen carry-over will be evident in future soil sampling.
- 5) Phosphorus based application. If the manure application is required to be based on phosphorus crop removal as determined by using Table 2 on page 29, the application rate shall be based on phosphorus removed in the harvested portion of the crop as listed in the most current version of SDSU Extension Publication EXEX 8009, Quantities of Plant Nutrients Contained in Crops. Application can be based on multi-year phosphorus crop removal but cannot exceed the one year nitrogen crop need, and no manure may be

1) Before manure application, each field shall be sampled to a depth of 0 to 6 inches for phosphorus and nitrate-nitrogen and to two feet for nitrate-nitrogen. The Secretary will determine on a case-by-case basis whether a land application site is located over a shallow aquifer. This will be done using the published South Dakota Geological Survey county studies, hydrologic reports, and first occurrence of aquifer materials maps, and well log information located near the fields. If manure application sites are located over shallow aquifers, the producer shall also either:

a) Take soil samples for nitrate-nitrogen from both 0 to 2 and 2 to 4 feet prior to manure application or

b) Take soil samples for nitrate-nitrogen to a depth of two feet both prior to manure application and within four weeks after harvesting the crop. This will apply to all fields in the nutrient management plan located over a shallow aquifer. Once the producer takes the post harvest soil samples, in lieu of the 2 to 4 foot samples, it will become a condition of this permit to continue taking post harvest samples for the fields located over shallow aquifers. If a producer does not take the required 2 to 4 foot samples prior to land application of manure, the post harvest sampling will then be required. In either case, the producer will no longer have the option of taking the deep soil samples.

If the post harvest soil sample results indicate the residual nitrate-nitrogen in the soil is above 100 pounds per acre, the yield goal shall be reduced by 25% the next time manure is applied to that field. If the residual post harvest nitrate-nitrogen in the soil remains above 100 pounds per acre, the department will remove that field from the approved nutrient management plan, and the producer will not be able to apply manure to this field for the life of this permit. Upon request of the producer, the department would evaluate adding back any removed field to the approved nutrient management plan when the general permit is reissued. The post harvest soil sampling information may be used to indicate permit compliance or noncompliance with the approved nutrient management plan.

2) A minimum of 15 soil sample cores shall be taken from each field or landscape position in the field. Soil sample cores that represent similar soil and landscape position may be composited into one sample.

3) The producer shall take a representative sample each year of the manure or process wastewater that will be land applied and have it tested for total nitrogen, inorganic nitrogen, and phosphorus. Organic nitrogen is equal to the total nitrogen minus the inorganic nitrogen.

4) Nitrogen based application. Based on a soil test, a manure test, type of crop, expected yield, legume credits, and sampling date, the producer shall determine the total nitrogen that can be applied to each field. When determining the application rate of nitrogen, the producer does not have to use the yield goals listed in the initial nutrient management plan. The producer may use the yield goal that is reasonably expected for that field. The total nitrogen that can be applied shall be determined as follows:

Table 2. Nitrogen Need/Phosphorus Crop Removal Manure Application Determination Table						
Soil Test Phosphorus ppm		Soil Loss – Erosion, Sheet and Rill Number (Tons per Acre)				Greater than 6
		Less than 4		4 to 6		
		100 Foot Vegetated Buffer		100 Foot Vegetated Buffer		
Olsen	Bray-1	Yes	No	Yes	No	
0-25	0-35	Nitrogen need	Nitrogen need	Nitrogen need	Nitrogen need	No application
26-50	36-75	Nitrogen need	Nitrogen need	Nitrogen need	Phosphorus crop removal <sup>1</sup>	No application
51-75	76-110	Nitrogen need	Phosphorus crop removal	Phosphorus crop removal	Phosphorus crop removal	No application
76-100	111-150	Phosphorus crop removal	Phosphorus crop removal	Phosphorus crop removal	Phosphorus crop removal	No application
Greater than 100	Greater than 150	No application	No application	No application	No application	No application

<sup>1</sup>Phosphorus crop removal is the amount of phosphorus a crop removes in a one year crop rotation.

- s. An estimate on the number of years it would take to raise all fields in the initial nutrient management plan to phosphorus soil test level over 50 parts per million using the Olsen test or 75 parts per million using the Bray-1 test.
  - t. Determination of the total amount of nitrogen (based on crop need) and phosphorus (based on crop removal) that can be applied to each field based on the crop planted at the field, the realistic yield goal, any residual nitrogen left in the field from past agricultural practices or crops, and the phosphorus soil test level.
  - u. Comparison of the total nitrogen requirement and crop removal of phosphorus for each field to the total nitrogen and phosphorus available in the manure. If the nitrogen in the manure exceeds the field nitrogen requirements, the producer shall identify additional fields that can be used for the application of manure.
  - v. A list indicating landowners who will be sold or given manure for its fertilizer value, the location and number of acres where manure will be applied, and the estimated amount of manure or process wastewater that will be given to each landowner. The producer must annually provide each landowner with the manure or process wastewater sample results for total nitrogen, inorganic nitrogen, and total phosphorus. Organic nitrogen is equal to the total nitrogen minus the inorganic nitrogen. Manure sold or given away may be subject to the South Dakota Department of Agriculture commercial fertilizer law, SDCL 38-19.
  - w. If any changes are made to the fields approved for use in the nutrient management plan, the producer shall submit an amendment to the department for review and approval prior to the change taking effect.
4. Annual Nutrient Management Requirements.
- a. Upon receiving permit coverage and prior to land applying manure, the producer shall use the following procedure to determine the appropriate application rates of manure and process wastewater based on a nitrogen or phosphorus plan (see Table 2). Upon determining the application rate, the producer shall apply the manure and process wastewater according to the calculated rate. Applying manure above the calculated rate is a violation of this permit. The following is the procedure for calculating the application rate:

- p. The results of a representative 0 to 6 inch soil phosphorus test from each field included in the nutrient management plan. To get a representative sample, a minimum of 15 soil sample cores shall be taken from each field or landscape position to determine the soil test phosphorus in the field.
- q. Identify the annual average soil loss value for sheet and rill erosion for each field to be included in the nutrient management plan using the most current soil loss prediction technology used by the South Dakota Natural Resources Conservation Service. References can be found in the South Dakota Natural Resources Conservation Service Field Office Technical Guide, Section 1, Erosion Prediction at the following web site: <http://efotg.nrcs.usda.gov/> or local Natural Resources Conservation Service office. The soil loss number may be adjusted by implementing alternative crop rotation and cropping practices, or implementing conservation practices such as contour farming, cross-slope farming, buffer strips, strip cropping, or terracing.
- r. Identify whether fields in the nutrient management plan can be used to land apply manure based on nitrogen need or phosphorus crop removal. Table 2 shall be used to make this determination for each field by considering the level of phosphorus in the soil, the soil loss number, and the presence or absence of a 100 foot vegetated buffer. Only fields identified as eligible for nitrogen based manure application can be included in the total acres needed to determine acres for manure application in the initial nutrient management plan. Fields requiring a phosphorous based plan can be listed in the plan and used for manure application. However, these acres cannot be used to show a producer has enough land to apply manure generated at the operation.

- d. An estimate of the total nitrogen and phosphorus in pounds that will be available for crop production. The producer may use either estimated nutrient concentrations for the animal manure or nutrient concentrations from laboratory analysis. If laboratory analysis is conducted, the analysis shall be included with the plan. If estimated concentrations are used to determine the total nutrients available, the source of the estimated concentrations of nitrogen for the animal manure shall be provided.
- e. The total number of days of storage in the manure containment structure(s).
- f. An estimate of the daily and annual amount of manure produced in tons of wet manure.
- g. The type or types of manure containment structures.
- h. The method(s) of manure application.
- i. The initial nutrient management plan shall include the proper mineralization rates for subsequent years of manure and process wastewater application to account for the potential buildup of nitrogen.
- j. The legal description of all fields to be used for land application, the crop to be planted on each field, the number of acres in each field, and whether the field is irrigated. Land identified or classified as wetlands, lakes, rivers, or streams, farmsteads, tree belts, or other buffer zones that cannot or will not be used for manure application shall not be included in the total number of acres available for land application. Wetlands may be used on a case-by-case basis if they are farmable and it would be a normal practice to apply fertilizer to them without impacting surface or ground water. Also, if either this permit or local governments require setback distances or buffer zones, areas within those buffer zones shall be identified on the field maps and cannot be included in the total number of acres.
- k. A copy of each written agreement executed with the owner of the land where manure will be applied. The written agreement shall indicate the acres that manure from the animal feeding operation may be applied and the length of the agreement. The producer shall ensure that there is enough land to apply manure consistent with the approved initial nutrient management plan.
- l. A detailed map showing the outline of each field listed in item j. above and all buffer zones and separation distances required by this permit.
- m. A soils map for the land application fields and a description of the predominate soil type(s) for each field.
- n. Realistic yield goals for each field and crop listed in item j. above. Yield goal calculations for initial nutrient management planning shall be determined from yields established for purchasing multi-peril crop insurance; proven yields on a field-by-field or farm-by-farm basis; or the South Dakota Agricultural Statistics Service using the published continuous five-year average yield plus ten percent. Proof of field-by-field or farm-by-farm yields shall be based on an average of actual crop receipts from a minimum of three consecutive years. If there is no information available for a crop and field listed in the nutrient management plan, documentation from the local extension service agronomy educator shall be included in the plan specifying that the yield is realistic for that crop in that area.
- o. Times of the year that land application is planned.

- q. All permanent manure stockpiles should be removed and land applied as soon as practicable. Example-When land is available or when stockpiling area is full.
  - r. Application of dry or solid manure on frozen or snow-covered ground should be avoided. If manure will be applied to frozen or snow-covered ground, the producer shall only apply manure on land with slopes less than 4%. The producer shall also maintain a minimum of a 100-foot buffer zone to any natural or manmade drainage.
  - s. To allow for normal winter operation in open lots, snow containing some manure removed from the concentrated animal feeding operation may be land applied and shall be placed on land with slopes less than 4%. The producer shall also maintain a minimum of a 100-foot buffer zone to any natural or manmade drainage.
  - t. Spray irrigation is allowed for land application of manure provided the producer incorporates the manure within 24 hours of application.
  - u. The producer shall inject, or incorporate any liquid manure or wastewater within 24 hours of application to nonvegetated cropland. If the manure is surface broadcast to cropped fields, grass, alfalfa, pasture land, or no till cropland, incorporation is not required.
  - v. The producer shall incorporate any solid or semi-solid manure within five days of application to nonvegetated cropland. If the application area is a cropped field, alfalfa, grass, pasture land, or no till cropland, incorporation is not required.
  - w. A producer may apply manure to property owned by other persons upon obtaining a written agreement from the property owner. Any lands owned by other persons that will be used for manure application shall be identified in the initial nutrient management plan. The producer shall be responsible for ensuring that the application of manure to the other person's property is in compliance with the terms and conditions of this permit and the nutrient management plan. Prior to such an application, a producer shall provide the person with a copy of the soil and manure test results and manure application rate calculation performed by the producer in accordance with the requirements of Sections 1.4.4.3. and 1.4.4.4. of this permit and a list of possible best management practices to ensure protection of surface and ground water.
  - x. Training and education. The producer shall participate in an approved environmental training program on proper operation and maintenance of a manure management system and proper natural resource management. Anyone wishing to provide an approved environmental training program must submit an outline of the training program to the Secretary for approval. Upon request, the Secretary will provide producers with a listing of approved environmental training programs. The producer shall submit training verification prior to receiving a Certificate of Compliance and coverage under this permit.
3. Initial Nutrient Management Plan Requirements for Permit Application. The initial nutrient management plan shall contain and address the following items:
- a. General information on local requirements and whether the producer has complied with those requirements.
  - b. The maximum amount of livestock that will be confined.
  - c. The average weight of the animals through the production cycle for all types of animals raised.

to contain the 25-year, 24-hour rainfall event or 100-year, 24-hour rainfall event for new swine, poultry and veal calf operations, within 14 days of any rainfall event or accumulation of manure or process wastewater that results in storage above the maximum operating level of the containment structure. If soil moisture conditions do not allow land application of manure or process wastewater within 14 days, the producer shall contact the department to discuss restoring the storage capacity of the containment structure. The maximum operating level is the elevation in the containment structure necessary to contain the designed storage of accumulated manure and process generated wastewater and any solids accumulation (see Appendix H). Producers that operate open lots shall have access at all times to equipment capable of dewatering the containment structures.

- g. The producer shall dispose of solids, sludges, manure, or other pollutants in a manner to prevent pollution of surface or ground water.
- h. Any permanent or temporary piping used to transfer manure to the irrigation system shall be designed, constructed and operated so liquid manure is not discharged to waters of the state at any time during start-up, operation, and shut down.
- i. The producer shall maintain at least a 100-foot buffer zone or 35-foot vegetated buffer between
  - 1) any manure land application areas and any natural or manmade drainage;
  - 2) any manure land application areas and open tile line intake structures or other conduits to surface water; and
  - 3) any irrigation of process wastewater and any natural or manmade drainage.

Depending on the results of a producer's soil phosphorus test and estimated field erosion, a 100-foot vegetated buffer zone shall be required if the producer wants to apply manure based on the nitrogen needs of the crop and not crop removal of phosphorus (see Table 2 on page 29).

- j. Fields should be diked or terraced to prevent the release of applied wastewater.
- k. Land to be irrigated or receive manure should have a slope less than 6%.
- l. Highly erodible soils due to water erosion should be avoided.
- m. Irrigation practices should be managed to prevent ponding of wastewater on the land application site.
- n. Application of manure shall not exceed the water storage capacity of the soil.
- o. Process wastewater or manure shall not be spray irrigated on frozen ground.
- p. Surface broadcast, injection, or incorporation of liquid manure or process wastewater should not be applied on frozen or snow-covered ground. If application to frozen or snow-covered ground is absolutely necessary, the producer should notify the department prior to application so the department may review buffer zone requirements with the producer and respond to inquiries from the public. The producer shall only apply liquid manure or process wastewater on land with slopes less than 4%. The producer shall also maintain a minimum of a 100-foot buffer zone to any natural or manmade drainage.

***APPENDIX III***

***MANURE MANAGEMENT AND OPERATION PLAN***

# **OPERATION AND MAINTENANCE MANUAL**

*for the*  
**OAK LAKE DAIRY  
ANIMAL WASTE MANAGEMENT SYSTEM**

*BROOKINGS COUNTY, SOUTH DAKOTA*

**November 14, 2016**

**DEC Project No. 1419**

**Producers:** Michael Crinion  
**Address:** 126 Pine Ridge Road  
Brookings, SD 57006  
**Phone:** (605) 691-1045  
**Project Location:** NE ¼ of Section 10, T112N R48W, Brookings County, SD

The Owner acknowledges responsibility for the proper operation and maintenance of the animal waste management system. Although the design is based on the best available technical knowledge, it must be recognized that any system creates some risks, and therefore needs to be properly operated and maintained, including periodic inspection. In addition, maximum efficiency cannot be obtained unless the system is properly operated and maintained so that it will function safely in its intended manner. Recognizing this, this Manual has been prepared for operating and maintaining the system. The following items list the anticipated major and uncommon items of Operation and Maintenance for this system. It is recommended that the following list be reviewed and be used as a checklist to ensure major elements of operation and maintenance are consistently being observed.

## I. Operation

### A. Inspection:

- \_\_\_ 1. Entire system weekly.
- \_\_\_ 2. Land application sites daily when application of manure is occurring.
- \_\_\_ 3. Fences and safety signs.
- \_\_\_ 4. Depth of waste.
- \_\_\_ 5. Inspect all components for signs of damage or leakage.
- \_\_\_ 6. Inspect earthwork for signs of seepage, rodent damage, settlement, misalignment, excessive vegetative growth, or erosion.
- \_\_\_ 7. Document all inspections on the form included with this manual, including all pertinent information.
- \_\_\_ 8. If a discharge from the manure management system or land application site is found to have occurred, the producer must report the discharge as soon as possible, but no later than twenty-four hours after the discharge was discovered. The discharge must be reported to the State of South Dakota at (605) 773-3351, or (605) 773-3231 after normal business hours.

### B. Daily Operation:

- \_\_\_ 1. All pond liner bottoms shall be kept submerged a minimum of one foot at all times. If there is less than one foot of water, additional water will need to be added to prevent the clay from shrinking and cracking. If cracking occurs, contact Dakota Environmental or the SD DENR to evaluate the liner.
- \_\_\_ 2. Divert stormwater and runoff from entering buildings, transfer structures, and the storage ponds.
- \_\_\_ 3. Confine travel of vehicles and livestock to designated areas to prevent erosion and enhance vegetation.
- \_\_\_ 4. Maintain grades around all components to assure positive surface drainage away from the structures in all directions. Fill any settled areas which may collect water.
- \_\_\_ 5. Piled feed should be kept covered to the maximum extent practical in order to prevent contact with stormwater. The open end of the piles should be kept as clean as possible so that no more

material than absolutely necessary is exposed. Good housekeeping practices shall be employed at the loading face of any pile to prevent loose material from piling up around the open face of the covered pile and becoming exposed.

- \_\_\_\_\_ 6. Manure must be removed from the freestall barn alleys by suction truck as needed to maintain adequate containment. Transfer of collected manure to the separator pit shall be via the opening in the pit cover.
- \_\_\_\_\_ 7. Manure from the freestall barn alleys must be manually scraped to the separator pit opening if the suction truck is unavailable.
- \_\_\_\_\_ 8. Land apply from the pond system as needed to maintain adequate freeboard and storage capacity. The liquid levels are not to exceed the maximum operating depth markers. If the maximum operating level is exceeded, storage capacity must be restored within 14 days by properly land applying wastewater from the pond according to the nutrient management plan.
- \_\_\_\_\_ 9. The contents of the storage ponds should be agitated during removal of wastes to prevent buildup of solids and sludge.
- \_\_\_\_\_ 10. Prepare an annual nutrient management plan based on actual analysis of nutrient levels in both the manure and the soil.
- \_\_\_\_\_ 11. As needed, apply wastes as determined by nutrients tests and the nutrient management plan. Whenever possible, apply downwind from any residences. Avoid applying on calm, humid days, since these conditions restrict the dispersion and dilution of odors. Application on weekends or holidays, when people in the area are more likely to be outdoors, should also be avoided.
- \_\_\_\_\_ 12. Do not apply waste on snow or frozen ground unless unavoidable. Consult the General Permit for conditions that must be followed in these circumstances.
- \_\_\_\_\_ 13. Do not apply waste material immediately after rain or within twelve hours of forecasted rain unless it can be immediately incorporated into the soil.
- \_\_\_\_\_ 14. Do not apply waste (solids and liquids) at a rate which exceeds the annual nitrogen needs of the crop or at a rate that produces runoff. No more than two inches should be applied at any one time.
- \_\_\_\_\_ 15. Keep records of the fields, days, temperature and wind direction when manure was applied using the form supplied with this manual.
- \_\_\_\_\_ 16. All provisions of the General Water Pollution Control Permit for Concentrated Animal Feeding Operations must be followed. The producer should be familiar with this permit in its entirety.
- \_\_\_\_\_ 17. For safety, cover all openings to pump pits and similar structures when not in use. Be certain the covers provide ventilation as explosive, poisonous, and suffocating gases are produced. This applies to all enclosed areas where manure is present.
- \_\_\_\_\_ 18. Extreme care must be exercised before entering any enclosure, such as pumping stations, for maintenance. This should include operations by experienced and knowledgeable workers **in pairs**, making use of appropriate safety equipment, such as a harness, forced ventilation, or the use of an oxygen mask. All operators should familiarize themselves with gas problems, special wiring needs and ventilation needs. **"NO SMOKING"** or similar signs to warn against ignition hazards should be posted to warn persons of

explosion danger at any pump pits or other enclosed, poorly ventilated areas in which combustible gases may accumulate.

## II. Maintenance

- \_\_\_\_ 1. Repair any earth work, or erosion thereof, to original grade. Grading must maintain a slope away from the buildings and storage pond in all directions to drain runoff.
- \_\_\_\_ 2. Repair and revegetate any areas of significant erosion.
- \_\_\_\_ 3. Repair any damaged system components.
- \_\_\_\_ 4. Seal any areas where seepage is noted. Cracks in concrete pit walls or floors must be sealed with a suitable high modulus sealant.
- \_\_\_\_ 5. Repair fences, covers, and safety signs, etc. to original specifications if damaged.
- \_\_\_\_ 6. Remove and dispose of trash and debris that will affect the aesthetics or functioning of the system.
- \_\_\_\_ 7. Remove any trees growing adjacent to pits, buildings, or ponds to prevent root damage to the structures.
- \_\_\_\_ 8. Apply herbicide as needed to retard growth of vegetation on the inside of the pond embankments so the integrity of the clay is not disturbed.

I have reviewed the above Operation and Maintenance Manual for my Waste Management System and agree to provide the necessary resources to properly implement its provisions.

\_\_\_\_\_  
Operator

\_\_\_\_\_  
Date





***APPENDIX IV***

***MANAGEMENT PLAN FOR FLY AND ODOR CONTROL***

# **MANAGEMENT PLAN FOR FLY AND ODOR CONTROL**

*for the*  
**OAK LAKE DAIRY**  
**ANIMAL WASTE MANAGEMENT SYSTEM**  
*BROOKINGS COUNTY, SOUTH DAKOTA*

**November 14, 2016**

**DEC Project No. 1419**

**Producers:** Michael Crinion  
**Address:** 126 Pine Ridge Road  
Brookings, SD 57006  
**Phone:** (605) 691-1045  
**Project Location:** NE ¼ of Section 10, T112N R48W, Brookings County, SD

This plan is provided to describe the Best Management Practices (BMPs) that are used to minimize any nuisance created by flies and odors from the proposed dairy facility. The BMPs described have been utilized at other facilities and have been reported to be useful. This plan deals with odor and fly control in the three most vital phases, which are the manure storage areas, the land application of manure, and the disposal of dead animals.

## **I. Manure Storage Areas**

The waste produced on the site will be contained in earthen storage ponds. The cattle will be housed in freestall barns from which manure is removed to a reception pit and solids separator before being discharged to the ponds. The ponds are designed in accordance with state law to provide adequate storage capacity as well as minimize odors. The storage ponds will likely form a semi-solid crust consisting of buoyant residues, which will serve to reduce odors by minimizing air contact with the raw manure.

The configuration of the buildings and manure collection reduce odors by removing manure from the housing areas as soon as possible. It is vital to the best interests of any dairy operation to keep the animals as clean and dry as possible, which is assurance that good housekeeping practices is maintained in the barn areas. A solids separator will be used to remove a significant percentage of the manure solids from the waste stream before it reports to the ponds. The solids will be dried and recycled as bedding, while any remaining solids will report to the ponds. Washwater used in the process of cleaning the milking parlor and holding area also dilutes the raw manure, resulting in less odor as well.

The site is located with consideration to applicable zoning ordinances and permit requirements for confined animal feeding operations. These include specific separation distances from roads, residences, churches, schools, businesses, and municipalities. These distances were established to prevent any nuisance to surrounding features from facilities of this type. Good ventilation of the buildings will be provided, which is also in the best interests of the animal herd and operator.

Final disposal of the manure will be by land application at rates that do not exceed the agronomic requirement of the crop to be grown and allow beneficial utilization of the manure nutrient content.

Since higher winds tend to disperse odors by agitating odors, windy days are when odors are usually noticed the least. On calm days, or days with light winds, odor is transported without being agitated. Therefore, trees, shrubs or other plantings will aid in the dispersion of airborne odors by agitation in either low or high wind conditions. Proposed shelterbelts are shown on the site plan.

Trees and vegetation also serve as habitat for species such as birds, which prey upon insects or insect larvae. For areas around the barns, pesticide, especially in powdered form, can also be used to control insects. The use of professional pest control services which utilize sprays or fogging to eliminate insects is also a common practice in the dairy industry.

Rodent control is aided by the fact that the configuration of the buildings offers little shelter for these animals. Control of rodents is also in the best interests of the dairy for reasons of sanitation and biosecurity, which is thoroughly inspected on a regular basis by state officials. For areas around the building walls, solid poison can be used to control rodents and keep burrowing from occurring near the concrete. Professional control services are also available, and are commonly used in the industry.

## **II. Manure Land Application**

Guidelines set forth in the South Dakota General Water Pollution Control Permit for Concentrated Animal Feeding Operations strictly regulate the land application of manure. Details of these guidelines can be found in the Nutrient Management Plan for this facility. Many of these guidelines were written with the control of odors in mind. Facilities must have adequate manure storage capacity to store manure over the winter, as manure should not be applied to frozen ground. The ponds are sized to contain a minimum of 365 days worth of manure and wastewater production from the facility. Manure solids removed from the waste stream by the solids separator will be recycled as bedding material within the barn. This manure will contain minimal moisture after separation, and is therefore not expected to produce significant odors. The ventilation of the barns will be reduced in the wintertime to minimize the amount of cold outside air into the barns resulting in greatly reduced odors at this time. Cold temperatures will accomplish insect control during this period as well.

Regardless of the type of manure, the times for manure land application should still be chosen carefully. Since higher winds tend to disperse odors faster, windy days are best. Days that are humid and calm, or have slight winds, should be avoided, as these conditions can result in the transport of odors over distances without dispersal. For the convenience of any neighbors, manure land application should be avoided on weekends, holidays, evenings, or any other times where people are likely to be involved in outdoor recreational or leisure activities. The Operation and Maintenance Manual for the facility outlines these best management practices (BMPs) for easy reference by the operator.

The General Permit requires liquid manure that is land applied to cropland (other than no-till) to be injected or incorporated immediately. In addition to greatly reducing the potential for surface water contamination, this practice serves to remove the source of odor by mixing it into the soil. This also will remove the source of attraction for flies and other insects. Equipment designed to inject or incorporate manure in this manner also keeps the manure totally contained between removal from the lagoon and incorporation by utilizing a pump and pipeline arrangement between the source and the field. Therefore, minimal odor will be produced during transport and land application, and the likelihood of spills will be greatly reduced. This method of application also results in much less wear of area roads.

In accordance with the Nutrient Management Plan, records must be kept regarding land application of manure. The date, time, location, wind direction, temperature, and amount of manure applied should be included whenever land application of manure takes place. These requirements were designed to eliminate over-application of manure and prevent runoff, excess odor, or other pollution by increasing the operator's awareness of proper land application practices.

### **III. Disposal of Dead Animals**

Disposal of dead animal is not expected to be a major concern at this facility, since death loss is generally very low at dairy operations not raising their own calves. The herd is generally culled on a regular basis, with animals which are not producing as desired being sold and removed. In this way, death loss is minimized by removing animals which are past their prime before they become chronically ill. A rendering service will be utilized in the infrequent occurrences of

mortality. This method is one of several approved by the State Animal Industry Board for removal of carcasses, and offers the most efficient option for the operator.

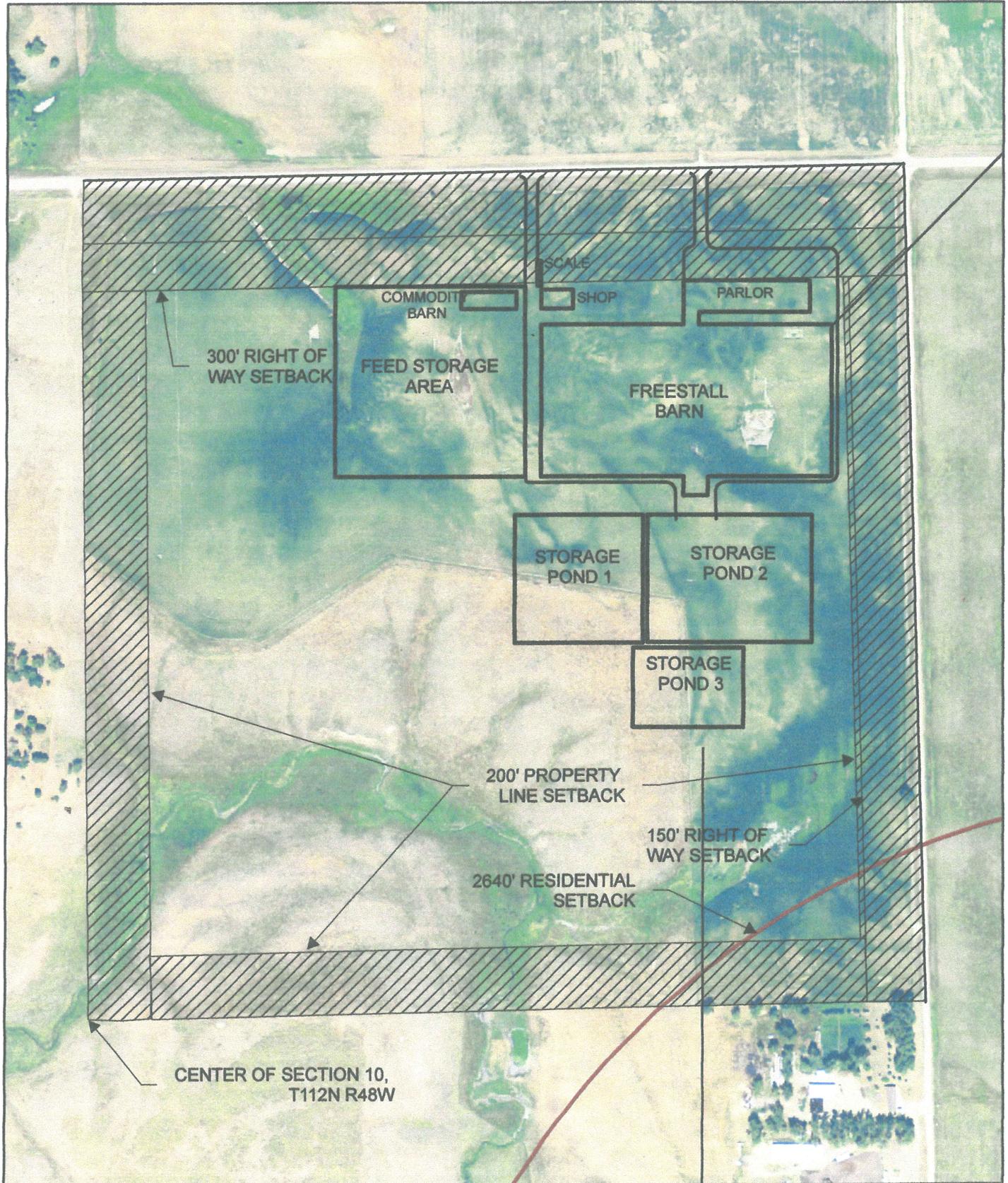
### **Summary**

The Best Management Practices that have been described above are fully expected to minimize nuisances from odors and insects at this facility. While some production of odor is inevitable, it is possible through concerted effort and careful attention to keep both the intensity and frequency of odors and insects at a level where area residents are not inconvenienced.

***APPENDIX V***  
***SETBACK MAP***

# OAK LAKE DAIRY

## SETBACK MAP

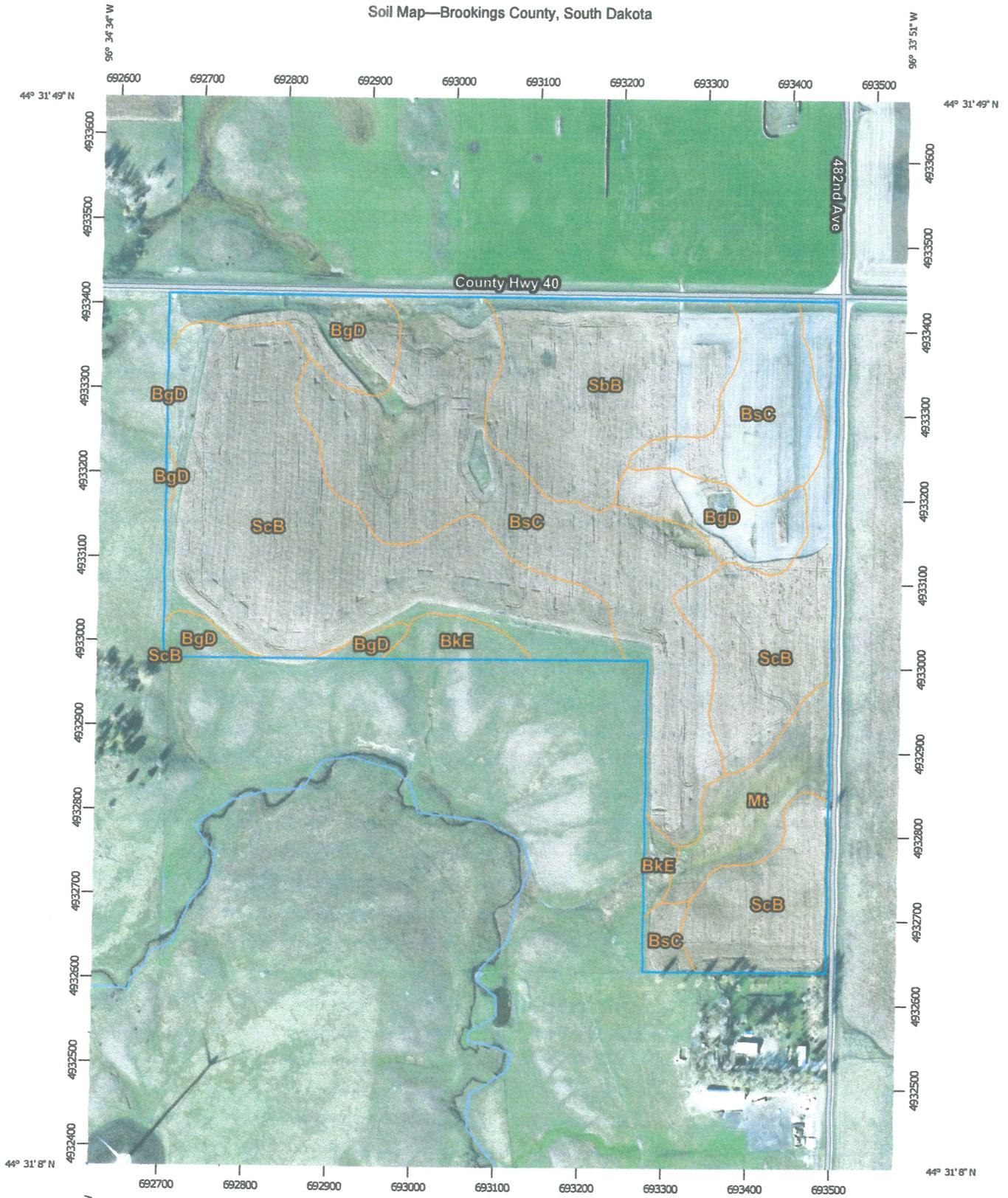


1 inch = 400 feet

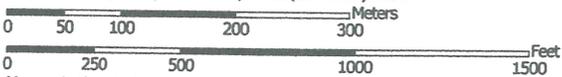
***APPENDIX VI***

***SOILS, SHALLOW AQUIFERS, WELLHEAD PROTECTION,  
& FLOODPLAIN INFORMATION***

Soil Map—Brookings County, South Dakota



Map Scale: 1:6,170 if printed on a portrait (8.5" x 11") sheet.



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



Natural Resources  
Conservation Service

Web Soil Survey  
National Cooperative Soil Survey

9/18/2014  
Page 1 of 3

Soil Map—Brookings County, South Dakota

**MAP LEGEND**

 Area of Interest (AOI)	 Spoil Area
<b>Soils</b>	 Stony Spot
 Soil Map Unit Polygons	 Very Stony Spot
 Soil Map Unit Lines	 Wet Spot
 Soil Map Unit Points	 Other
<b>Special Point Features</b>	 Special Line Features
 Blowout	<b>Water Features</b>
 Borrow Pit	 Streams and Canals
 Clay Spot	<b>Transportation</b>
 Closed Depression	 Rails
 Gravel Pit	 Interstate Highways
 Gravelly Spot	 US Routes
 Landfill	 Major Roads
 Lava Flow	 Local Roads
 Marsh or swamp	<b>Background</b>
 Mine or Quarry	 Aerial Photography
 Miscellaneous Water	
 Perennial Water	
 Rock Outcrop	
 Saline Spot	
 Sandy Spot	
 Severely Eroded Spot	
 Sinkhole	
 Slide or Slip	
 Sodic Spot	

**MAP INFORMATION**

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

Source of Map: Natural Resources Conservation Service  
 Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>  
 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: Brookings County, South Dakota  
 Survey Area Data: Version 19, Mar 27, 2014

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

Date(s) aerial images were photographed: Aug 6, 2010—Oct 21, 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

Brookings County, South Dakota (SD011)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BgD	Buse-Barnes loams, 9 to 20 percent slopes	10.0	9.6%
BkE	Buse-Lamoure, channeled, complex, 0 to 40 percent slopes	2.4	2.3%
BsC	Buse-Singsaas complex, 6 to 9 percent slopes	31.7	30.2%
Mt	McIntosh-Badger silty clay loams, 0 to 2 percent slopes	5.0	4.7%
SbB	Singsaas-Buse complex, 2 to 6 percent slopes	13.9	13.3%
ScB	Singsaas-Waubay silty clay loams, 1 to 6 percent slopes	41.9	40.0%
<b>Totals for Area of Interest</b>		<b>104.9</b>	<b>100.0%</b>

# OAK LAKE DAIRY

## SOIL BORING

### LOCATIONS MAP



1 inch = 400 feet



SOIL BORING LOG

Dakota Environmental Consultants, Inc. P.O. Box 636 Huron, SD 57350 (605) 352-5610

Boring #

**SB1**

Soil Description	WL	Depth	Geo.	Elevation	Sample ID	USCS
Topsoil		0.0		1937.0		
		0.5	Topsoil	1936.5	SB1 0'-1.5'	OL
		1.0		1936.0		
	1.5		1935.5			
Sandy clay brown/olive, moist, very stiff		2.0		1935.0	SB1 1.5'-6'	
		2.5		1934.5		
		3.0		1934.0		
		3.5		1933.5		
		4.0		1933.0		
		4.5		1932.5		
		5.0		1932.0		
		5.5		1931.5		
		6.0		1931.0		
		6.5		1930.5		
		7.0		1930.0		
Sandy clay, brown/olive, moist, stiff to very stiff		7.5		1929.5	SB1 6'-42'	CL
		8.0		1929.0		
		8.5		1928.5		
		9.0		1928.0		
		9.5		1927.5		
		10.0		1927.0		
		10.5		1926.5		
		11.0		1926.0		
		11.5		1925.5		
		12.0	Weathered Till	1925.0		
		12.5		1924.5		
		13.0		1924.0		
		13.5		1923.5		
		14.0		1923.0		
		14.5		1922.5		
		15.0		1922.0		
		15.5		1921.5		
		16.0		1921.0		
	16.5		1920.5			
	17.0		1920.0			
	17.5		1919.5			
	18.0		1919.0			
	18.5		1918.5			
	19.0		1918.0			
	19.5		1917.5			
	20.0		1917.0			
	20.5		1916.5			
	21.0		1916.0			
	21.5		1915.5			
	22.0		1915.0			
	22.5		1914.5			
	23.0		1914.0			
	23.5		1913.5			
	24.0		1913.0			
	24.5		1912.5			
	25.0		1912.0			
	25.5		1911.5			

Water level at time of boring: None	Water Level: None	DEC #	Date of Boring: 9/17/2014
	Method: Split Spoon	<b>1419</b>	Page: 1 of 2
	Driller: RR	Chkd by: BF	Elevation: 1937
	Sampler: JB	Project:	
	Recorded By: RR	<b>Oak Lake Dairy AWMS</b>	
	Entered By/Date: TB 9/22/14		



SOIL BORING LOG

Dakota Environmental Consultants, Inc. P.O. Box 636 Huron, SD 57350 (605) 352-5610

Boring #

**SB1**

Soil Description	WL	Depth	Geo.	Elevation	Sample ID	USCS	
Sandy clay, brown/olive, moist, stiff to very stiff		26.0		1911.0	SB1 6'-42'	CL	
		26.5		1910.5			
		27.0		1910.0			
		27.5		1909.5			
		28.0		1909.0			
		28.5		1908.5			
		29.0		1908.0			
		29.5		1907.5			
		30.0		1907.0			
		30.5		1906.5			
		31.0		1906.0			
		31.5		1905.5			
		32.0		1905.0			
		32.5		1904.5			
		33.0		1904.0			
		33.5		1903.5			
		34.0		1903.0			
		34.5		1902.5			
		35.0		1902.0			
	Sandy clay, olive/gray, moist, stiff		35.5				1901.5
		36.0		1901.0			
		36.5		1900.5			
		37.0		1900.0			
		37.5		1899.5			
		38.0		1899.0			
		38.5		1898.5			
		39.0		1898.0			
		39.5		1897.5			
		40.0		1897.0			
		40.5		1896.5			
		41.0		1896.0			
		41.5		1895.5			
		42.0		1895.0			
		42.5		1894.5			
END OF BORING		43.0		1894.0			
		43.5		1893.5			
		44.0		1893.0			
		44.5		1892.5			
		45.0		1892.0			
		45.5		1891.5			
		46.0		1891.0			
		46.5		1890.5			
		47.0		1890.0			
		47.5		1889.5			
		48.0		1889.0			
		48.5		1888.5			
		49.0		1888.0			
		49.5		1887.5			
		50.0		1887.0			
		50.5		1886.5			
		51.0		1886.0			
		51.5		1885.5			
Water level at time of boring: None	Water Level:	None		DEC #	Date of Boring: 9/17/2014		
	Method:	Split Spoon		<b>1419</b>	Page: 2 of 2		
	Driller:	RR		Chkd by: BF	Elevation: 1937		
	Sampler:	JB		Project:			
	Recorded By:	RR		<b>Oak Lake Dairy AWMS</b>			
	Entered By/Date:	TB 9/22/14					



SOIL BORING LOG

Dakota Environmental Consultants, Inc. P.O. Box 636 Huron, SD 57350 (605) 352-5610

Boring #

SB2

Soil Description	WL	Depth	Geo.	Elevation	Sample ID	USCS
Topsoil		0.0	Topsoil	1940.0	SB2 0'-0.5'	OL
Sandy clay, brown, moist, stiff to very stiff		0.5		1939.5	SB2 0.5'-15'	CL
		1.0		1939.0		
		1.5		1938.5		
		2.0		1938.0		
		2.5		1937.5		
		3.0		1937.0		
		3.5		1936.5		
		4.0		1936.0		
		4.5		1935.5		
		5.0		1935.0		
		5.5		1934.5		
		6.0		1934.0		
		6.5		1933.5		
		7.0		1933.0		
		7.5		1932.5		
		8.0		1932.0		
		8.5		1931.5		
		9.0		1931.0		
		9.5		1930.5		
		10.0		1930.0		
Well graded sand, light brown, dry		10.5	Weathered Till	1929.5	SB2 15'-16'	SW
		11.0		1929.0		
		11.5		1928.5		
		12.0		1928.0		
		12.5		1927.5		
		13.0		1927.0		
		13.5		1926.5		
		14.0		1926.0		
		14.5		1925.5		
		15.0		1925.0		
Sandy clay, brown, moist, stiff		15.5		1924.5	SB2 16'-22.5'	CL
		16.0		1924.0		
		16.5		1923.5		
		17.0		1923.0		
		17.5		1922.5		
		18.0		1922.0		
		18.5		1921.5		
		19.0		1921.0		
		19.5		1920.5		
		20.0		1920.0		
Sandy clay, brown/olive, moist, medium stiff to stiff		20.5		1919.5	SB2 22.5'-24'	
		21.0		1919.0		
		21.5		1918.5		
Sandy clay, gray, very slight weathering, moist, stiff		22.0		1918.0	SB2 24'-30'	
		22.5		1917.5		
		23.0		1917.0		
		23.5		1916.5		
		24.0		1916.0		
Water level at time of boring: None		24.5		1915.5		
		25.0		1915.0		
		25.5		1914.5		
	Water Level: None	DEC #	Date of Boring: 9/17/2014			
	Method: Split Spoon	1419	Page: 1 of 2			
Driller: RR	Chkd by: BF	Elevation: 1940				
Sampler: JB	Project: Oak Lake Dairy AWMS					
Recorded By: RR						
Entered By/Date: TB 9/22/14						



SOIL BORING LOG

Dakota Environmental Consultants, Inc. P.O. Box 636 Huron, SD 57350 (605) 352-5610

Boring #

**SB2**

Soil Description	WL	Depth	Geo.	Elevation	Sample ID	USCS
Sandy clay, gray, very slight weathering, moist,		26.0		1914.0	SB2 24'-30'	
		26.5		1913.5		
		27.0		1913.0		
		27.5		1912.5		
		28.0		1912.0		
		28.5		1911.5		
		29.0		1911.0		
		29.5		1910.5		
		30.0		1910.0		
		30.5		1909.5		
Sandy clay, gray, unweathered, moist, stiff to very stiff		31.0		1909.0	SB2 30'- 45'	CL
		31.5		1908.5		
		32.0		1908.0		
		32.5		1907.5		
		33.0		1907.0		
		33.5		1906.5		
		34.0		1906.0		
		34.5	Weathered Till	1905.5		
		35.0		1905.0		
		35.5		1904.5		
		36.0		1904.0		
		36.5		1903.5		
		37.0		1903.0		
		37.5		1902.5		
		38.0		1902.0		
	38.5		1901.5			
	39.0		1901.0			
	39.5		1900.5			
	40.0		1900.0			
	40.5		1899.5			
	41.0		1899.0			
	41.5		1898.5			
	42.0		1898.0			
	42.5		1897.5			
	43.0		1897.0			
	43.5		1896.5			
	44.0		1896.0			
	44.5		1895.5			
END OF BORING		45.0		1895.0		
		45.5		1894.5		
		46.0		1894.0		
		46.5		1893.5		
		47.0		1893.0		
		47.5		1892.5		
		48.0		1892.0		
		48.5		1891.5		
		49.0		1891.0		
		49.5		1890.5		
	50.0		1890.0			
	50.5		1889.5			
	51.0		1889.0			
	51.5		1888.5			

Water level at time of boring: None	Water Level: None	DEC #	Date of Boring: 9/17/2014
	Method: Split Spoon	<b>1419</b>	Page: 2 of 2
	Driller: RR	Chkd by: BF	Elevation: 1940
	Sampler: JB	Project:	
	Recorded By: RR	<b>Oak Lake Dairy AWMS</b>	
	Entered By/Date: TB 9/22/14		



SOIL BORING LOG

Dakota Environmental Consultants, Inc. P.O. Box 636 Huron, SD 57350 (605) 352-5610

Boring #

**SB3**

Soil Description	WL	Depth	Geo.	Elevation	Sample ID	USCS	
Topsoil		0.0		1937.0			
		0.5	Topsoil	1936.5	SB1 0'-1'	OL	
		1.0		1936.0			
		1.5		1935.5			
		2.0		1935.0			
		2.5		1934.5			
		3.0		1934.0			
		3.5		1933.5			
		4.0		1933.0			
		4.5		1932.5			
		5.0		1932.0			
Sandy clay, brown, moist, stiff to very stiff		5.5		1931.5	SB3 1'-11'	CL	
		6.0		1931.0			
		6.5		1930.5			
		7.0		1930.0			
		7.5		1929.5			
		8.0		1929.0			
		8.5		1928.5			
		9.0		1928.0			
		9.5		1927.5			
		10.0		1927.0			
		10.5		1926.5			
Well graded gravel, brown, wet	(TOB)	11.0	Weathered Till	1926.0	SB3 11'-12'	GW	
		11.5		1925.5			
		12.0		1925.0			
Clayey gravel, brown, wet		12.5		1924.5	SB3 12'-14'	GC	
		13.0		1924.0			
		13.5		1923.5			
		14.0		1923.0			
		14.5		1922.5			
		15.0		1922.0			
		15.5		1921.5			
Sandy clay, brown/olive, moist, soft to medium stiff		16.0		1921.0	SB3 14'-18'		
		16.5		1920.5			
		17.0		1920.0			
		17.5		1919.5			
		18.0		1919.0			
Sandy clay, gray/olive, moist, medium stiff		18.5		1918.5	SB3 18'-20'		
		19.0		1918.0			
		19.5		1917.5			
		20.0		1917.0			
		20.5		1916.5			
		21.0		1916.0			
		21.5		1915.5			
Sandy clay, gray, slight weathering, moist, medium stiff		22.0		1915.0	SB3 20'-25'		
		22.5		1914.5			
		23.0		1914.0			
		23.5		1913.5			
		24.0		1913.0			
		24.5		1912.5			
		25.0	Unweathered Till	1912.0			
Sandy clay, dark gray, moist, unweathered, stiff		25.5		1911.5	SB3 25'-40'		
Water level at time of boring: 11'	Water Level: None	DEC #	Date of Boring: 9/18/2014				
	Method: Split Spoon	<b>1419</b>	Page: 1 of 2				
	Driller: RR	Chkd by: BF	Elevation: 1937				
	Sampler: JB	Project:					
	Recorded By: RR	<b>Oak Lake Dairy AWMS</b>					
	Entered By/Date: TB 9/22/14						



### SOIL BORING LOG

Dakota Environmental Consultants, Inc. P.O. Box 636 Huron, SD 57350 (605) 352-5610

Boring #

# SB3

Soil Description	WL	Depth	Geo.	Elevation	Sample ID	USCS
Sandy clay, dark gray, moist, unweathered, stiff		26.0		1911.0	SB3 25'-40'	CL
		26.5		1910.5		
		27.0		1910.0		
		27.5		1909.5		
		28.0		1909.0		
		28.5		1908.5		
		29.0		1908.0		
		29.5		1907.5		
		30.0		1907.0		
		30.5		1906.5		
		31.0		1906.0		
		31.5		1905.5		
		32.0	Unweathered	1905.0		
		32.5	Till	1904.5		
		33.0		1904.0		
		33.5		1903.5		
		34.0		1903.0		
		34.5		1902.5		
		35.0		1902.0		
		35.5		1901.5		
	36.0		1901.0			
	36.5		1900.5			
	37.0		1900.0			
	37.5		1899.5			
	38.0		1899.0			
	38.5		1898.5			
	39.0		1898.0			
	39.5		1897.5			
END OF BORING		40.0		1897.0		
		40.5		1896.5		
		41.0		1896.0		
		41.5		1895.5		
		42.0		1895.0		
		42.5		1894.5		
		43.0		1894.0		
		43.5		1893.5		
		44.0		1893.0		
		44.5		1892.5		
		45.0		1892.0		
		45.5		1891.5		
		46.0		1891.0		
		46.5		1890.5		
		47.0		1890.0		
		47.5		1889.5		
		48.0		1889.0		
	48.5		1888.5			
	49.0		1888.0			
	49.5		1887.5			
	50.0		1887.0			
	50.5		1886.5			
	51.0		1886.0			
	51.5		1885.5			
Water level at time of boring: 11'	Water Level:	None	DEC #	Date of Boring: 9/18/2014		
	Method:	Split Spoon	<b>1419</b>	Page: 2 of 2		
	Driller:	RR	Chkd by: BF	Elevation: 1937		
	Sampler:	JB	Project:			
	Recorded By:	RR	<b>Oak Lake Dairy AWMS</b>			
	Entered By/Date:	TB 9/22/14				



SOIL BORING LOG

Dakota Environmental Consultants, Inc. P.O. Box 636 Huron, SD 57350 (605) 352-5610

Boring #

**SB4**

Soil Description	WL	Depth	Geo.	Elevation	Sample ID	USCS
Topsoil		0.0	Topsoil	1938.0	SB4 0'-0.5'	OL
Sandy clay, brown/olive, dry, hard		0.5		1937.5	SB4 0.5'-4'	
		1.0		1937.0		
		1.5		1936.5		
		2.0		1936.0		
		2.5		1935.5		
		3.0		1935.0		
		3.5		1934.5		
		4.0		1934.0		
		4.5		1933.5		
		5.0		1933.0		
		5.5		1932.5		
		6.0		1932.0		
		6.5		1931.5		
		7.0		1931.0		
		7.5		1930.5		
	8.0		1930.0			
	8.5		1929.5			
	9.0		1929.0			
	9.5		1928.5			
	10.0		1928.0			
	10.5		1927.5			
	11.0	Weathered	1927.0			
	11.5	Till	1926.5			
	12.0		1926.0			
Sandy clay, brown/olive, moist, very stiff		12.5		1925.5	SB4 4'-23'	CL
		13.0		1925.0		
		13.5		1924.5		
		14.0		1924.0		
		14.5		1923.5		
		15.0		1923.0		
		15.5		1922.5		
		16.0		1922.0		
		16.5		1921.5		
		17.0		1921.0		
		17.5		1920.5		
		18.0		1920.0		
		18.5		1919.5		
		19.0		1919.0		
		19.5		1918.5		
	20.0		1918.0			
	20.5		1917.5			
	21.0		1917.0			
	21.5		1916.5			
	22.0		1916.0			
	22.5		1915.5			
	23.0		1915.0			
	23.5		1914.5			
	24.0		1914.0			
	24.5		1913.5			
	25.0		1913.0			
	25.5		1912.5			
Sandy clay, olive/gray, moist, stiff		23.0		1915.0	SB4 23'-25'	
		23.5		1914.5		
		24.0		1914.0		
Sandy clay, brown, moist, stiff		24.5		1913.5	SB4 25'-30'	
		25.0		1913.0		
		25.5		1912.5		

Water level at time of boring: None	Water Level: None	DEC #	Date of Boring: 9/18/2014
	Method: Split Spoon	<b>1419</b>	Page: 1 of 2
	Driller: RR	Chkd by: BF	Elevation: 1938
	Sampler: JB	Project:	
	Recorded By: RR	<b>Oak Lake Dairy AWMS</b>	
	Entered By/Date: TB 9/22/14		



SOIL BORING LOG

Dakota Environmental Consultants, Inc. P.O. Box 636 Huron, SD 57350 (605) 352-5610

Boring #

**SB4**

Soil Description	WL	Depth	Geo.	Elevation	Sample ID	USCS
Sandy clay, brown, moist, stiff		26.0		1912.0	SB4 25'-30'	
		26.5		1911.5		
		27.0		1911.0		
		27.5		1910.5		
		28.0		1910.0		
		28.5		1909.5		
		29.0		1909.0		
		29.5		1908.5		
		30.0	Weathered Till	1908.0		
		30.5		1907.5		
Sandy clay, olive/gray, moist, stiff		31.0		1907.0	SB4 30'-36'	
		31.5		1906.5		
		32.0		1906.0		
		32.5		1905.5		
		33.0		1905.0		
		33.5		1904.5		
		34.0		1904.0		
		34.5		1903.5		
		35.0		1903.0		
		35.5		1902.5		
Sandy clay, gray, unweathered, moist, stiff		36.0		1902.0	SB4 36'-50'	CL
		36.5		1901.5		
		37.0		1901.0		
		37.5		1900.5		
		38.0		1900.0		
		38.5		1899.5		
		39.0		1899.0		
		39.5		1898.5		
		40.0		1898.0		
		40.5		1897.5		
		41.0		1897.0		
		41.5		1896.5		
		42.0	Unweathered Till	1896.0		
		42.5		1895.5		
		43.0		1895.0		
	43.5		1894.5			
	44.0		1894.0			
	44.5		1893.5			
	45.0		1893.0			
	45.5		1892.5			
	46.0		1892.0			
	46.5		1891.5			
	47.0		1891.0			
	47.5		1890.5			
	48.0		1890.0			
	48.5		1889.5			
	49.0		1889.0			
	49.5		1888.5			
<b>END OF BORING</b>		50.0		1888.0		
		50.5		1887.5		
		51.0		1887.0		
		51.5		1886.5		

Water level at time of boring: None .	Water Level:	None	DEC #	Date of Boring:	9/18/2014
	Method:	Split Spoon	<b>1419</b>	Page:	2 of 2
	Driller:	RR	Chkd by: BF	Elevation:	1938
	Sampler:	JB	Project:		
	Recorded By:	RR	<b>Oak Lake Dairy AWMS</b>		
	Entered By/Date:	TB 9/22/14			



### ATTERBERG LIMITS

Dakota Environmental Inc. P.O. Box 636 Huron, SD 57350 (605) 352-5610

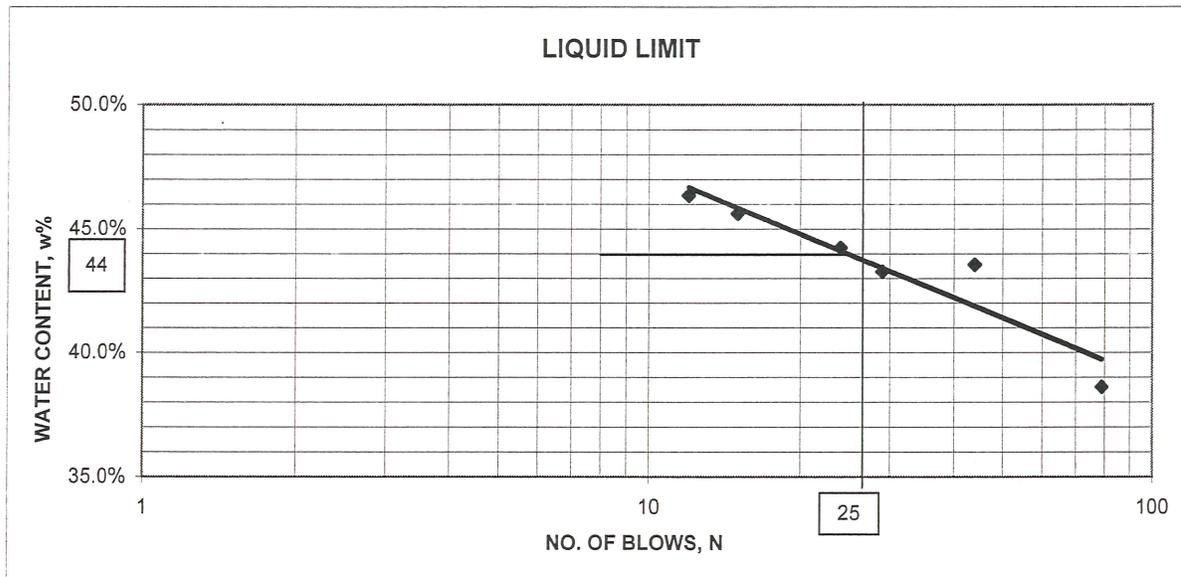
Project Oak Lake Dairy AWMS Job No. 1419

Location of Project S 1/2 Section 29, T121N R52W, Grant Coun Test No. 1419-PL-1

Description of Soil Sandy clay, brown (CL), SB4 16-18' Test Method ASTM: D4318, Multipoint

Tested By RR Test Date 9/23/2014 Reviewed by BF

Can no.	X	Q	D	U	Y	JJ
Mass of wet soil + can	21.21	20.72	21.74	21.22	20.46	21.92
Mass of dry soil + can	19.55	19.03	19.81	19.42	18.85	19.76
Mass of can	15.25	15.15	15.35	15.35	15.32	15.10
Mass of dry soil	4.30	3.88	4.46	4.07	3.53	4.66
Mass of moisture	1.66	1.69	1.93	1.80	1.61	2.16
Water Content, w%	38.6%	43.6%	43.3%	44.2%	45.6%	46.4%
No of Blows, N	79	44	29	24	15	12



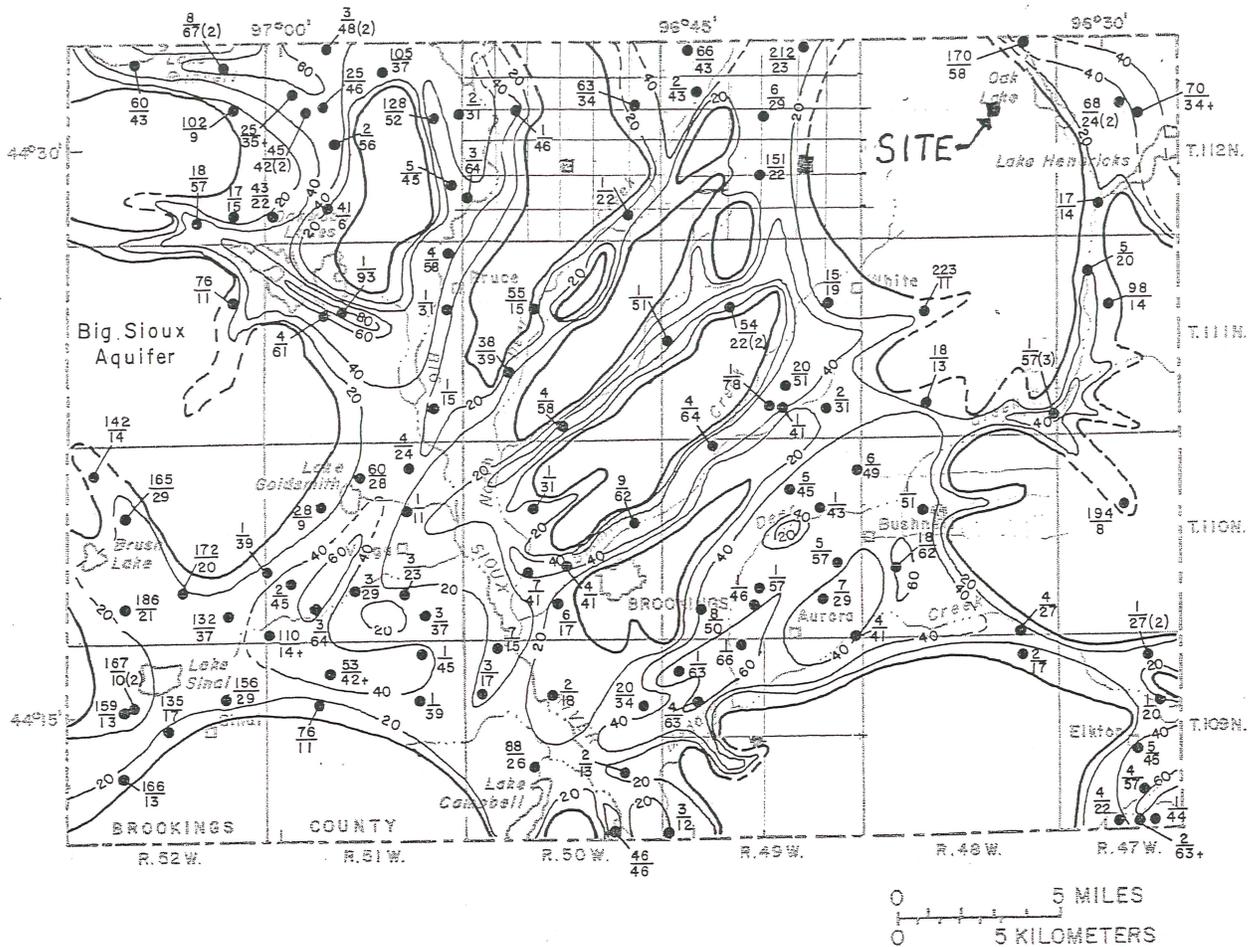
#### Plastic Limit Data

Can no.	C	E	Average
Mass of wet soil & can	18.63	18.86	
Mass of dry soil & can	17.99	18.24	
Mass of can	15.42	15.82	
Mass of dry soil	2.57	2.42	
Mass of Moisture	0.64	0.62	
Water Content, w% = wp	24.9%	25.6%	25.3%

Liquid limit 44  
 Plastic limit 25  
 Plasticity Index 19

% retained on #200 sieve (est.) 34%

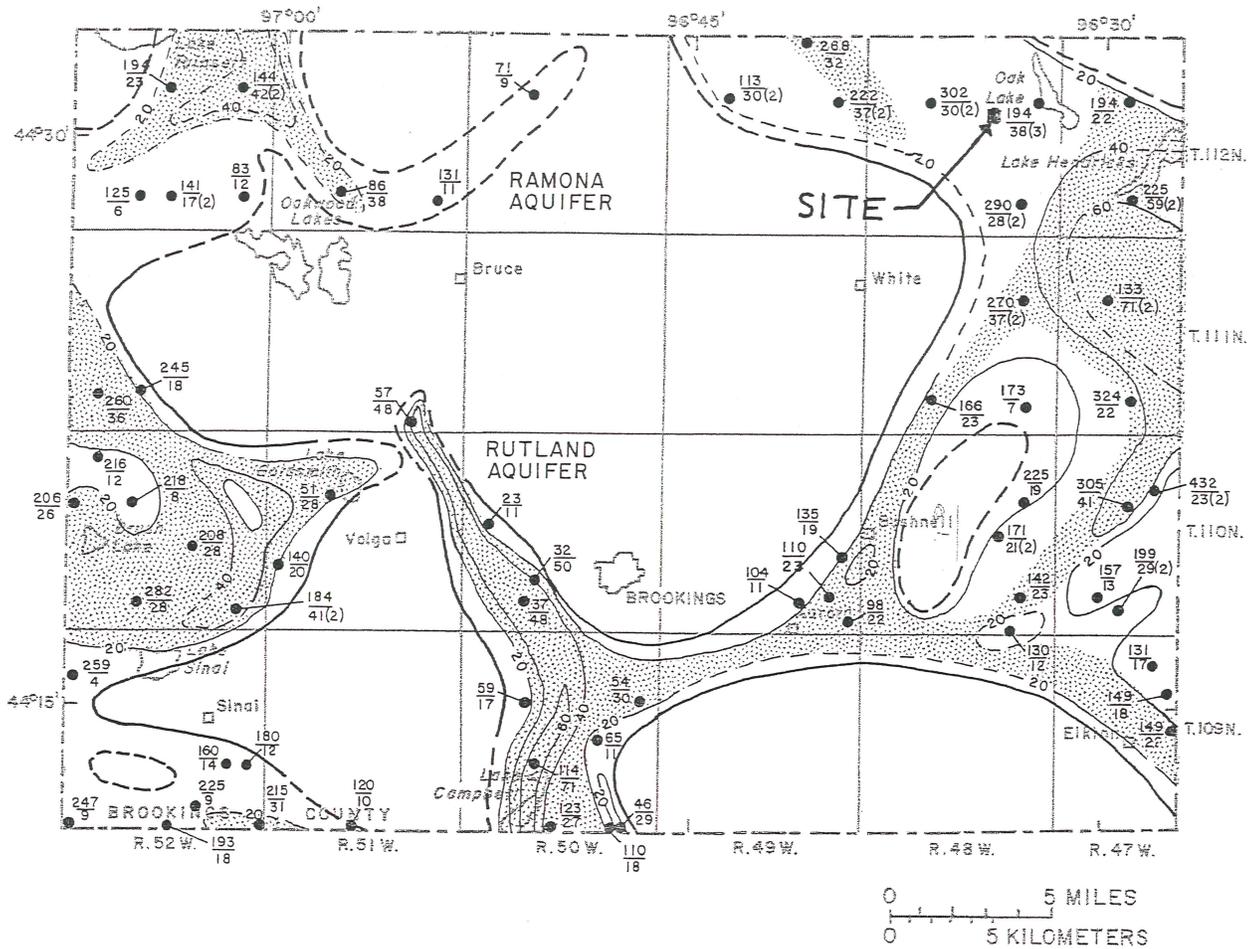




### EXPLANATION

- WELL OR TEST HOLE - Upper number is depth, in feet, to top of sand and gravel including the unsaturated zone. Lower number is thickness, in feet, of sand and gravel, including the unsaturated zone. A plus (+) indicates greater than shown. Number in parenthesis is number of aquifer units penetrated, where greater than one
- 40 — LINE OF EQUAL THICKNESS OF SAND AND GRAVEL - Dashed where inferred. Interval 20 feet
- - - - - INTERMITTENT STREAM
- - - - - AQUIFER BOUNDARY - Dashed where inferred. Based on test holes and private domestic and farm wells

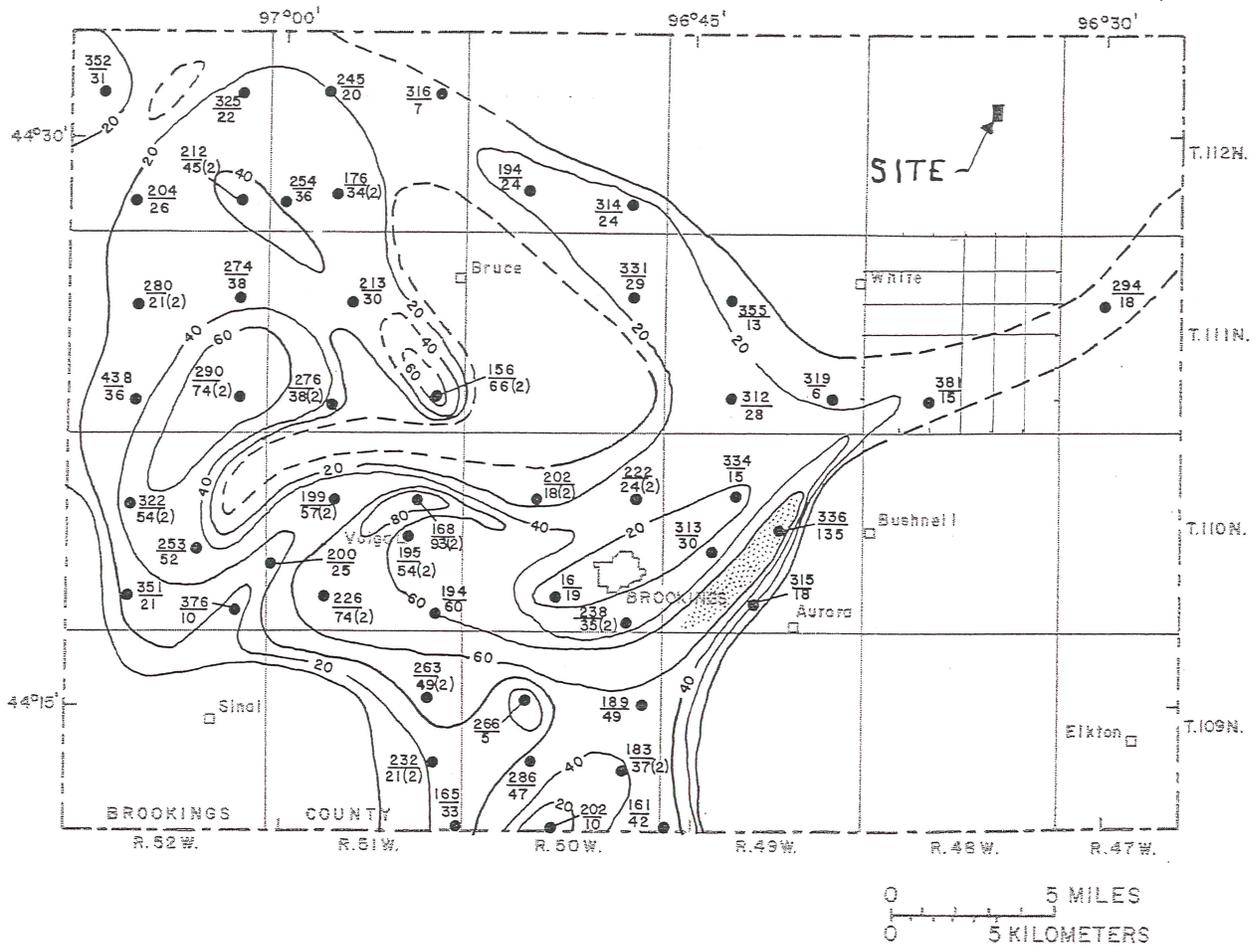
Figure 9.--Extent, depth, and thickness of the Big Sioux and Vermillion East Fork aquifers.--Continued



**EXPLANATION**

- $\frac{70}{34+}$  WELL OR TEST HOLE - Upper number is depth, in feet, to top of sand and gravel including the unsaturated zone. Lower number is thickness, in feet, of sand and gravel, including the unsaturated zone. A plus (+) indicates greater than shown. Number in parenthesis is number of aquifer units penetrated, where greater than one
- 40 — LINE OF EQUAL THICKNESS OF SAND AND GRAVEL - Dashed where inferred. Interval 20 feet
- · · · — INTERMITTENT STREAM
- - - - AQUIFER BOUNDARY - Dashed where inferred. Based on test holes and private domestic and farm wells

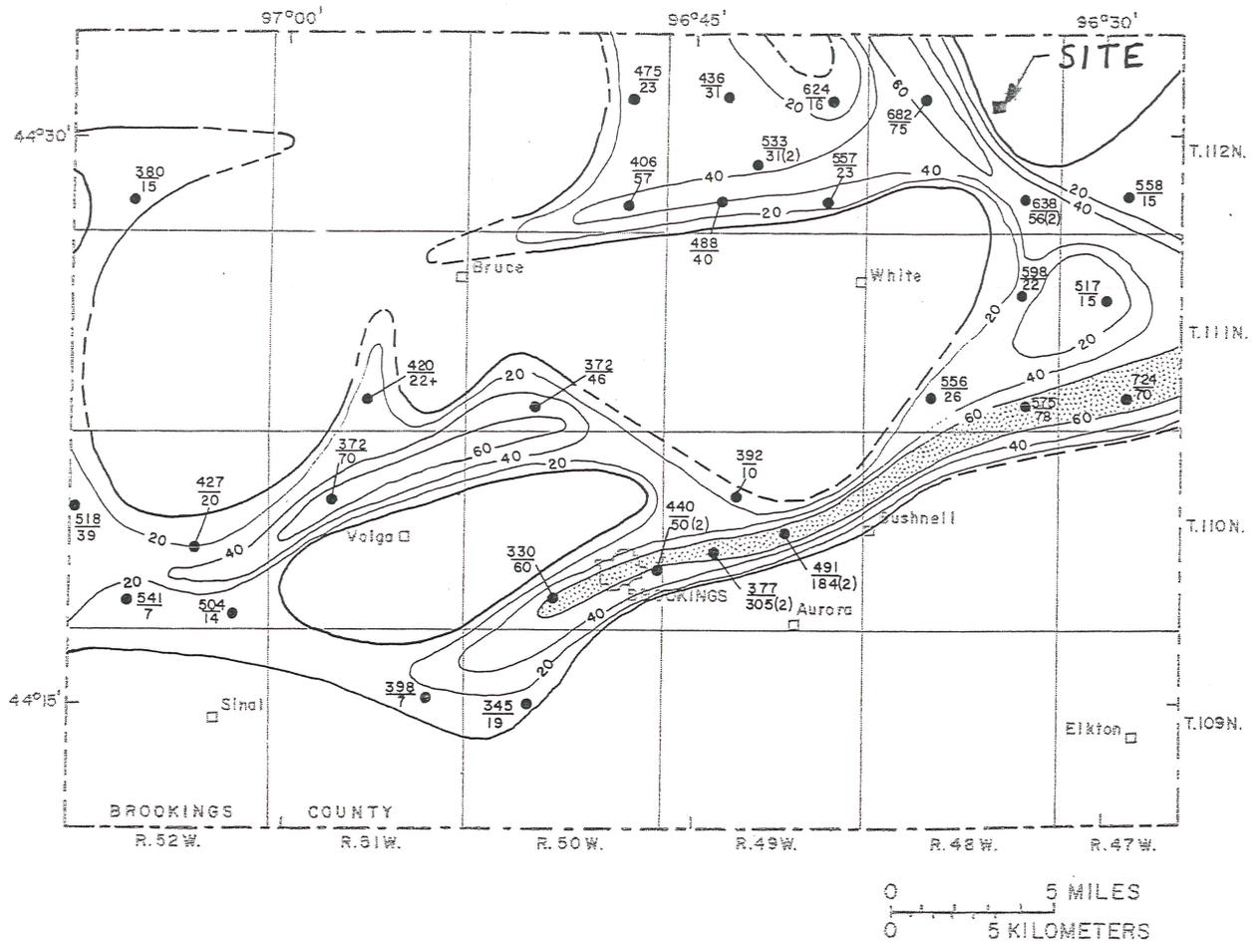
Figure 14.--Extent, depth, and thickness of the Ramona and Rutland aquifers.--Continued



### EXPLANATION

- $\bullet$   
 $\frac{70}{34+}$ 
 WELL OR TEST HOLE - Upper number is depth, in feet, to top of sand and gravel including the unsaturated zone. Lower number is thickness, in feet, of sand and gravel, including the unsaturated zone. A plus (+) indicates greater than shown. Number in parenthesis is number of aquifer units penetrated, where greater than one
- 40 ---  
 --- - - - ---
 
 LINE OF EQUAL THICKNESS OF SAND AND GRAVEL - Dashed where inferred. Interval 20 feet
- - - - ---
 
 INTERMITTENT STREAM
- - - - ---
 
 AQUIFER BOUNDARY - Dashed where inferred. Based on test holes and private domestic and farm wells

Figure 16.--Extent, depth, and thickness of the Howard aquifer.--Continued



**EXPLANATION**

- $\frac{70}{34+}$  WELL OR TEST HOLE - Upper number is depth, in feet, to top of sand and gravel including the unsaturated zone. Lower number is thickness, in feet, of sand and gravel, including the unsaturated zone. A plus (+) indicates greater than shown. Number in parenthesis is number of aquifer units penetrated, where greater than one
- 40 — LINE OF EQUAL THICKNESS OF SAND AND GRAVEL - Dashed where inferred. Interval 20 feet
- · — · — INTERMITTENT STREAM
- · — · — AQUIFER BOUNDARY - Dashed where inferred. Based on test holes and private domestic and farm wells

Figure 18.--Extent, depth, and thickness of the Altamont aquifer.--Continued

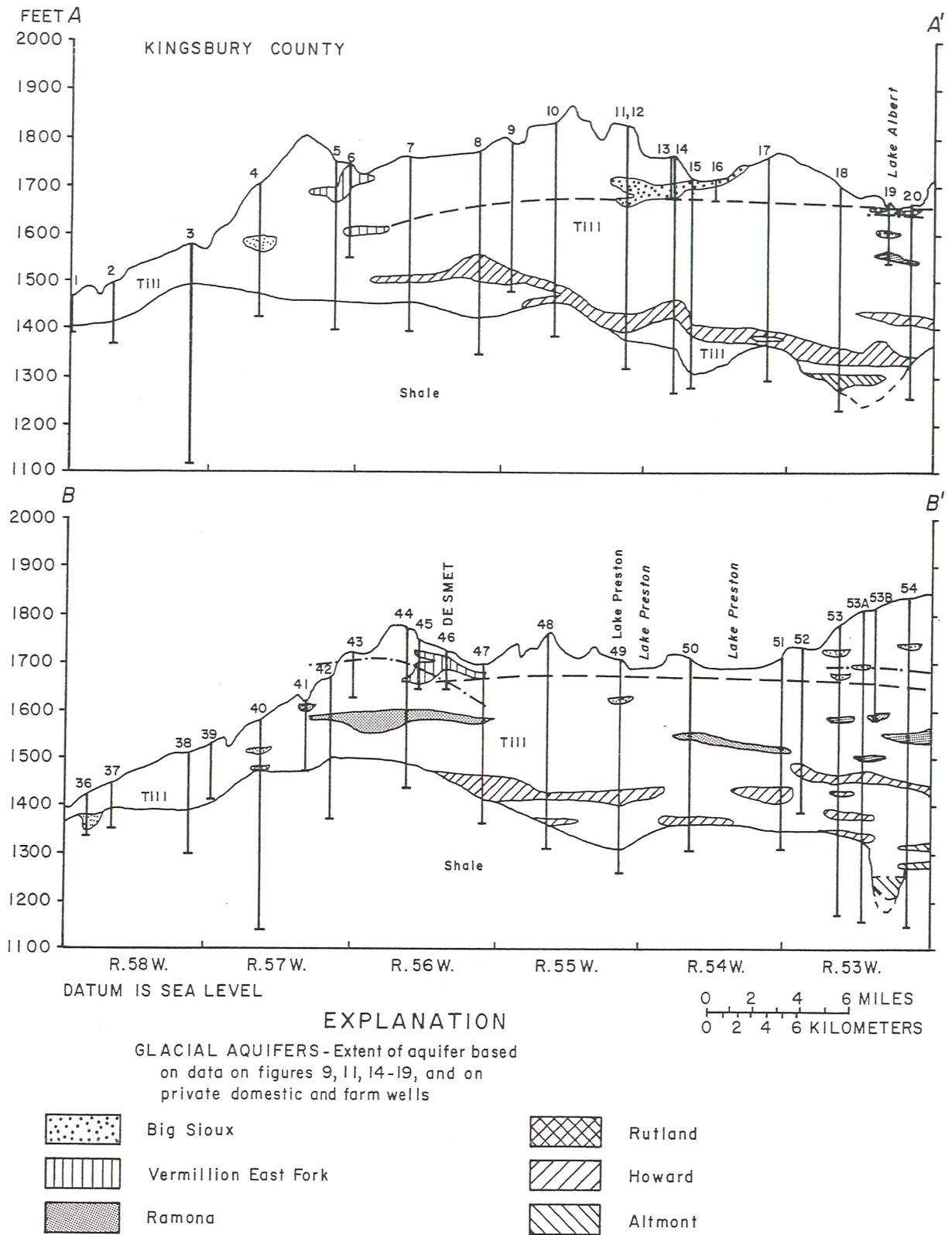
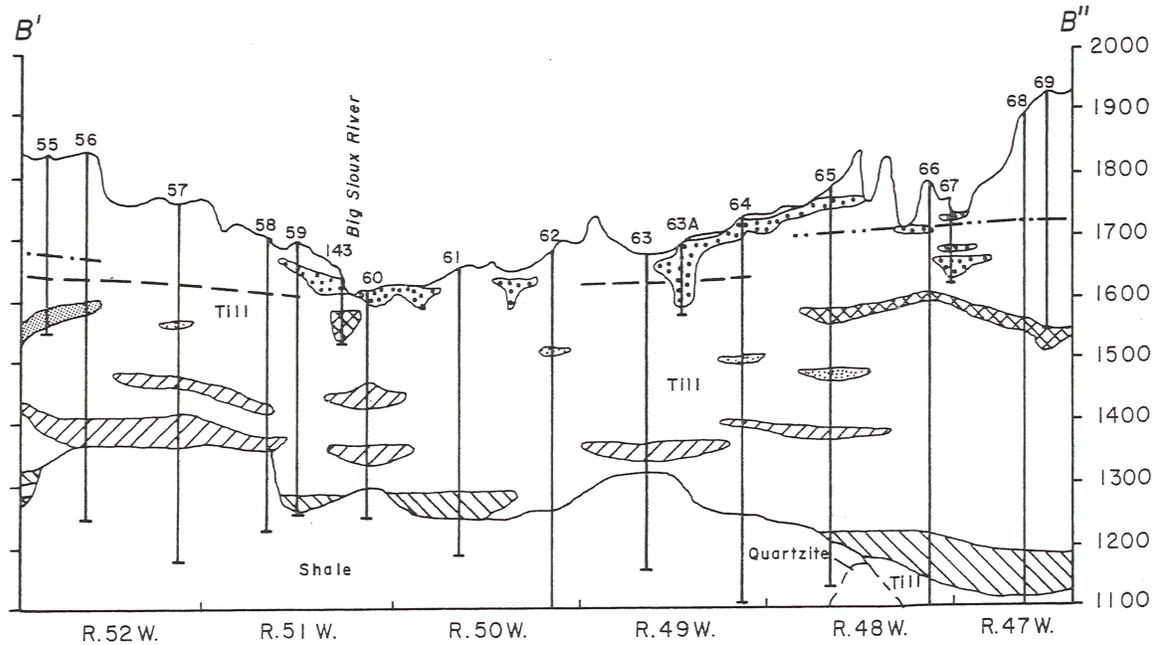
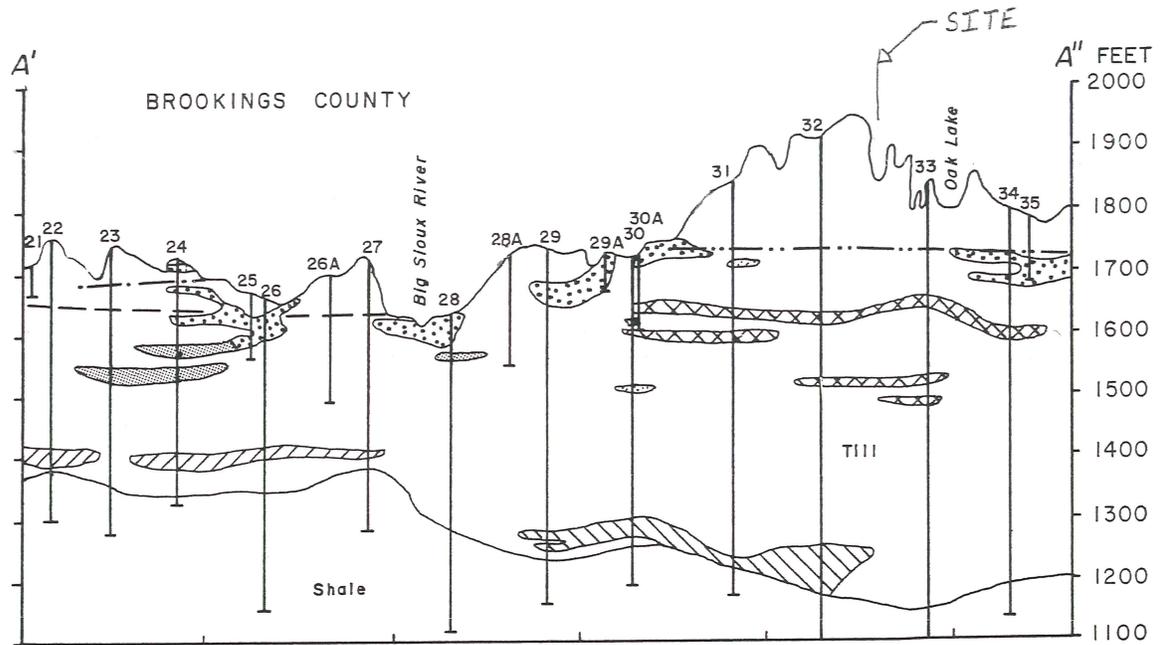


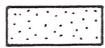
Figure 7.--Aquifers and potentiometric surfaces in glacial deposits.  
(Location of sections shown in fig. 6.)



VERTICAL SCALE IS GREATLY EXAGGERATED



GLACIAL AQUIFERS - cont.



Minor

--- CONTACT - Dashed where inferred



WELL OR TEST HOLE - Number is hole number shown in figure 6

POTENTIOMETRIC SURFACE, 1982-84 -- Shows altitude at which water would have stood in tightly cased wells

..... Ramona aquifer

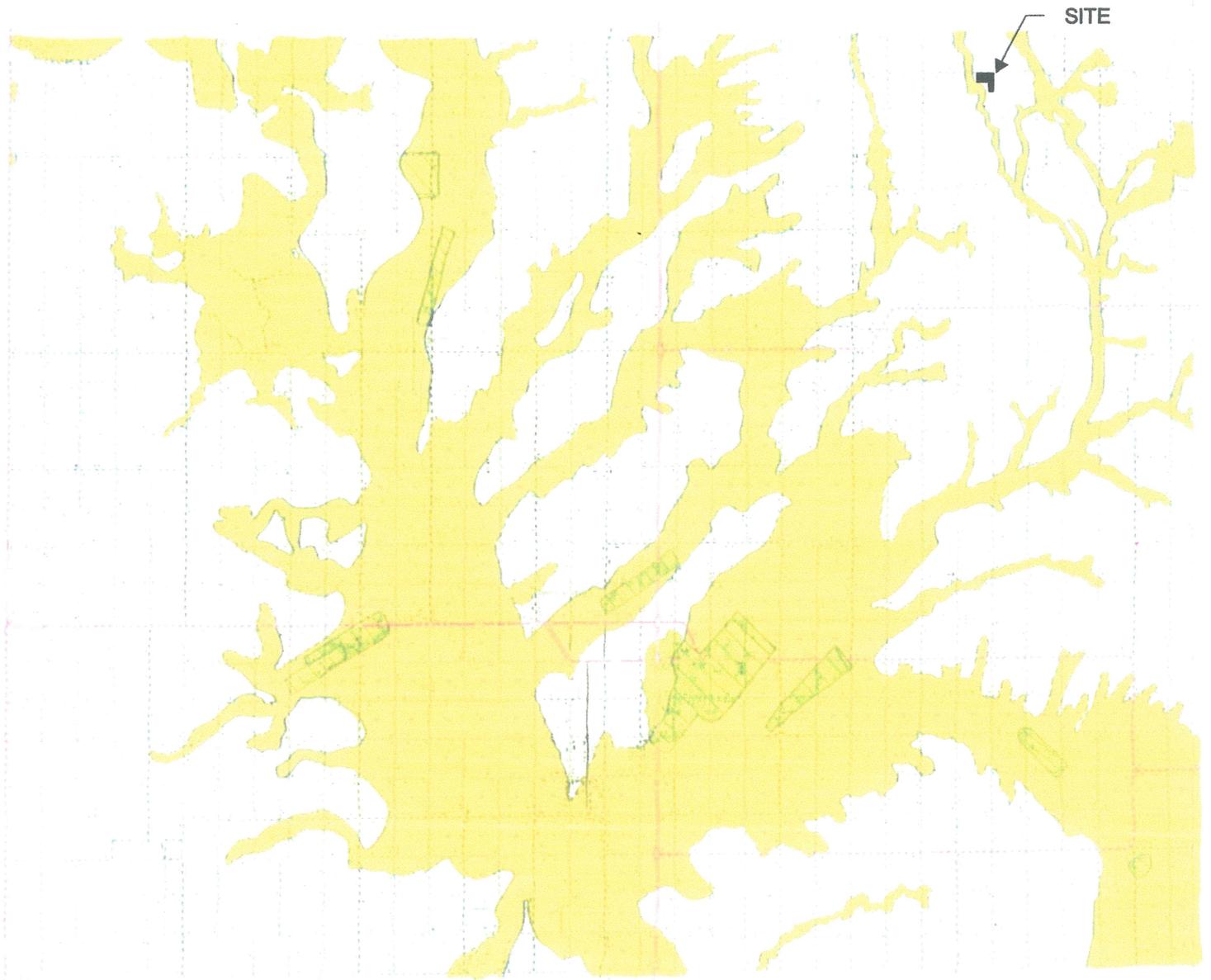
--- Rutland aquifer

--- Howard aquifer

Figure 7.--Aquifers and potentiometric surfaces in glacial deposits.--Continued



# Brookings County Groundwater Protection Zones

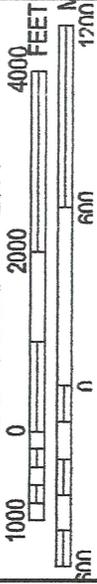


- Zone A - Wellhead Protection Area
- Areas Contributing Drainage to Zone A
- Zone B - Shallow Aquifer Boundaries

- Shallow Aquifer Boundaries
- 300 ft accuracy
- 1600 ft accuracy
- Areas Contributing Drainage to Zone A



MAP SCALE 1" = 2000'



PANEL 0150C

**FIRM**  
FLOOD INSURANCE RATE MAP  
BROOKINGS COUNTY,  
SOUTH DAKOTA  
AND INCORPORATED AREAS

PANEL 150 OF 700

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY NUMBER 460283  
BROOKINGS COUNTY PANEL SUFFIX 0150 C

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.



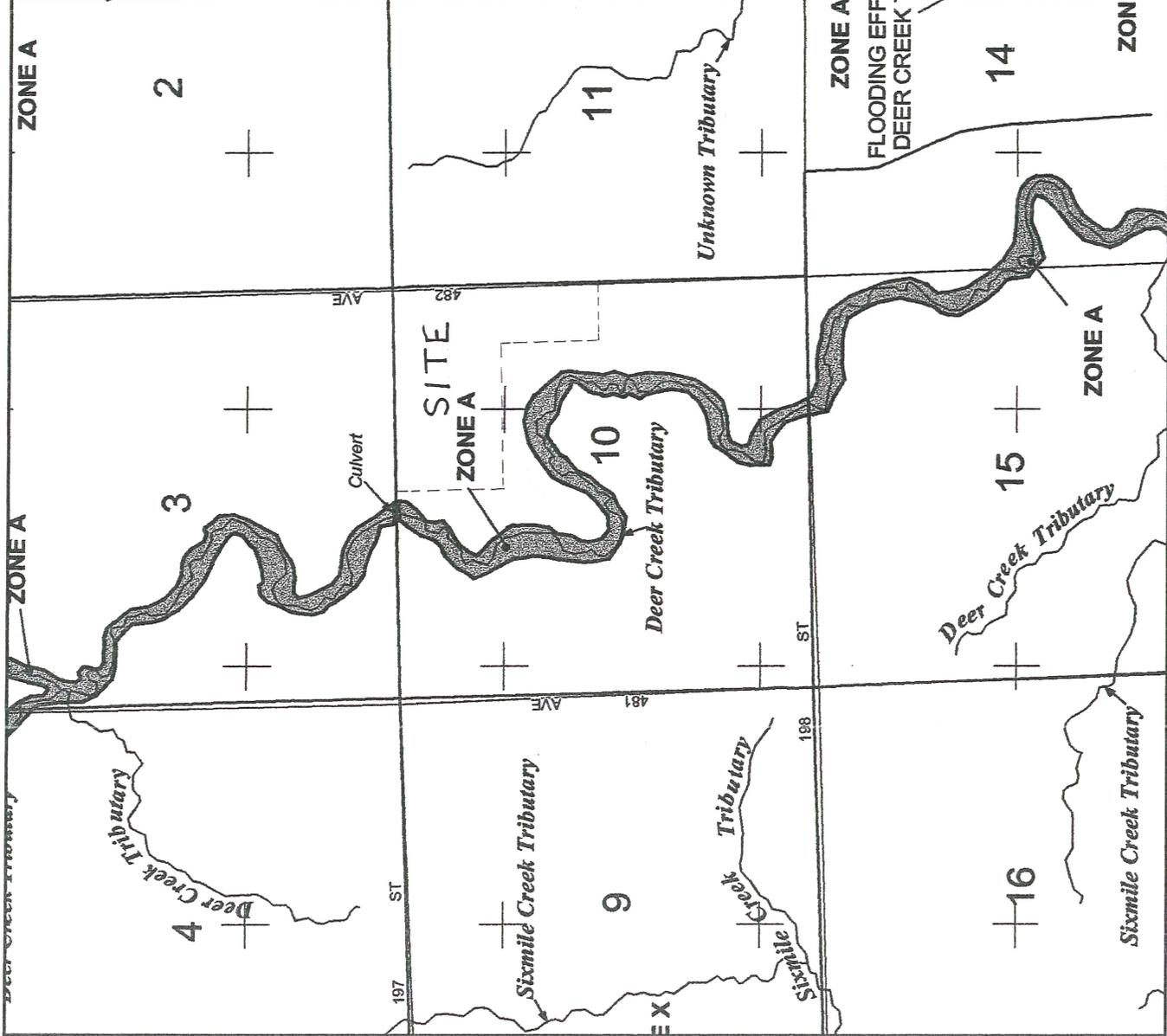
MAP NUMBER  
46011C0150C

EFFECTIVE DATE  
JULY 16, 2008

Federal Emergency Management Agency

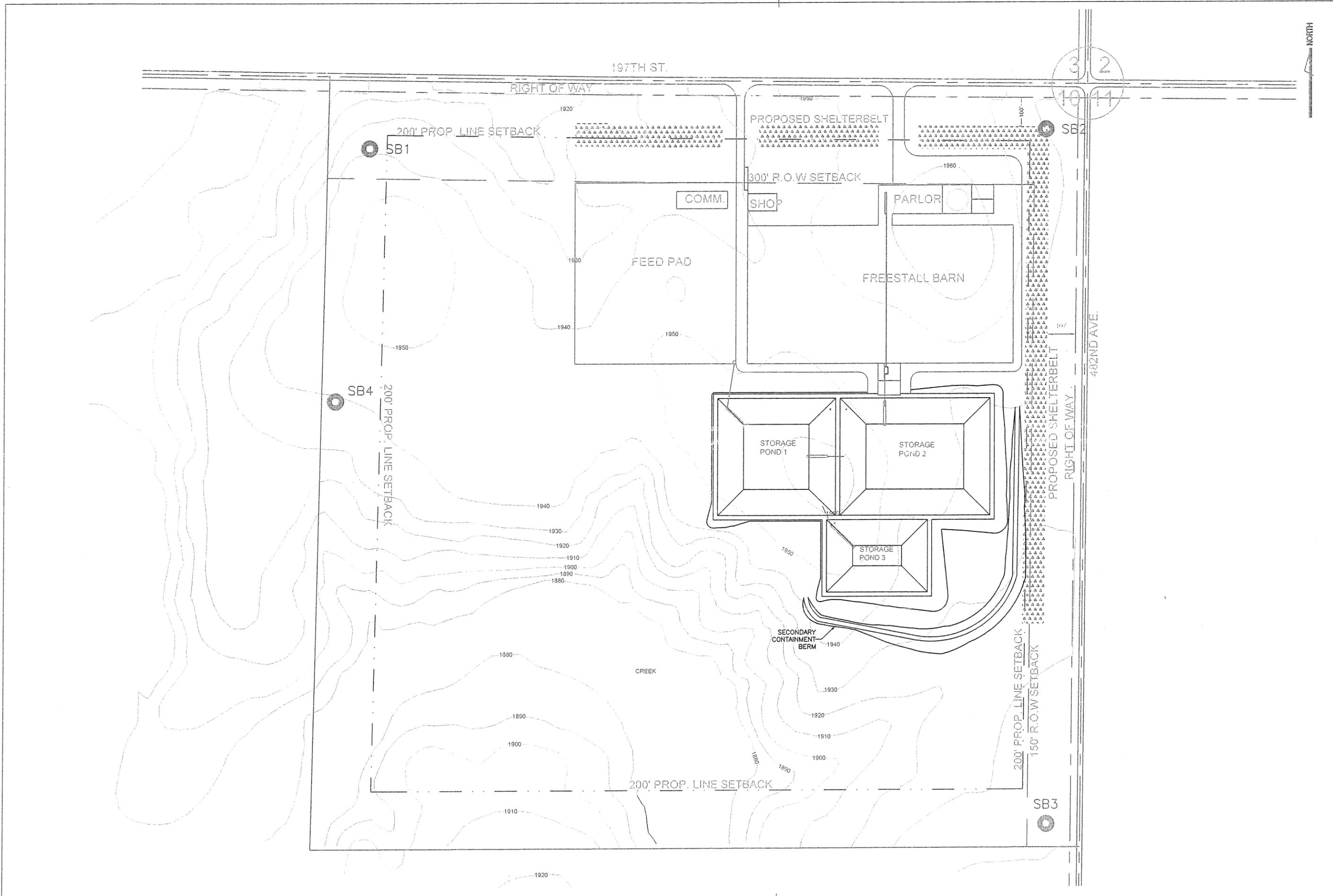
NATIONAL FLOOD INSURANCE PROGRAM

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at [www.msc.fema.gov](http://www.msc.fema.gov)



***APPENDIX VII***

***SITE PLAN / PLANS AND SPECIFICATIONS***



SITE PLAN		REV. DATE	DESCRIPTION	BY	CHKD
OAK LAKE DAIRY AWMS		DATE:	DRAWN:	CHECKED:	BF
DAKOTA ENVIRONMENTAL CONSULTANTS INCORPORATED			TB		
		JOB NO:	1419		
		SCALE:	1"=300'		
		DWG:	1		
		P.O. BOX 636 HURON, SD 57350		605-352-5610	

COMMODITY BARN

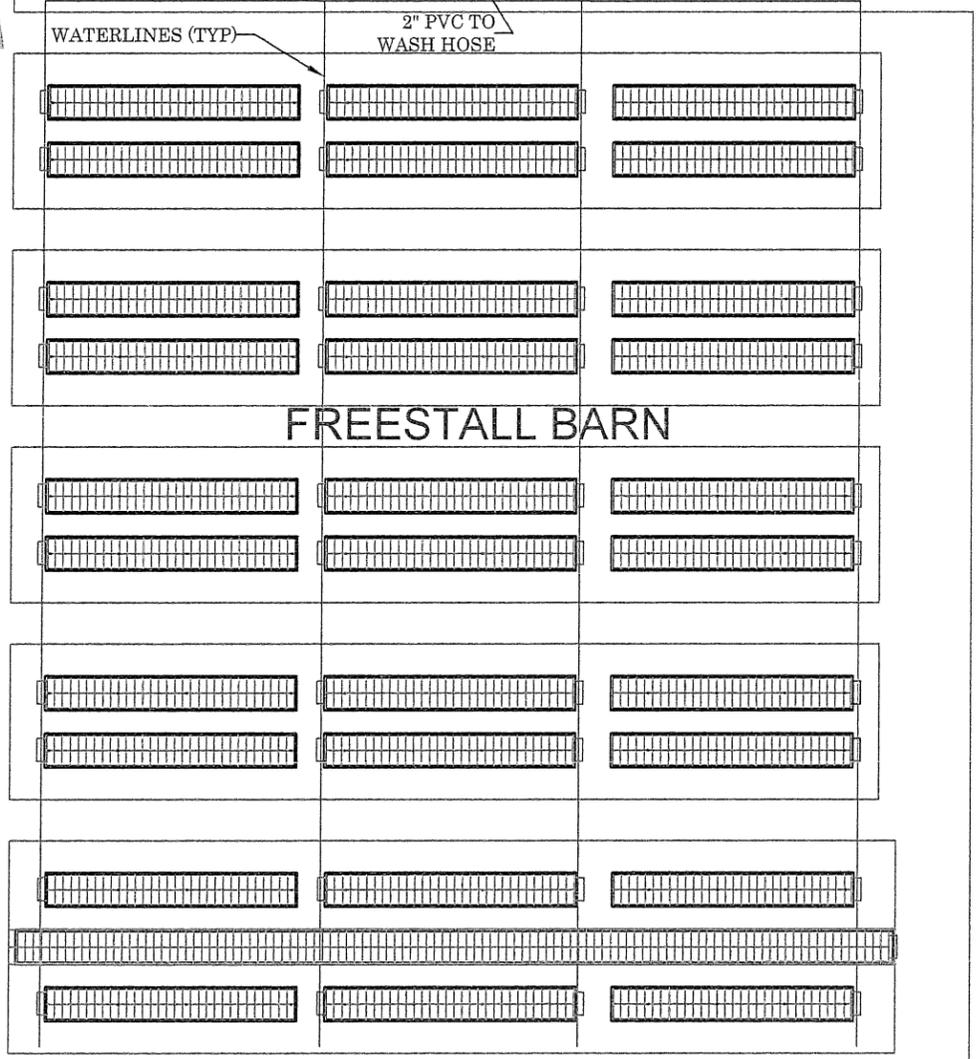
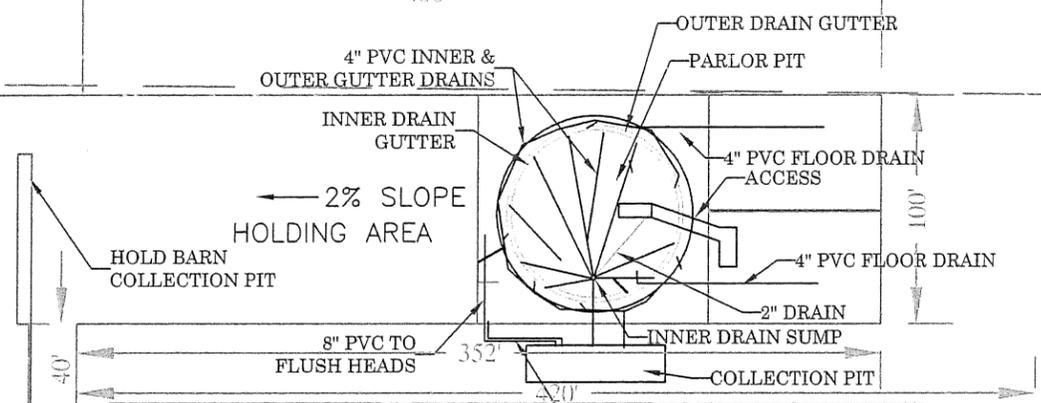
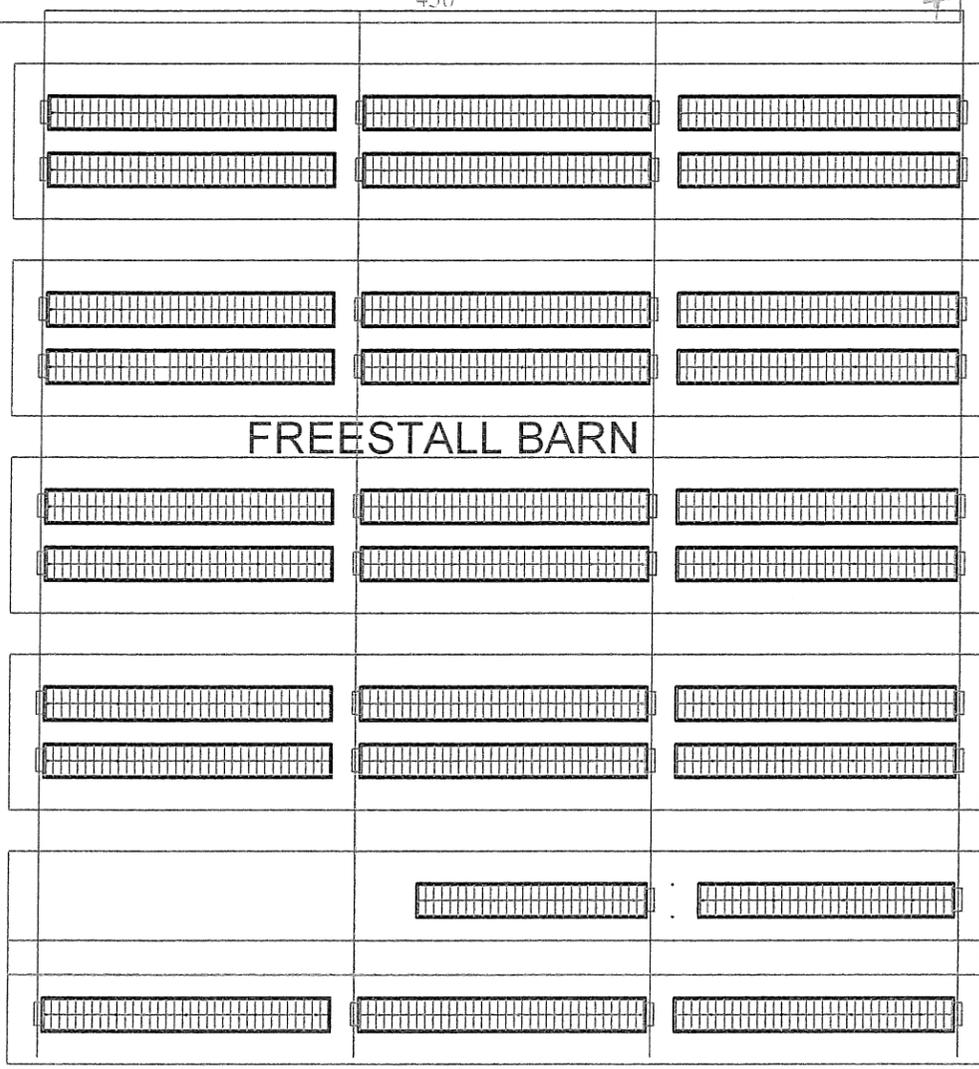
SCALE

100'  
SHOP

300' R.O.W SETBACK

FEED PAD

478'



200' PROPERTY LINE SETBACK

150' R.O.W SETBACK

NORTH

RUNOFF CATCH PIT

DRAINAGE PIPE TO POND 1 FROM FEED PAD

SEPARATOR BARN

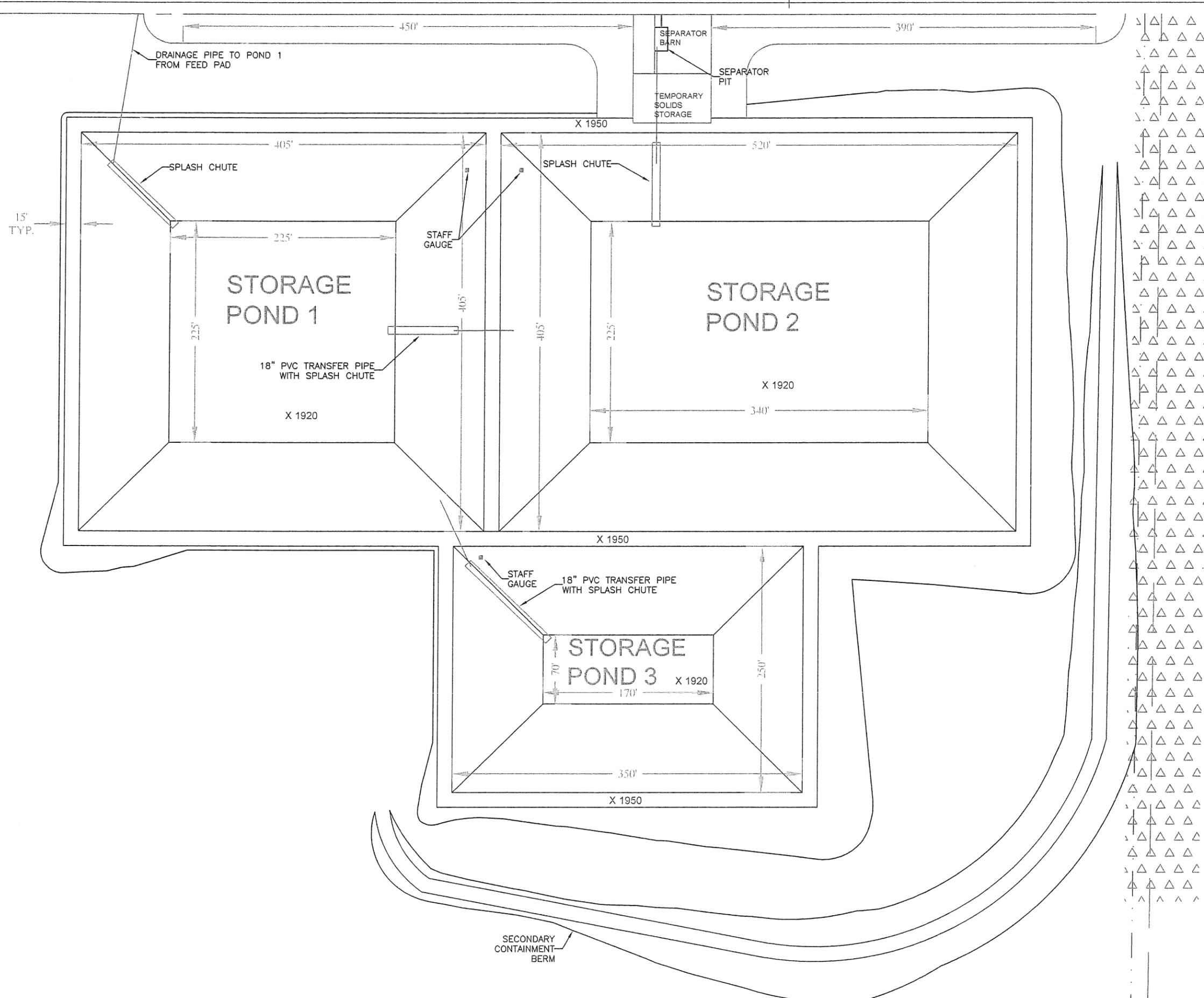
SEPARATOR PIT

TEMPORARY SOLIDS STORAGE

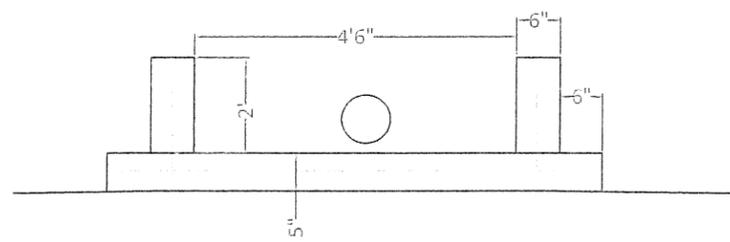
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REV.	DATE	DESCRIPTION	BY	CHKD
	11/14/16		TB	BF
BUILDING PLAN				
OAK LAKE DAIRY AWMS				
DAKOTA ENVIRONMENTAL CONSULTANTS INCORPORATED				
P.O. BOX 636 HURON, SD 57350 605-352-5610				
JOB NO: 1419				
SCALE: 1"=80'				
DWG: 2				

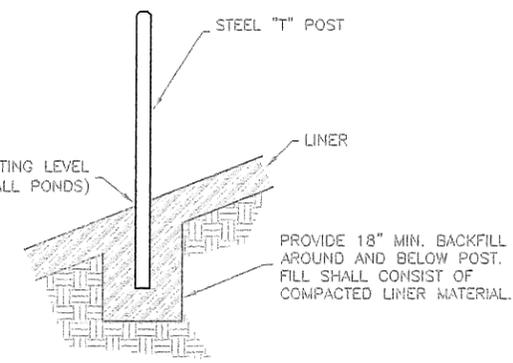




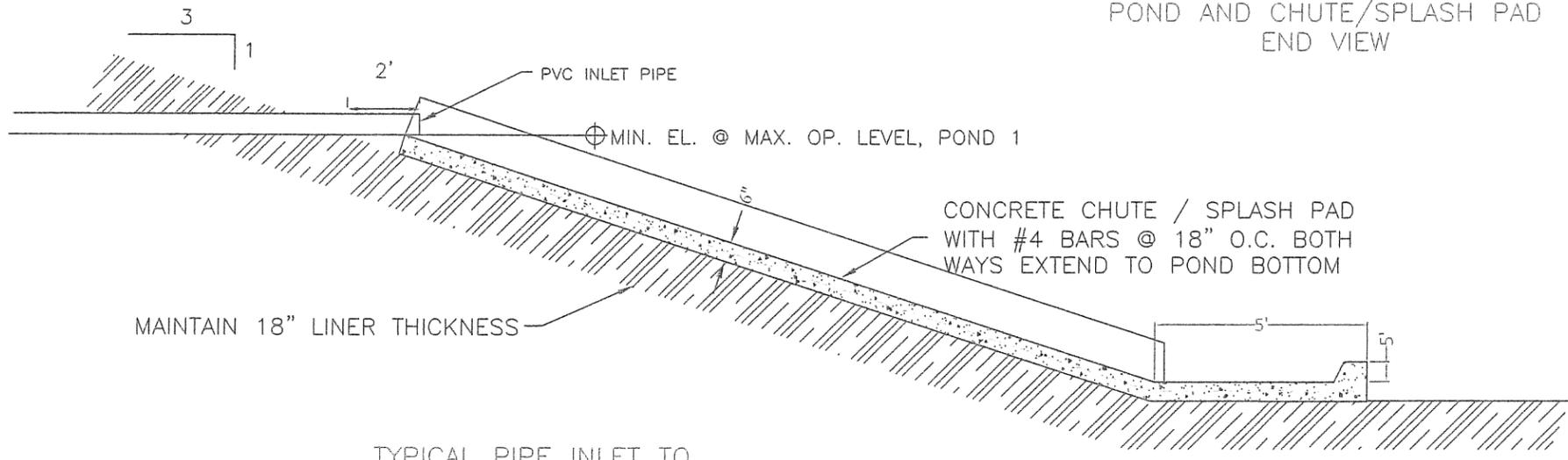
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DAKOTA ENVIRONMENTAL CONSULTANTS INCORPORATED		P.O. BOX 636 HURON, SD 57350 605-352-5610			
		JOB NO: 1419			
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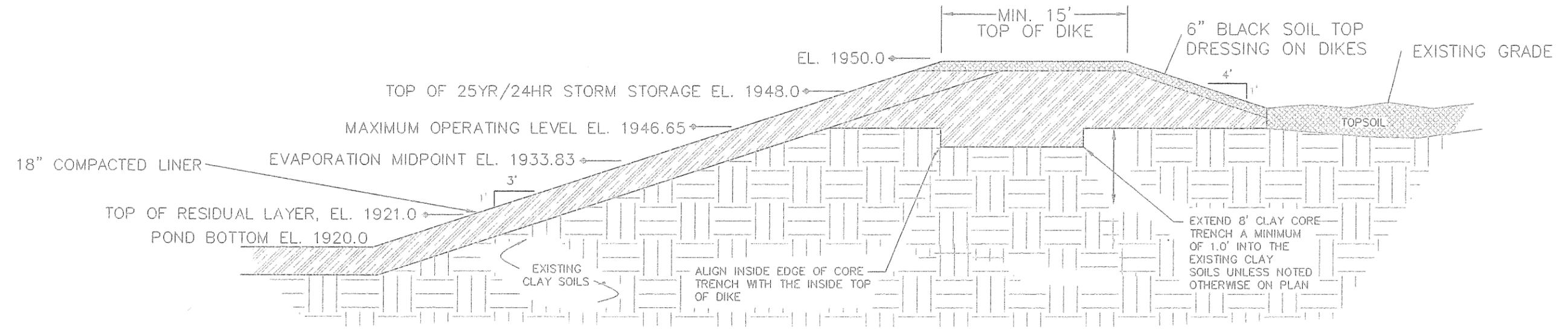
TYPICAL PIPE INLET TO POND AND CHUTE/SPLASH PAD  
END VIEW



POND STAFF GAUGE  
NTS

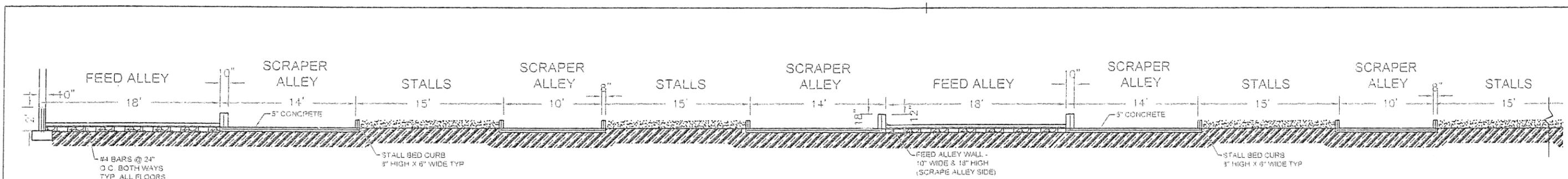


TYPICAL PIPE INLET TO POND AND CHUTE/SPLASH PAD  
SIDE VIEW

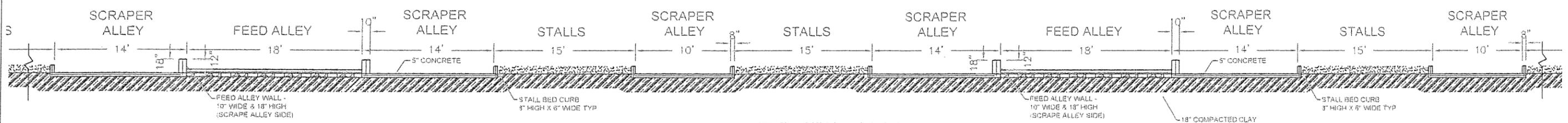


TYPICAL POND DIKE CROSS SECTION  
POND 1 ELEVATIONS SHOWN  
NTS

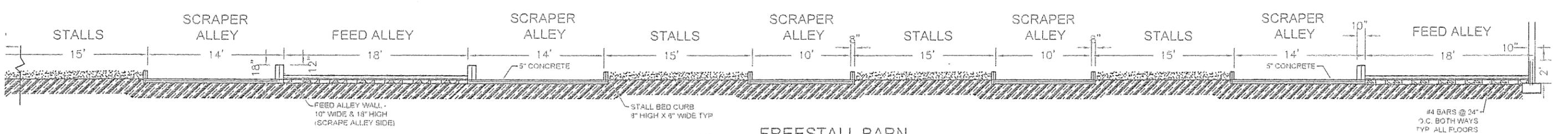
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POND DETAILS				
OAK LAKE DAIRY AWMS				
DAKOTA ENVIRONMENTAL CONSULTANTS INCORPORATED				
P.O. BOX 636 HURON, SD 57350 605-352-5610				
				
JOB NO:				
1419				
SCALE:				
NTS				
DWG:				
4				



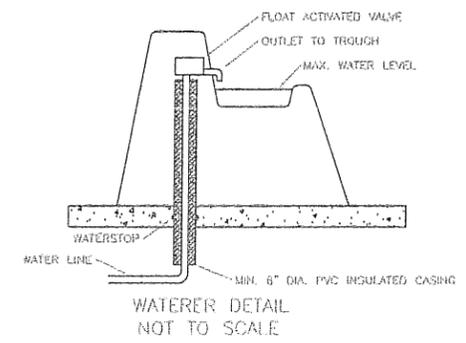
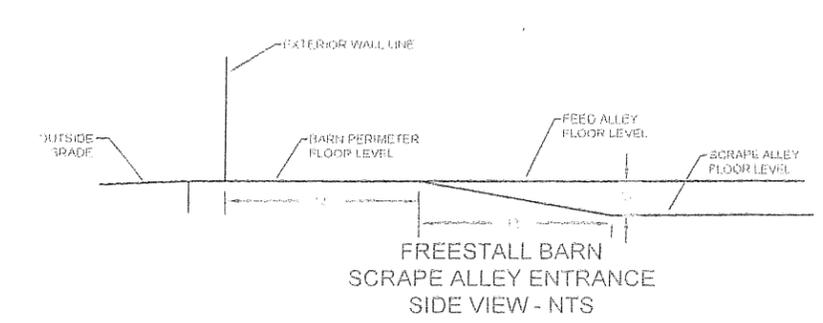
(A4/8) FREESTALL BARN  
TRANSVERSE SECTION  
SOUTH SEGMENT



(A4/8) FREESTALL BARN  
TRANSVERSE SECTION  
MIDDLE SEGMENT



(A4/8) FREESTALL BARN  
TRANSVERSE SECTION  
NORTH SEGMENT

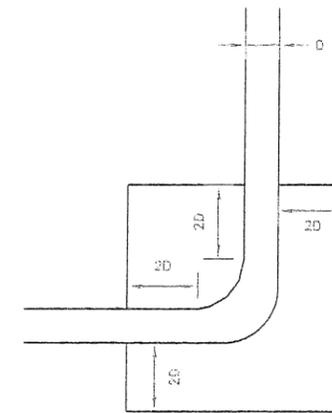
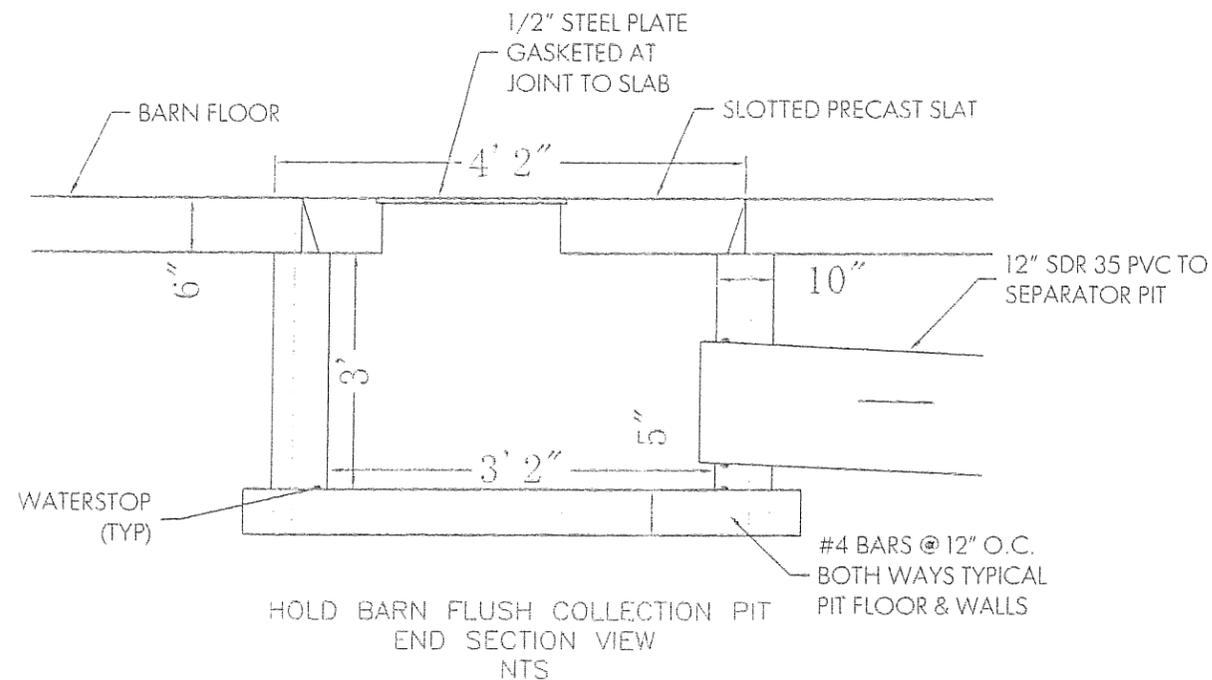


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	REV.	DATE:	11/14/16

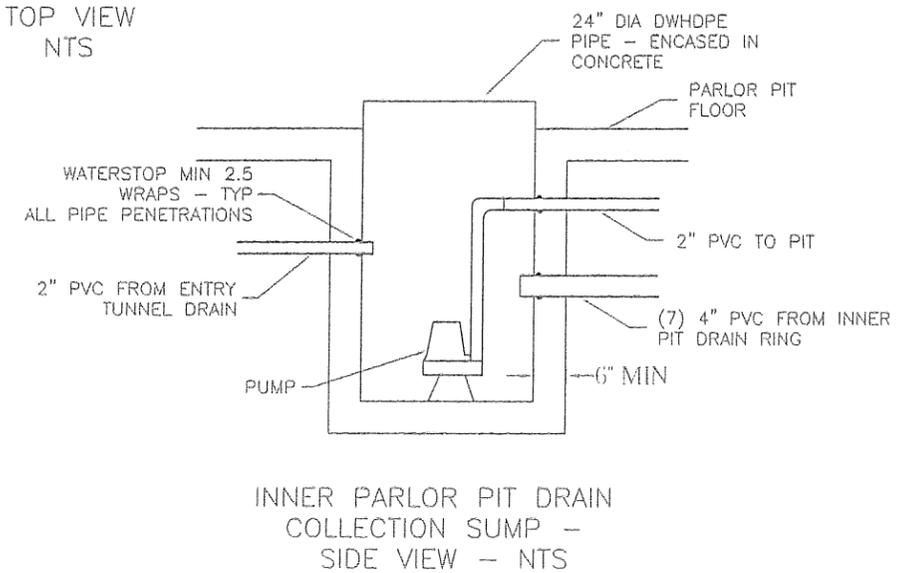
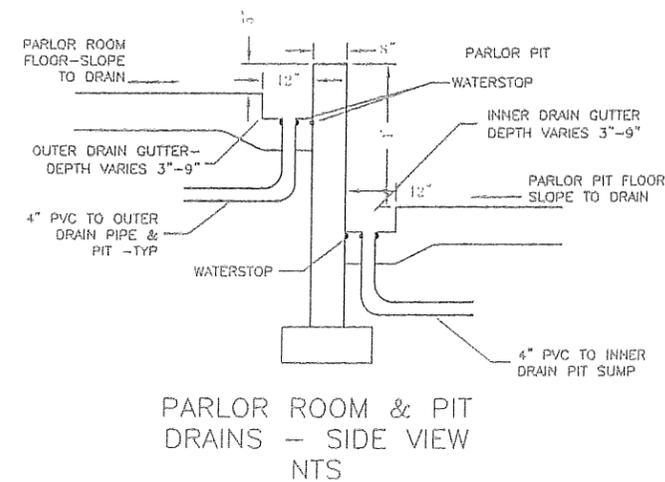
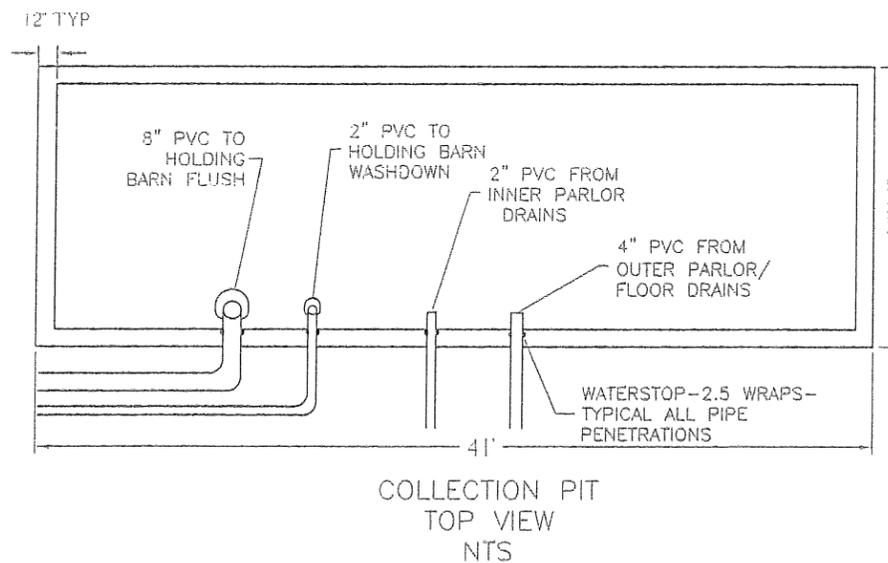
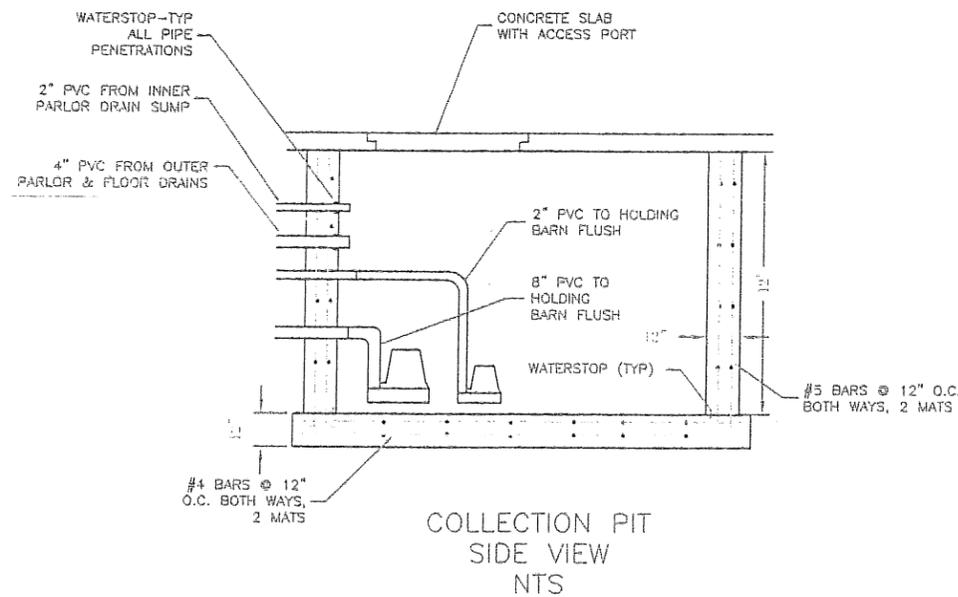
FREESTALL BARN SECTION  
 OAK LAKE DAIRY AWMS



JOB NO:	1419
SCALE:	NTS
DWG:	5



- NOTES:
1. PROVIDE ENCASEMENT MIN 2 PIPE DIAMETERS BEFORE TO AFTER ANY BEND IN FORCEMAIN
  2. PROVIDE ENCASEMENT MIN 2 PIPE DIAMETERS AROUND PERIMETER OF FORCEMAIN AT ANY BEND.

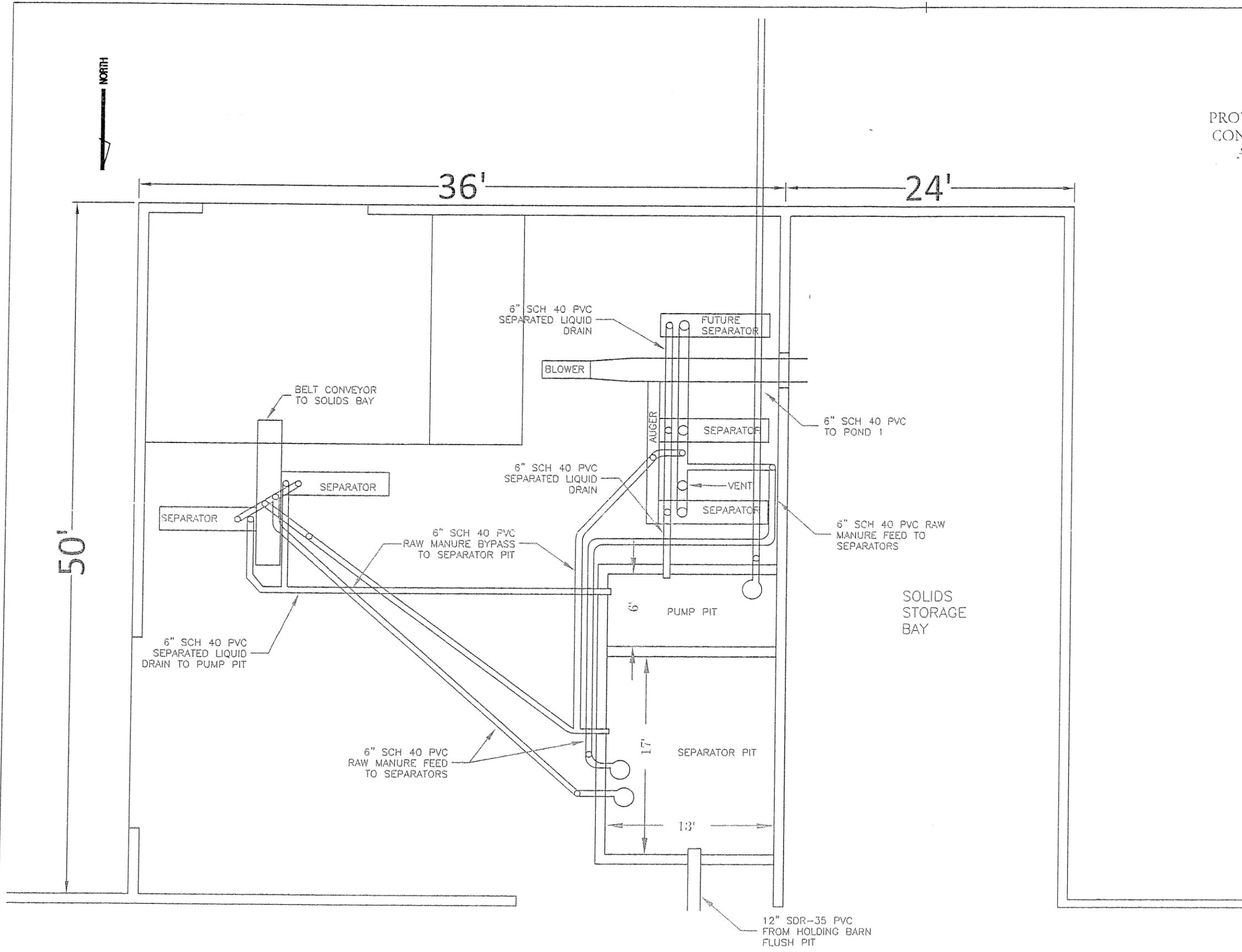


COLLECTION PIT DETAILS  
OAK LAKE DAIRY AWMS

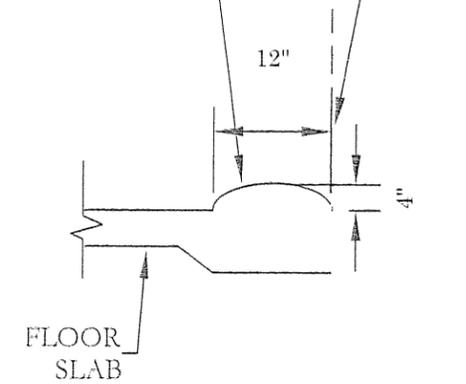


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REV.	DATE	DESCRIPTION	BY	CHKD
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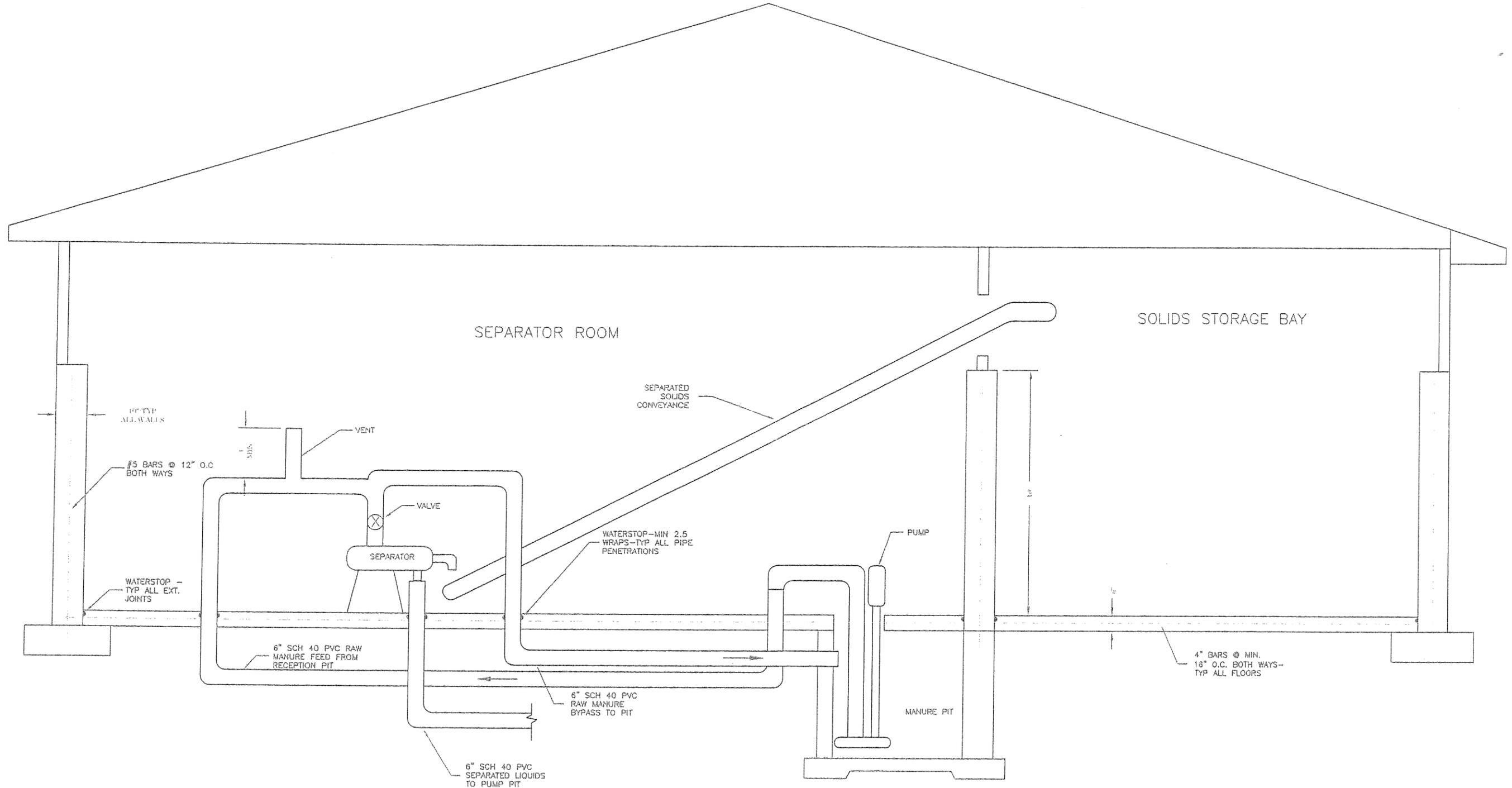


PROVIDE FORMED CONCRETE LIP AT ALL ENTRANCES  
 EXTERIOR WALL LINE OF BUILDING



FLOOR DETAIL AT DOOR OPENINGS

REV.	DATE	DESCRIPTION	BY	CHKD
	11/14/16			BF
		DRAWN: RR		
SEPARATOR BUILDING PLAN				
OAK LAKE DAIRY AWMS				
				
JOB NO:				
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SCALE:				
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DWG:				
7				



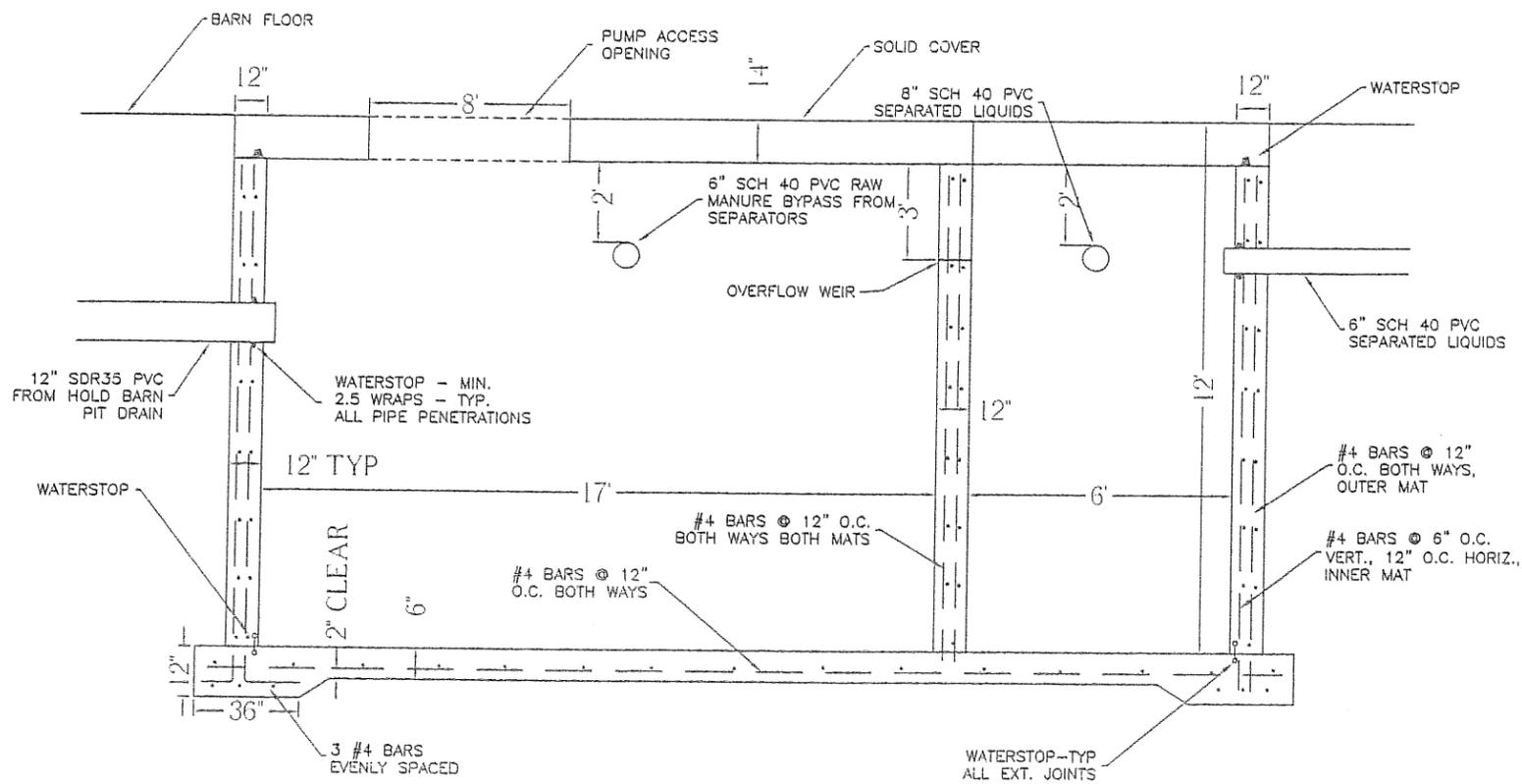
SEPARATOR BARN &  
GENERAL SEPARATOR  
SCHEMATIC-NTS

REV.	DATE	DESCRIPTION	BY	CHKD
	11/14/16	RR		BF

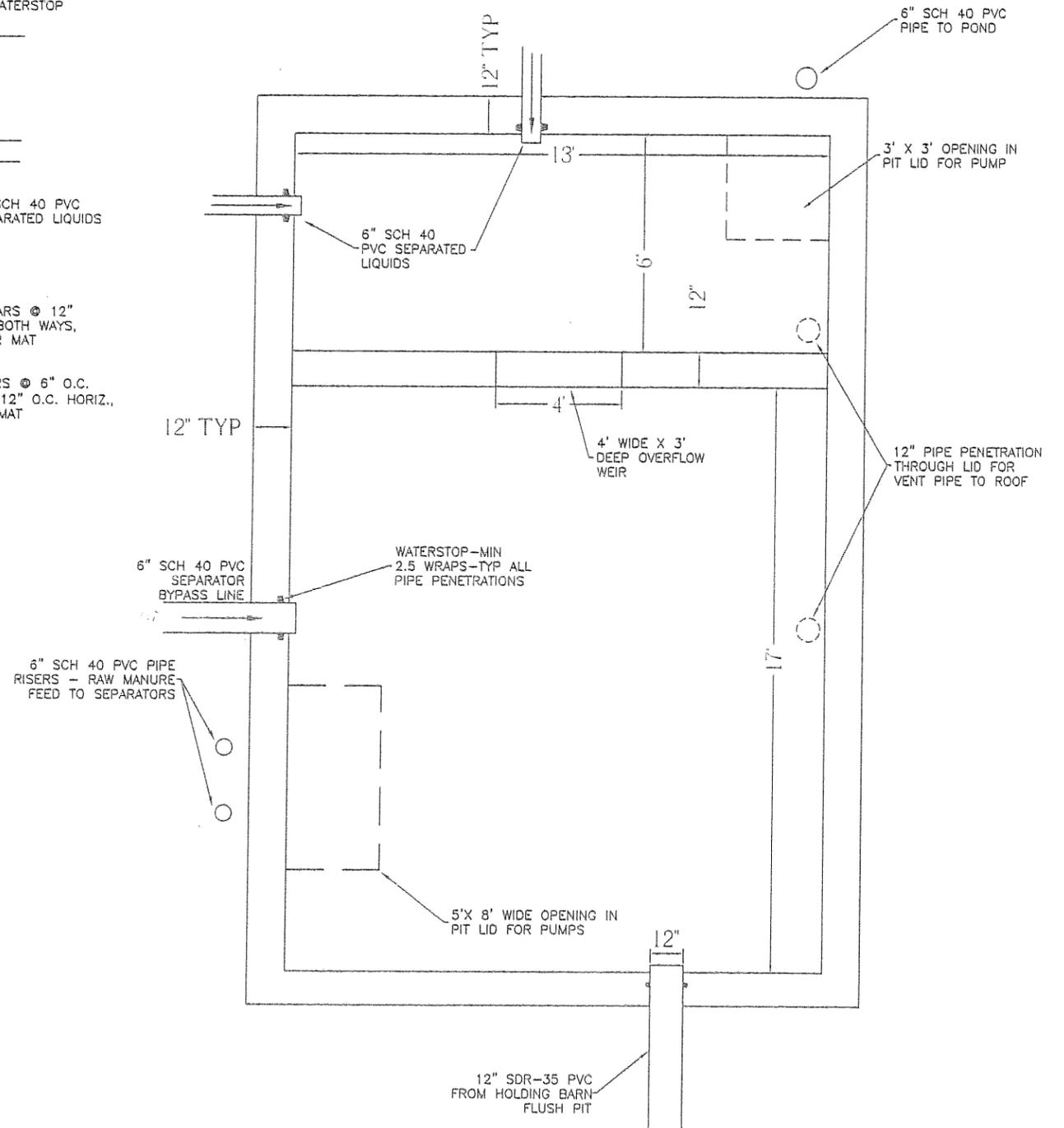
SEPARATOR BUILDING SECTION  
OAK LAKE DAIRY AWMS



JOB NO:	1419
SCALE:	NTS
DWG:	8



SEPARATOR PIT  
SIDE VIEW



SEPARATOR PIT  
PLAN VIEW

REV.	DATE	DESCRIPTION	BY	CHKD
	11/14/16			
		DATE	RR	BF
		DRAWN		
SEPARATOR DETAILS				
OAK LAKE DAIRY AWMS				
				
JOB NO:				
1419				
SCALE:				
NTS				
DWG:				
9				

**GENERAL NOTES/SPECIFICATIONS**

1. **NO VARIATION FROM THESE PLANS IS AUTHORIZED WITHOUT PRIOR APPROVAL OF ENGINEER. THE BUILDER IS TO ADVISE ENGINEER IMMEDIATELY UPON DISCOVERY OF ANY INCONSISTENCY OR DISCREPANCY IN THESE PLANS WITH FIELD CONDITIONS OR PLANS PROVIDED BY OTHERS.**
2. Any new water supply wells placed on the site must be a minimum of 150 feet from the closest point of any waste holding structure including manure pits. Any new well must be a minimum of 50 feet from the closest point of a sewer line.
3. Strip topsoil and vegetation from all areas under structures and embankments. Stripping excavation shall extend to a depth sufficient to expose subsoil reasonably free of roots and other perishable material. Excavated earth material determined to be satisfactory by the Engineer shall be used for earth fill or topsoil. Stripped material suitable for topsoil shall be stockpiled and spread, as specified in these specifications.
4. Stripping excavation for foundations shall extend to consolidated subsoil and shall be left as reasonably smooth surfaces free of unconsolidated or loose soil. Because of the fact that imposed structural loads are distributed laterally with depth, when replacing poor soils with compacted fill it is necessary to oversize the excavation to a certain extent. In most soils we recommend that at least a 1:1 lateral oversize be maintained in excavating below footing grade. In soft clay and swamp deposits we generally recommend a 2:1 or even 3:1 lateral oversize.
5. Excavated soils consisting of loams and clay shall be deemed satisfactory for earth fill to the extent needed. Sandy soil shall be blended to provide for earth fills, or be wasted as directed by the Engineer. The selection, blending, routing, and disposition of material shall be the responsibility of the Builder and subject to approval by the Engineer. Fill materials shall contain no frozen material, ice, snow, sod, brush, roots or other perishable materials, or rocks larger than four inches in diameter. No fill shall be placed on a frozen surface.
6. Prior to placement of fill, the entire area to receive fill shall be rolled with heavy equipment (such as a loaded end-dump) and inspected to identify any unsuitable soils that require removal. Unsuitable materials shall be overexcavated to a depth of 2 feet. After stripping or overexcavating, the foundation shall be loosened thoroughly by scarifying or discing to a minimum depth 6 inches. The entire foundation area shall then be compacted to the density and at the moisture specified for the fill.
7. All foundation excavation and/or preparation shall be completed before placing fill. The fill shall be placed such that the distribution of materials is essentially uniform throughout the entire fill and is free from lenses, pockets, streaks, or layers of material differing substantially from surrounding material.
8. Fill shall be placed within specified moisture contents. When material deposited on the fill is too dry, water may be added to the fill material in the borrow area, or after material has been brought onto the fill. If moisture is added to the fill, uniform moisture distribution shall be obtained by discing, blading or other approved methods.
9. Density and moisture content of the fill will be tested during the course of the work following the methods described in ASTM D2216, ASTM D1556, or equivalent. The engineer shall be notified two days prior to the need for performance of compaction tests. Testing shall be performed at the following rates:
  - a) Earthen liners: A minimum of 4 per lift for areas up to two (2) acres. Provide an additional 2 tests per lift for each additional acre.

- b) Earthfill: A minimum of one compaction test for every 5000 cu. yd.  
If a compaction test fails to meet the required level of compaction, the Builder shall be responsible for the cost of re-testing after the area has been recompacted.
10. In lieu of conducting density tests on the completed liner, there shall be a minimum of two permeability tests conducted on the completed liner. For ponds larger than two acres, one permeability test shall be conducted for each acre of liner. The locations of the tests must be random and equally distributed over the liner bottom and inside embankments. All liner tests shall demonstrate an in-place permeability not to exceed  $1.0 \times 10^{-7}$  cm/sec.
11. Builder is responsible to manage the routing and stockpiling of material for the clay liner. It is anticipated the native clay soils below the topsoil will be suitable for use as liner material, though certain soils encountered may contain excessive sand or silt and are not suitable. As early as possible during excavation, field evaluation of the quality of the native clay soil in the vicinity of the bottom liner should be performed with the engineer to verify its adequacy. The contractor shall stockpile choice clay materials during the progress of excavation to ensure the availability of a suitable volume and quality of liner material.
12. When in-place native soils are used as for compacted liner, excavate beyond the design bottom an additional twelve inches. The next six inch layer shall be scarified and recompacted. Additional six inch lifts of select material will be placed and compacted to reach the specified liner thickness. When imported clay material is used for a liner, overexcavate beyond the design bottom by the liner thickness. The entire liner subgrade area shall be rolled to identify any unsuitable soils that require removal. Following overexcavation, six inch lifts of select material will be placed and compacted to reach the specified liner thickness.
13. Pipe trench bottoms shall be uniform so that the pipe will lay on the bottom without bridging. Clods, rocks, and uneven spots which could damage or cause non-uniform support to the pipe shall be removed. Where rocks, boulders or any other material which might damage pipe are encountered, the trench bottom shall be undercut a minimum of 4 inches below final compacted fine-grained soils. Provisions shall be made to insure safe working conditions where unstable soil, trench depth, or other conditions are such as to impose a safety hazard to personnel working in the trench.
14. Pipe shall be installed in accordance with these plans, the manufacturer's recommendations, and ASTM D2321. Pipe shall be fully supported its entire length by hand excavation or other suitable means. Initial pipe backfill shall be of selected material free from sharp edged rocks, stones or clods. Care shall be taken to avoid deformation or displacement of the pipe during initial backfill operation. The remainder of the backfill shall be placed and spread in approximately uniform layers in such a manner as to completely fill the trench so that there will be no unfilled spaces in the backfill. Mound the backfill soil to replace the soil removed from the trench.
15. All piping shall be installed so a minimum of 5 feet of cover is present between the surface and the crown of the pipe if additional insulation is not provided.
16. Gravity sewer and drainage pipes shall be constructed using SDR 35 or heavier PVC pipe laid at the grades shown on the drawings. Pressure pipe (force main) shall be constructed using SDR-26 PVC pipe or heavier. On pressure pipe systems, provide concrete thrust blocks, with at least 4 square feet of bearing on undisturbed, firm soil, at all bends, valves, tees, fittings or reducers. Where water supply pipes cross under or within 18 inches of any sewer piping, encase the water line in concrete (minimum of 6" surrounding the pipe) for at least 10 feet either side of the crossing.
18. All sewer pipes shall be pressure tested. Contractor shall provide written certification of pressure testing results to the engineer prior to application for payment. The contractor shall provide all labor and materials for pressure testing.

19. Pressure tests of gravity sewers shall be performed as follows: A test plug shall be inserted at the point of discharge into the pond. The sewer shall then be filled with water to the top of the inlet pipe. The water level at the top of the inlet shall not drop for at least fifteen minutes.
20. Pressure tests of pressurized sewers shall be performed as follows:
  - a) Fill the service line and bleed to remove all air.
  - b) Isolate service line from main and raise pressure to 50% above the design operating pressure.
  - c) Maintain pressure within 1 psi for a minimum of 30 minutes.
  - d) Line will pass the test if leakage is no more than the following:  
 $L = (N \times D \times P) / 1850$   
Where:  
L = Allowable leakage, in gallons per hour.  
N = Number of pipe joints.  
D = Nominal pipe diameter, in inches  
P = Average test pressure during test, in psig.
21. Unless otherwise specified on the plans, the fill shall be compacted to the following specifications. Maximum density shall be determined by ATSM-D-698, Standard Proctor Test.
 

	% maximum dry density	% moisture range about optimum	max. lift thickness	total liner thickness
Embankment	90%	-2 to +2	12"	-
Structural fill beneath slabs and pipe	97%	-3 to +3	8"	-
Pond liner	95%	-2 to +2	6"	18"
22. In locations where existing embankments or liners are disturbed to install, remove, or modify piping or appurtenances, the disturbed embankments shall be recompacted to the above specified densities using the procedure described above. The disturbed liner shall be replaced and recompacted to the above specifications. Rammer or plate compactors are considered to be acceptable if larger compacting equipment is not practical for these locations.
23. Seed disturbed and topsoiled areas using Fairway Crested Wheatgrass at 15#/acre, or Smooth Bromegrass at 20#/acre. Apply seed when soil is not wet, using a grass drill at a depth of 1/4 to 3/4 inch, or with other approved types of equipment that will ensure a uniform distribution of the seed. Areas with slopes steeper than 4:1 shall be mulched with straw or hay and anchored by use of a mulching machine or netting.

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				DATE		11/14/16
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GENERAL NOTES & SPECS.						
OAK LAKE DAIRY AWMS						
						
JOB NO:						
1419						
SCALE:						
NTS						
DWG:						
10						

**CONCRETE CONSTRUCTION NOTES**

1. **BUILDER SHALL NOTIFY THE ENGINEER OF CONSTRUCTION SCHEDULE TO PERMIT SCHEDULING OF PRE-CONSTRUCTION MEETING AND CONSTRUCTION OBSERVATION.**
2. **NO VARIATION FROM THESE PLANS IS AUTHORIZED WITHOUT PRIOR APPROVAL OF THE ENGINEER.**
3. **BUILDER IS RESPONSIBLE TO ADVISE ENGINEER IMMEDIATELY UPON DISCOVERY OF ANY INCONSISTENCY OR DISCREPANCY IN THESE PLANS WITH FIELD CONDITIONS OR PLANS PROVIDED BY OTHERS.**
4. Any required grounding of building components including concrete reinforcement shall be installed in accordance with the provisions of the National Electric Code and regulations.
5. No excavation shall begin without first having locations of all present utilities identified. Builder is responsible for contacting South Dakota One-Call at 1-800-781-7474.
6. All concrete work shall conform to the American Concrete Institute's "Building Code Requirements for Structural Concrete" (ACI 318).
7. Concrete Materials and Testing:
  - a) All concrete shall have 3/4 inch maximum aggregate size. Provide a mix with a slump of 4 inches +/- 1 inch. Do not exceed a water/cementitious materials ratio of 0.45. Water reducing admixtures may be used at the discretion of the contractor.
  - b) Concrete shall use Type II cement and be furnished with proper admixture to obtain 5% +/- 1% air entrainment.
  - c) Concrete shall develop a minimum 28 day strength of 4000 psi.
  - d) Provide quality assurance testing in accordance with the following requirements. Submit the results of all tests to the Engineer. **Testing will be wholly the contractor's responsibility.**
  - e) Collect concrete test cylinders in accordance with ASTM C31. Test cylinders may be taken either at the batch plant (assure materials are thoroughly mixed, at least 1½ minutes after all water and cementitious materials have been introduced), or in the field. Test cylinders shall be made in sets of two. At least one set of two cylinders shall be taken each day concrete may be placed, however, procurement of test cylinders may be waived with the concurrence of the engineer or when less than 40 cubic yards is placed in a given day.  
 Obtain at least the following numbers of test cylinders:  
 One set of 2 cylinders for each 3000 square feet of flatwork;  
 one set of 2 cylinders for each 500 linear feet of exterior walls;  
 and one set of 2 cylinders each for floors and walls of any individual pit.  
 Test all cylinders in accordance with ASTM C39 at 28 days.
8. During hot weather (80° F and above), comply with ACI 305 "Hot Weather Concreting". During cold weather (40° F and below), comply with ACI 306 "Cold Weather Concreting."
9. Calcium Chloride accelerators will not be allowed.
10. Steel reinforcing shall comply with the following:
  - a) Steel for walls shall be ASTM A615, Grade 60.

- b) Reinforcing steel for floors shall be ASTM A615, Grade 40 or Grade 60.
11. All steel shall be lapped 36 bar diameters at splices unless noted otherwise. Splices shall be staggered at least 3 feet. Splices occurring at the same location shall be at least 6 bars apart.
12. Standard concrete cover of bars shall be as follows, unless noted otherwise:
  - a) Where earth formed 3 inches
  - b) Where exposed to earth or weather 2 inches
13. Walls and slabs shall bear on soil capable of safely supporting 2400 psf. Pier bearing elevations are to be at least 4.5 feet below finished grade.
14. For backfill provide granular or low plasticity soil such as silt and clay mixtures, sandy clay, or clean sand and gravel. All backfill materials are subject to approval of the engineer. Compact all fill and backfill in maximum 12-inch layers (loose thickness) to at least 95% of the maximum density as determined by Standard Proctor test (ASTM D698).
15. Excavate the area to the required lines and grades. The entire area shall be rolled as needed to compact any loosened materials. The subgrade shall be trimmed and compacted to provide a uniform surface that does not vary in depth more than 2" in 10 feet from the grades shown on the plan. Fill below footings and slabs, if needed due to unsuitable soils or uneven surface grading, shall consist of clean granular material (sand with less than 12% passing a #200 US sieve) compacted as specified for backfill in note #14, above. Constructed thickness of slabs shall not be less than the dimension given on the drawings.
16. If necessary, wall penetrations shall avoid interruption of steel reinforcement, where possible. Where interruption by piping is required, additional reinforcement around the openings shall be as shown on plans.
17. If groundwater conditions or any soft or potentially unstable materials are encountered during excavation, the Engineer shall be notified immediately.
18. Provide suitable chairs, spacers, or bolsters to support all reinforcing. Accessories shall be as specified in the latest edition of "Concrete Reinforcing Steel Institute Handbook." Maximum spacing of accessories shall be 5'-0". All accessories shall have galvanized or plastic feet. For slabs on grade, use supports with sand plates or horizontal runners if needed. No aluminum items shall be embedded.
19. Install all construction or control (contraction) joints as called for on the drawings or as approved by the floor engineer.
20. Concrete construction shall be planned to minimize the number of construction joints. Except at corners, the location of all construction joints in walls and floor slabs, and the layout of slab control (contraction) joints, shall be reviewed with and approved by the engineer prior to construction.
21. All construction joints in and between floor slabs and exterior walls shall be provided with waterstop. Provide Waterstop RX 102, as manufactured by American Colloid Corp., or polyvinyl chloride waterstop, style #703 as manufactured by Greenstreak or approved equal. Install waterstop in accordance with manufacturer's recommendations on the manure side of reinforcing steel, near the middle of the of the wall or slab section, and as shown on the detail

- drawings. Maintain specified concrete cover over waterstop and reinforcing steel.
22. All pipe penetrations shall be provided with suitable waterstops.
  23. Contractor/builder shall notify the Engineer approximately 48 hours prior to the following activities to permit inspections:
    - a) after subbase preparation, including compaction of granular cushion, and prior to drilling of piers.
    - b) during installation of wall forms and reinforcement, prior to casting concrete.
    - c) after form removal and prior to backfill to permit visual inspection of finished work.
  24. Any imperfections or damage to concrete surfaces below the waterline shall be repaired as approved by the Engineer.
  25. Compaction of fill adjacent to new concrete shall not be started until at least seven days after placement of the concrete and after all walls are laterally braced.
  26. These plans are intended to provide details relevant to the animal waste management system and are a supplement to the building plans supplied by others. The builder is responsible for confirmation of all work to be coordinated with others. Anchorage requirements, embedded items, dimensions of slats, openings for doors or fans, etc. shall be confirmed prior to erection of forms and concrete placement.
  27. Any new water supply wells placed on the site must be a minimum of 150 feet from the closest point of any waste holding structure including manure pits (1,000 feet if the well will be used for human consumption). Any new well must be a minimum of 50 feet from the closest point of a sewer line.
  28. All buried water service lines shall be installed to maintain a minimum of 3 feet of separation from any manure containment or storage structure.
  29. Seed disturbed and topsoiled areas as directed by the project engineer.

			CHKD	BY	CHECKED: BF
			DESCRIPTION	DRAWN: RR	
		DATE	11/14/16		
		REV. DATE			
CONCRETE NOTES			OAK LAKE COLONY AWMS		
					
JOB NO:					
1419					
SCALE:					
NTS					
DWG:					
11					

## Robert Hill

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**From:** Chuck Nygaard <crepair@itctel.com>  
**Sent:** Monday, November 28, 2016 8:56 AM  
**To:** Robert Hill  
**Subject:** Oak Lake Dairy

Bob, could you please pass this on to the members of the P&Z Board? Please reply. Thanks

To the Planning and Zoning Board of Brookings County:

As a board former member of the Lake Hendricks Improvement Association, naturally our concern is runoff from the proposed dairy near Oak Lake into Deer Creek Watershed, continuing on to Lake Hendricks and Oak Lake. The biggest enemy of this site is the topography. A lot of time, effort, and money has been put forth in recent years to clean up the water in the lake, and we would hate to see this all go for naught, because as time goes by, we are seeing results of our efforts. We feel this will happen in one of four ways.

1. Problems stemming from leaks/mismanagement of the containment system/facility. Leaks probably wouldn't happen until sometime down the road, but as time goes on, that probability increases. Mismanagement can come at any time, whether it comes from feed, manure, dead animals, disease, chemicals, just to name a few. Some of these could also affect herds in pastures downstream, as pasture is a predominant land use in the watershed.

2. Runoff from heavy rainfall. In their plan, they address a 25 year rain event, which I believe is 4 inches of rain in a 24 hour period. This has gotten to be an event we pretty much plan on every year, if not 5 to 6 inches. One inch of rain on a 220 acre site equates to nearly 6 million gallons, so 4 inches is 24 million gallons. Where is that headed for? It won't be contained on the site, also doesn't help that it would be built on a hill.

3. Runoff from snowmelt. On the Buffalo Ridge, our weather is totally different even compared to Brookings. You can be driving from Brookings to Hendricks, and when you hit the curves by White or the valley, you can be in a different world. If anyone gets pounded with snow and wind, it's us. This could also hamper or endanger workers getting to and from the site. Police and Fire/Rescue don't appreciate looking for someone in a snowstorm. Everything accumulates in snowdrifts. When the melt comes, everything moves with the water. I would guess that this would also be one of the times the manure storage would be at its peak, and there is nowhere to go with it until fields dry out to apply manure. The plan also suggests that manure can be applied on top of snow, which one would think anyone would be opposed to. That area is nothing but hills and valleys.

4. Over application of manure. To be done correctly, soil tests need to be

done before manure should be applied. Application rates should coincide with what the next crop will use during the next crop year. We are aware that other facilities keep applying to the same fields year after year, just to get rid of the manure in close proximity to cut expense. We understand this is not well regulated in South Dakota once the permit is issued.

We feel it is not if this will happen, but when.  
Our goals have not changed and that would be for the P&Z to vote this down, or at least have the issue tabled until correct information can be gathered by P&Z, or a different site be chosen.

Thank You for your time,

Chuck Nygaard  
Hendricks MN

## Robert Hill

---

**From:** Joe Beech <joeabeech@hotmail.com>  
**Sent:** Monday, November 28, 2016 10:11 AM  
**To:** Robert Hill  
**Cc:** Tom Landmark; Chuck Nygaard  
**Subject:** December 6 P&Z Meeting  
**Attachments:** IMG\_20141029\_161414802[1].jpg; IMG\_20141029\_161402074[1].jpg; IMG\_20141029\_161402074.jpg; IMG\_20141029\_161348375[1].jpg

Good Morning,

I was asked to send you some of the pictures from the dairy at Bruce SD.  
Where manure spills and over application is a daily routine.

This is in advance of the meeting Dec 6 where Killeskillen is seeking a conditional use permit to build a dairy in Brookings Co.

As in the past Brookings co is in the middle of this. We in Brookings co as residents and tax payers strongly oppose this dairy because of its location and the risk it adds to Lake Hendricks.

*Thanks,*

*Joe Beech  
20441 472nd Ave  
Brookings, SD 57006  
605-695-3072....Office*









## Robert Hill

---

**From:** Robert Hill  
**Sent:** Monday, November 28, 2016 10:23 AM  
**To:** 'Joe Beech'  
**Cc:** Tom Landmark; Chuck Nygaard; Richard Haugen (rhaugen@brookingscountysd.gov); Rae Lynn Maher  
**Subject:** RE: December 6 P&Z Meeting

Sir,

I also noticed that you mentioned Tuesday December 6, 2016 as the meeting date. The Killeskillen Dairy CUP and Variance will be heard on December 5, 2016.

Sincerely,

Bob

Brookings County  
County Development Department Director  
Emergency Management / Planning, Zoning and Drainage  
Robert W. Hill, CEM®  
520 3rd Street, Suite 200  
Brookings, SD 57006  
605-692-5212  
605-696-8355 (Fax)



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**From:** Joe Beech [mailto:joebeech@hotmail.com]  
**Sent:** Monday, November 28, 2016 10:11 AM  
**To:** Robert Hill <rhill@brookingscountysd.gov>  
**Cc:** Tom Landmark <tom.landmark@usbank.com>; Chuck Nygaard <crepair@itctel.com>  
**Subject:** December 6 P&Z Meeting

Good Morning,

I was asked to send you some of the pictures from the dairy at Bruce SD. Where manure spills and over application is a daily routine.

This is in advance of the meeting Dec 6 where Killeskillen is seeking a conditional use permit to build a dairy in Brookings Co.

As in the past Brookings co is in the middle of this. We in Brookings co as residents and tax payers strongly oppose this dairy because of its location and the risk it adds to Lake Hendricks.

*Thanks,*

*Joe Beech  
20441 472nd Ave  
Brookings, SD 57006  
605-695-3072....Office*

## Richard Haugen

---

**From:** My Yahoo <cindiemk@yahoo.com>  
**Sent:** Friday, December 02, 2016 10:37 AM  
**To:** Richard Haugen; Robert Hill  
**Subject:** Astoria Property  
**Attachments:** Astoria 1 ac Site Plan.pdf; ATT00001.htm

Hello Richard and Robert,

I am writing to let you know that in April, 2016, my husband Kyle and I put an offer in on a 20 acre building site 1 mile south and 1/4 mile east of Astoria, SD. I no longer have the address, but have attached an image of where we were going to put our house. We were working with a Century 21 realtor and had sold our Brookings home and been looking for an acreage since November, 2015. We were extremely excited about this property and the Deubrook school district for our 2 children. About 10 days after we submitted our offer and earnest money, I found out that a 4,000 head dairy operation was proposed to be built only 1.5 miles as the crow flies southwest (upwind) of the land we were under contract to buy. I contacted a few people and learned a couple of things. First I learned the permit was being contested, and that it wouldn't be known until after our purchase was final whether this confined dairy facility would be built. Second, a friend of mine had recently had to sell their acreage north of Watertown because a dairy facility had been built over 2 miles away, but upwind of them. He said there were days when the wind was right that if they hung laundry on the line it would come in smelling of manure from the confined dairy operation. We decided we couldn't risk investing in the property. Once informing our banker at First Bank and Trust of the facility, they also stated that we were making a good decision. Because of the uncertainty with the facility, our earnest money was refunded and we were released from the contract. Our long term goal is to live a sustainable life and grow our own food on a small acreage. Because of Brookings County land use policies and how the county is trying to drive people out of the country and into cities to increase opportunities for large agricultural operations, we ended up moving out of the county. Thanks for your time in reading this message.

Sincerely,

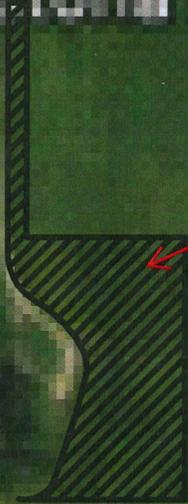
Cindie McCutcheon

605-695-1060

Hermosa, SD

# Astoria Acreage

Hatched Area -  
Approx. 1.0 acre for  
building site.





December 4, 2016

Mr. Michael Crinion  
Global Dairy LP  
46844 SD Hwy 28  
Estelline, SD 57234

Dear Mr. Crinion,

The purpose of this letter is to express support of the Brookings Economic Development Corporation for your efforts to grow the regional dairy industry. As you are well aware, the economic benefits of value-added processes which produce grains and forage for feed, and the eventual conversion of that feed to higher value products such as milk or cheese, produce a tremendous economic benefit for our region.

Industries, such as the dairy industry, result in high levels of capital investment, create quality employment opportunities for our graduates and residents, and support a myriad of related production and service businesses, many of which also require highly skilled employees. Brookings and Brookings County have most certainly been benefactors of the positive impact of this industry for many years.

Brookings County officials clearly recognize the importance of this industry to the county's agricultural producers and economy. This is evidenced by the county's efforts to carefully study and evaluate those locations within the county that are deemed appropriate for the development and expansion of feeding operations. We understand that your dairy proposal had been evaluated within the context of this prior research, approved for development, and then delayed due to some historical technicalities.

We support your efforts, and Brookings County's efforts, to continue to grow this important industry in our region and encourage the Brookings County Planning Commission and Board of Commissioners to carefully examine your request and take action that will allow for sustainable economic growth of Brookings County's agricultural economy.

Sincerely,

A handwritten signature in black ink, appearing to read "Al Heuton", with a horizontal line extending to the right.

Al Heuton, Executive Director

## Opposition to Conditional Use Permit (CUP) cu2016022 for Killeskillen LLC Dairy CAFO

The Brookings County Planning and Zoning board is required to find that the proposed CAFO “**will not adversely affect the public interest**” (Brookings County Zoning Regulation Article 5 Section 5.05 e.). To do so, the board must pay “**particular attention to .... Economic, noise, glare or other effects of the conditional use on adjoining properties and surrounding properties,**” as well as “**General compatibility with adjacent properties and other property in the district.**” (Brookings County Zoning Ordinance Article 5 Section 5.05 f.3. and 5.05 f.8).

We ask the board to deny this conditional use on the grounds that it would adversely affect the public interest, due to conflicts with the ordinance and the following effects on surrounding properties:

1. An Aquifer Protection Zone B stream, containing shallow aquifer materials, flows through the southwest quadrant of the site. Class A, B, and C CAFOs are prohibited in Aquifer Protection Zone B. The close proximity of the CAFO facility to this Zone B aquifer significantly increases the risk of pollution to surface and ground waters, and is **adverse to the public interest.**
2. The stream flowing through this site feeds into Lake Hendricks. A CAFO at this site would substantially increase the potential for water pollution affecting properties not only adjacent to the site, but in the Deer Creek and Lake Hendricks areas. The presence of a CAFO is **incompatible with other property in the area**, and the potential for damage to health, safety and property values is **adverse to the public interest.**
3. The stream running through the site has been designated as a Flood Zone A, and is known and documented as a flood-prone region, exacerbated by steep slopes. The presence of a CAFO in close proximity to this flood zone dramatically increases the potential for flooding, water pollution, property damage, and danger to the public downstream of the site, and is **adverse to the public interest.** The county should reduce flood losses by “(1) **Restricting or prohibiting uses which are dangerous to health, safety, and property due to water or erosion hazards, etc.**” (Article 15:01.4, p 45)
4. The topography of the site and surrounding area includes steep slopes, substantially increasing the risk of water pollution and flooding. The siting of a CAFO in such terrain is **incompatible with other property in the area and adverse to the public interest.**
5. A well is located less than ¼ mile from the proposed site. Class A CAFOs **cannot be located less than ½ mile from any well. (Article 22:00-14)**
6. There is significant potential for damage to the environment and wildlife of the area, via drainage into the Deer Creek basin, the aquifer bordering Oak Lake and Lake Hendricks, and Lake Hendricks, from nitrates, phosphates, and other pollutants. The presence of a CAFO is **incompatible with other property in the area and adverse to the public interest.**
7. The siting of a CAFO in this location poses an increased risk to public safety and to the environment, due to the potential for improper storage, handling, and application of manure.

Supporting evidence is provided in detail below.

1. An Aquifer Protection Zone B stream, containing shallow aquifer materials, flows through the southwest quadrant of the site. Class A, B, and C CAFOs are prohibited in Aquifer Protection Zone B. The close proximity of the CAFO facility to this Zone B aquifer significantly increases the risk of pollution to surface and ground waters, and is adverse to the public interest.

The legal description of the animal feeding operation property is "NE1/4 of Section 10, T112N, R48W," i.e., the site encompasses the entire quarter section (Figure 1).

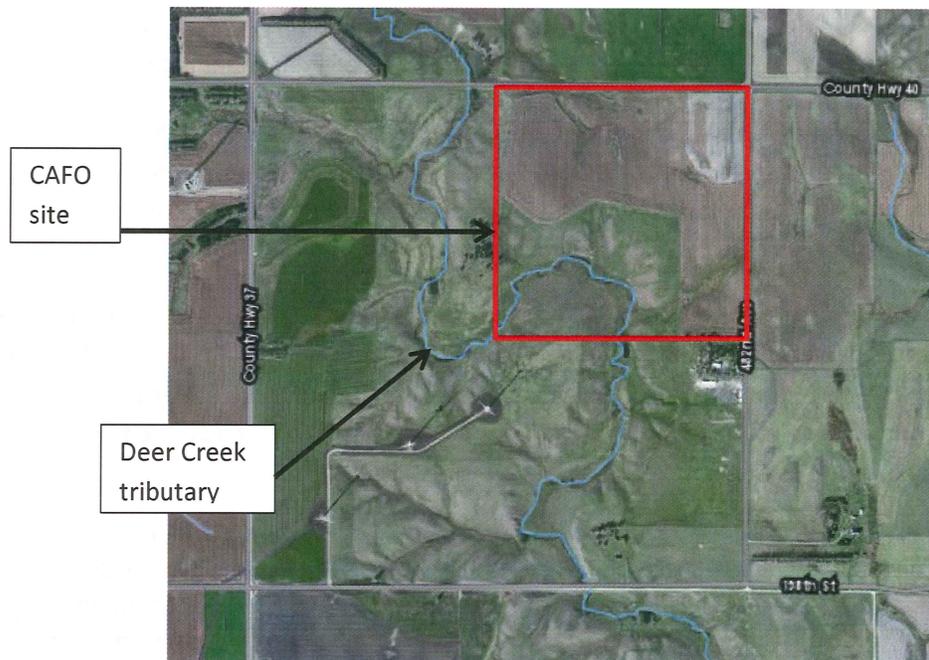


Figure 1. Section 10 of Oak Lake Township, showing the proposed CAFO site (outlined in red). Cultivated area in beige. The stream (blue) is a tributary of Deer Creek.

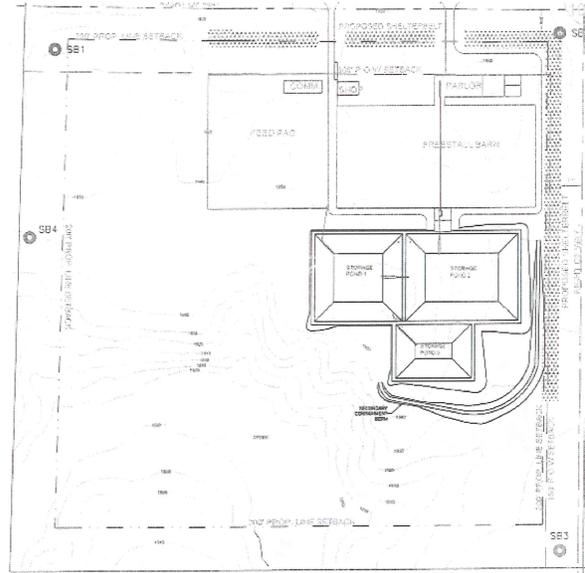
Figure 2A, below, shows the CAFO site. The stream that flows through the southwest quadrant of the site is a Deer Creek tributary. Several smaller tributaries or drainages flow into it along the arc of its passage through the site, due to the strongly sloped terrain surrounding the stream. The currently cultivated area shows as beige and the stream and vegetation are visible in green.

Figure 2B shows the building plans, sized to match 2A. (The dashed line along the west and south marks the 200 ft setback.) Figure 3 shows the building plans overlain on the site. Note that Storage Ponds 1 and 3 extend west of the cultivated area and into the slopes bordering the stream; i.e., the cultivated area does not exactly correspond to the building plan.

Figure 3 shows the building plans overlain on the site. Note that Storage ponds 1 and 3 extend west of the cultivated area.



A

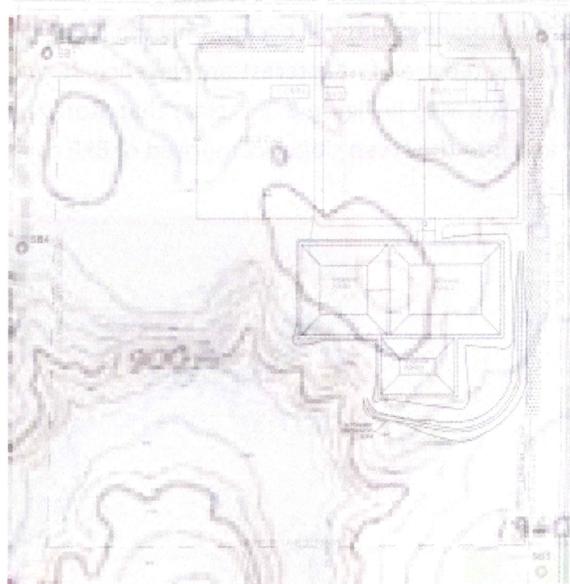


B

Figure 2.A. The quarter section including the CAFO site, from the Beacon viewer township sections map. (<https://beacon.schneidercorp.com/Application.aspx?AppID=134&LayerID=1601&PageTypeID=1&PageID=914>)  
B. The CAFO building plans, as submitted by the applicant, at same scale as Figure 2A.



A



B

Figure 3.A. Building plans overlain on the quarter section/CAFO site, aerial view.  
B. Building plans overlain on the quarter section/CAFO site, topographic map.

Figure 4 shows the soil types found on the site. The Soil Map in Figure 4A was provided by the applicant, who used an Area of Interest (blue line) that encompassed only the cultivated area of the site. In Figure 4B, we have drawn the Area of Interest to encompass the entire site, i.e., the whole quarter section. BkE soils are shaded in yellow.

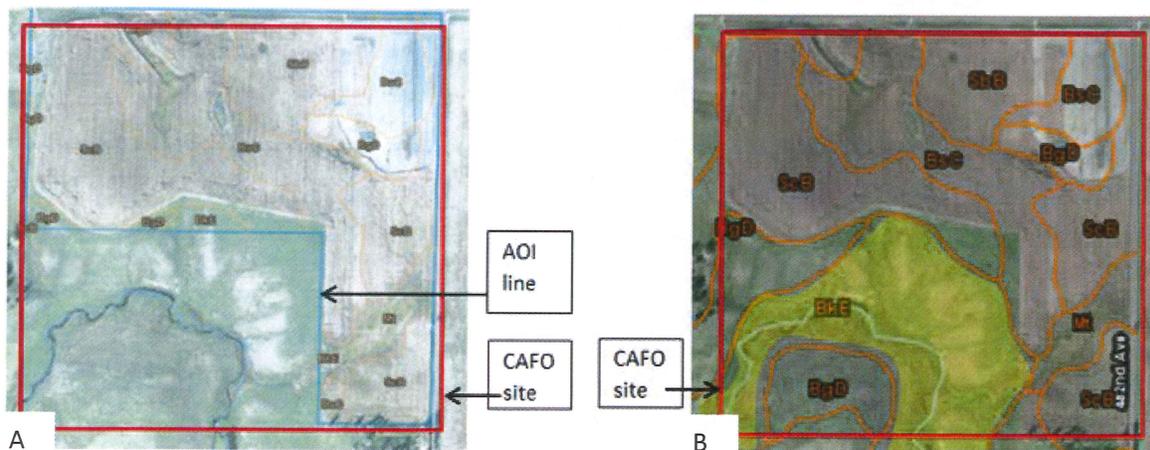


Figure 4. Soil maps of the CAFO site (outlined in red). A. Soil Map from applicant's CUP application, Appendix VI. Area of interest (blue line) is drawn around only the cultivated area, excluding the area where Storage Ponds 1 and 3 overlap to the west. B. Soil map using the full site as the Area of Interest. (<http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>) BkE soils are shaded in yellow.

The soil map provided by the applicant (Figure 4A) gives the misleading impression that the buildings and storage ponds will occupy only the cultivated portion of the site, and thus the soils outside the cultivated area are of no interest or relevance. However, when the building plans are overlain onto the full site Soil Map in Figure 5, it is clear that Storage Ponds 1 and 3 extend to the west of the cultivated area and into the steep slopes comprised of BkE soils. (Cf. Topography map, Figure 15, below).

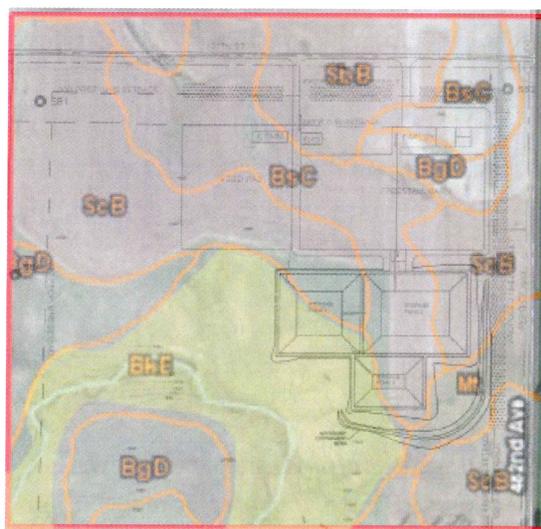


Figure 5. Building plan overlain onto full site soil map.

(The accuracy of our overlay is confirmed by examining the overlay in the applicant's Setback map (CUP application Appendix V), which also shows the storage ponds extending west of the cultivated area.)

The CAFO site also appears to be depicted inaccurately, i.e., not showing the full extent of the area occupied by the storage ponds, on the applicant's Flood Zone Map (Appendix VI), which appears to construe the site as only within the cultivated area of the section.

The soil types shown in Figures 4 and 5 include BgD and BkE soils. BgD is Buse-Barnes loam soil, with slope of 9 to 20%, and typical of moraines. BkE (Figure 4B, yellow shading) is Buse-Lamoure soil, channeled, with slopes ranging from 9 to 40%, and typical of moraines and floodplains (Web Soil Survey Map Unit Description <http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>).

The applicant submitted soil boring results from samples at the northeast, northwest, west, and southeast corners of the site (Figure 6). No soil boring was taken in the southwest area of the site, where Storage ponds 1 and 3 extend into the BkE region (Figure 5).

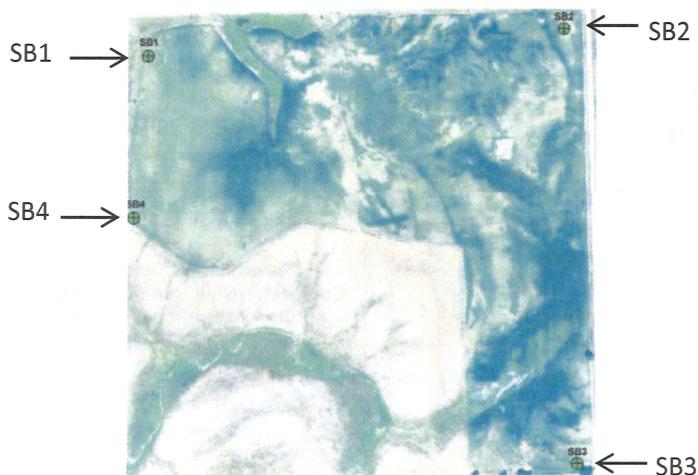


Figure 6. Soil boring (SB) sample locations, from CUP application Appendix VI.

A wet gravel layer was found in soil boring number 3 (SB3) at 11-14 feet. This was suggested (Friedrichsen letter) to be "a small deposit within the till and is not believed to represent an aquifer. Additionally, boring 3 is located well south of the proposed storage ponds." However, we suggest that it may, indeed, represent shallow aquifer materials, which may also be found in the southwest quadrant of the site. Considering the slopes and the presence of BkE soils immediately to the south and west of Storage Ponds 1 and 3, it is strange that a soil boring was not taken from this area. As BkE soils are typical of moraines, it is likely that such a sample may also contain water and gravel, indicating the presence of shallow aquifer materials.

The entire area immediately adjacent to and southwest of Storage Ponds 1 and 3 was ignored both in terms of determining what soil types were present, and taking soil borings. Even if, as the applicant contends, the site comprises only the structures and the ground on which they sit, the storage ponds extend past the applicant's Area of Interest zone and into the slopes and BKE soils to the west and southwest. A soil boring should have been taken in that area.

The stream flowing through the proposed site is known to be a Zone B aquifer protection area (Figure 7). The Brookings County Zoning Ordinance specifies that Class A, Class B, and Class C CAFOs are expressly prohibited in both Zone A and Zone B (**Brookings County Zoning Ordinance Article 16 Section 16.00-5**).

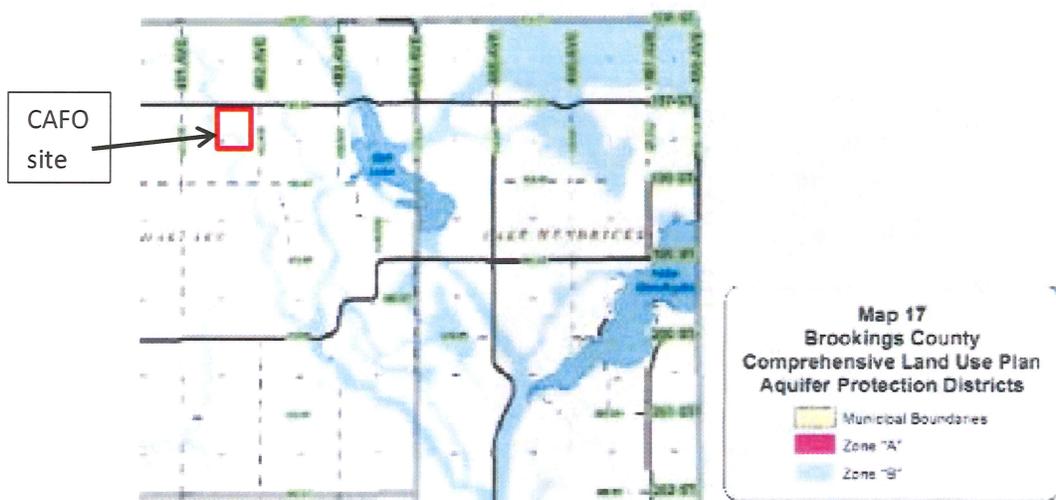


Figure 7. Northeast corner of Map 17 (p 39), Brookings County Comprehensive Land Use Plan Aquifer Protection Zones. The Deer Creek tributary within the site is blue, indicating a Zone B Aquifer Protection district.

The South Dakota Geological Survey map of the First Occurrence of Aquifer Materials in Brookings County ([http://www.sdgs.usd.edu/pubs/pdf/AM-19\\_20040803.pdf](http://www.sdgs.usd.edu/pubs/pdf/AM-19_20040803.pdf) accessed 11/24/16) shows the presence of shallow aquifer materials. We have zoomed in on the northeast corner (Figure 8) of this map. The Deer Creek tributary that flows through the site is clearly designated as a shallow aquifer zone having shallow aquifer materials (sand and gravel) within 50 feet of the surface.

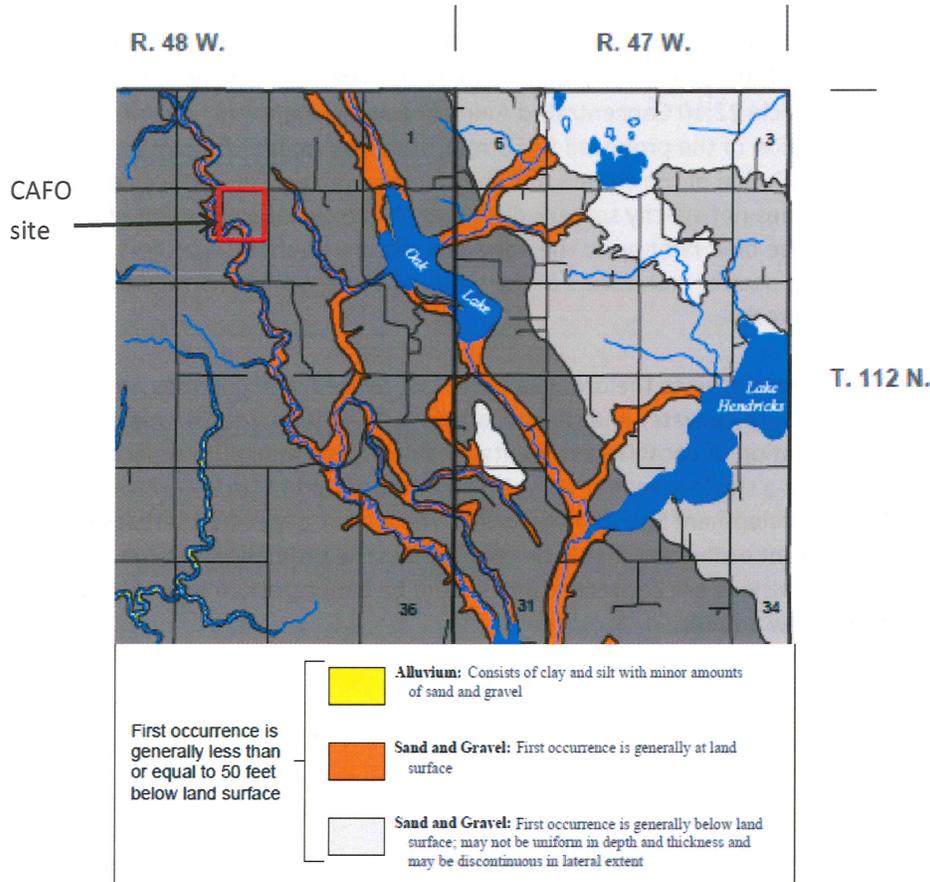


Figure 8. Zoom-in of northeast corner of SD Geological Survey Map of First Occurrence of Aquifer Materials. Streams and lakes are shown in blue, shallow aquifer materials (sand and gravel) within 50 feet of the surface shown in orange. CAFO site outlined in red. ([http://www.sdgs.usd.edu/pubs/pdf/AM-19\\_20040803.pdf](http://www.sdgs.usd.edu/pubs/pdf/AM-19_20040803.pdf) accessed 11/24/16).

The size and concentration of many CAFOs and the quantities of waste stored at such sites increase the potential for water pollution. In addition to seepage through the foundation soil, leakage occurs due to cracks, seams, structural faults, spills, etc., even when liners are required. The North Carolina State University Biological & Agricultural Engineering department, an advocate of industrial agriculture, notes that “All lagoons, storage ponds, or holding tanks leak to some extent” (NCSU FAQs About Livestock Production). The potential for significant damage to ground and surface waters, not only to adjacent properties but at considerable distance from the site, underlies the need for prohibitions and setbacks from shallow aquifers, and the importance of evaluating the potential environmental impact of each proposed site.

The Brookings County Zoning Ordinance states: **“In general, no Concentrated Animal Feeding Operation shall be constructed, located, or operated so as to create a significant contribution of pollution.”** (Article 22:10 Concentrated Animal Feeding Operation Control Requirements 1, p 83). The location of the proposed CAFO relative to the Aquifer Protection Zone B constitutes a significant risk of pollution of the stream and the shallow aquifer. The ordinance prohibits CAFOs on shallow aquifers, but does not specify setback distances. A narrow interpretation of the ordinance would allow CAFOs to be built right up to the edge of a shallow aquifer, regardless of the substantial risk of pollution to the aquifer and waters of the state. Allowing such construction would clearly be adverse to the public interest.

CAFO sizes have dramatically increased since the ordinance was last revised, and counties are prudently adopting setback distances from surface water and shallow aquifers. The SD County Site Analysis Plan developed by First District Association of Local Governments recommends a minimum separation distance of ½ mile from a CAFO to a shallow aquifer (First District Association of Local Governments. 2015. Brookings County Rural Development Site Analysis, p 20). The lack of a specified setback distance from shallow aquifers in the current ordinance should be corrected in the ordinance revision, which is currently in progress. Until the revisions are adopted, there should be a moratorium on new CAFOs within less than ¼ mile of a shallow aquifer.

2. The stream flowing through this site feeds into Lake Hendricks. A CAFO at this site would substantially increase the potential for water pollution affecting properties not only adjacent to the site, but along Deer Creek and around Lake Hendricks. The potential for damage to health, safety and property values is adverse to the public interest.

The Deer Creek tributary, which loops through the southwest quadrant of the site, flows into Deer Creek, which flows into the Deer Creek-Lake Hendricks watershed and the flood plain southwest of Lake Hendricks (Figure 9). The terrain from just northwest of the site and extending southeast past the tip of Lake Hendricks is hilly, with steep slopes, and intersected with multiple streams and tributaries. There are fewer cultivated fields in this region due to the steep terrain and the potential for erosion.

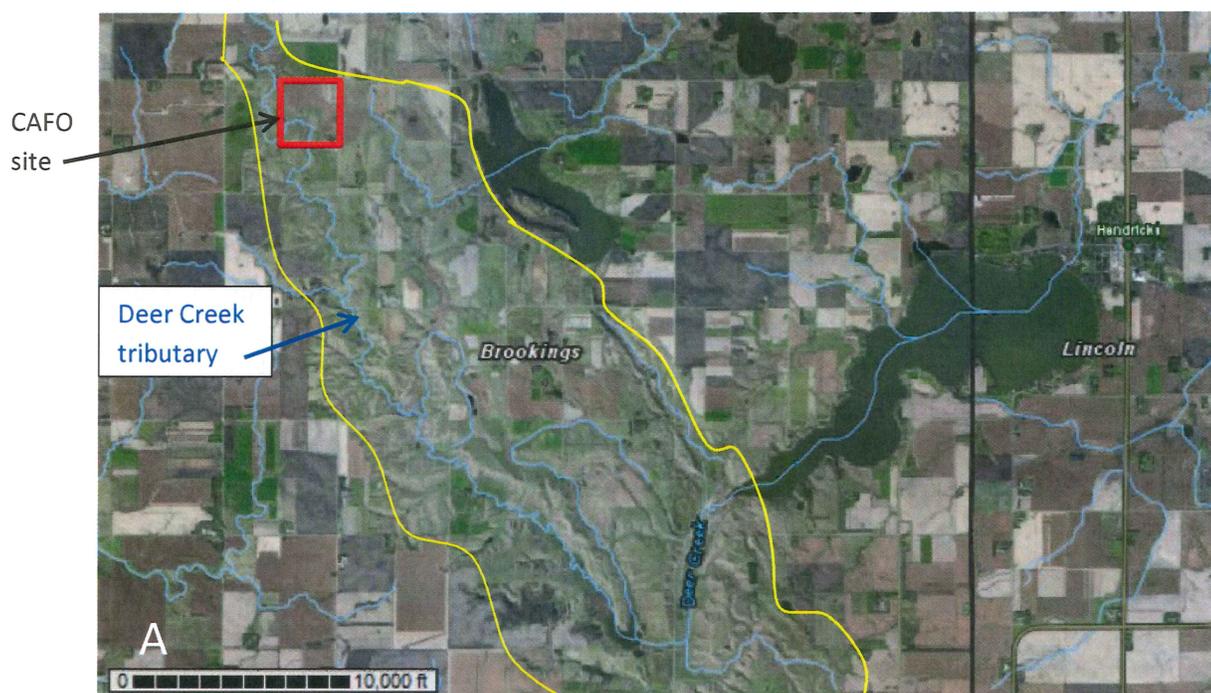


Figure 9. Streams and lakes of the area. Deer Creek and Oak Lake tributaries are shown in blue, draining into Lake Hendricks or Oak Lake. CAFO site outlined in red. Yellow lines approximate the perimeter of hills and steep slopes extending northwest to southeast. (Natural Resource Conservation Service/Web Soil Survey map <http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx> )

The site is within the Upper Deer Creek and Lake Hendricks watershed (<http://www.brookingscountysd.gov/AgendaCenter/ViewFile/Item/1467?fileID=2043>). Streams and tributaries on and around the site lead to the aquifer bordered by Oak Lake on the north, Lake Hendricks on the east, and Deer Creek on the south and west (Figure 8 and <http://www.brookingscountysd.gov/DocumentCenter/View/73>). Lake Hendricks township and the eastern half or more of Oak Lake township are part of the Lac Qui Parle sub-basin (hydrologic coded 0702003) of the Minnesota River basin (<http://mrbdc.mnsu.edu/lac-qui-parle-river-major-watershed> and

<http://www.brookingscountysd.gov/DocumentCenter/View/73>), and both townships have been so designated by the SD River Basin Natural Resource District Oversight Advisory Task Force <http://sdlegislature.gov/img/Maps/BasinMaps/Red%20Minnesota.png>.

Seventy to eighty percent of the ~25,000 acre Lake Hendricks watershed is in South Dakota (<http://www.pca.state.mn.us/index.php/water/water-types-and-programs/watersheds/lac-qui-parle-river.html>), with drainage into upper Deer Creek (Brookings Conservation District Report 2002; SDDENR Watershed Protection Program 1999), then into Lake Hendricks.

Pollutants from Deer Creek, including fecal coliform bacteria, have contributed to diminished water quality in Lake Hendricks. Thus, the concerns of citizens not only directly adjacent to the proposed facility but also in the specific watershed and hydrologic sub-basin must be considered. Much of the value of lake area property derives from the usability and quality of the lake. Allowing uses that increase the potential for pollution and environmental degradation will diminish property values.

The city of Hendricks, the Lake Hendricks Improvement Association, SDGFP, and other agencies have recently engaged in extensive and costly efforts to improve and maintain the water quality of Lake Hendricks and to restore the Deer Creek wetlands (Lake Hendricks Restoration Project 2009) through which these waters pass on their way into Lake Hendricks. This remarkable cooperative effort to secure the safety of Lake Hendricks waters and the Deer Creek-Lake Hendricks environment for residents and wildlife in the region was supported by both MN and SD agencies including MNDNR, Brookings Conservation district, EDWDD, NRCS, and national conservation groups Pheasants Forever and Ducks Unlimited, at a cost of over \$4,000,000 (C. Nygaard, LHIA Board, pers. comm). The proposed CAFO poses an unacceptable risk to these areas, threatening the work done to improve and protect Deer Creek and Lake Hendricks.

Even if the board agrees with the applicant that the facility includes only the actual buildings and storage ponds, and even if the prohibition against CAFOs in Zone B can be interpreted to mean only the physical placement of structures directly over the Zone B shallow aquifer, nevertheless, the proximity of the CAFO facility, its structures, operations and activities, to a Zone B stream and associated shallow aquifer significantly increases the risk for pollution of Deer Creek and Lake Hendricks, threatening the safety and well-being of citizens and communities downstream of the site. Such an increased risk calls for rejection of this CUP.

3. The stream running through the site has been designated as a Flood Zone A, and is known and documented as a flood-prone region, exacerbated by steep slopes. The presence of a CAFO in close proximity to this flood zone dramatically increases the potential for flooding, water pollution, property damage, and danger to the public downstream of the site, and is adverse to the public interest.

The stream flowing through the southwest quadrant of the site is designated as a floodplain zone, as indicated by the Oak Lake Township map (Figure 10), which also shows outwash deposits; and by Map 16 (p 38) of the Brookings County Comprehensive Plan of 2016 (<http://www.brookingscountysd.gov/DocumentCenter/View/1557>) and the FEMA map in the applicant’s Appendix VI.

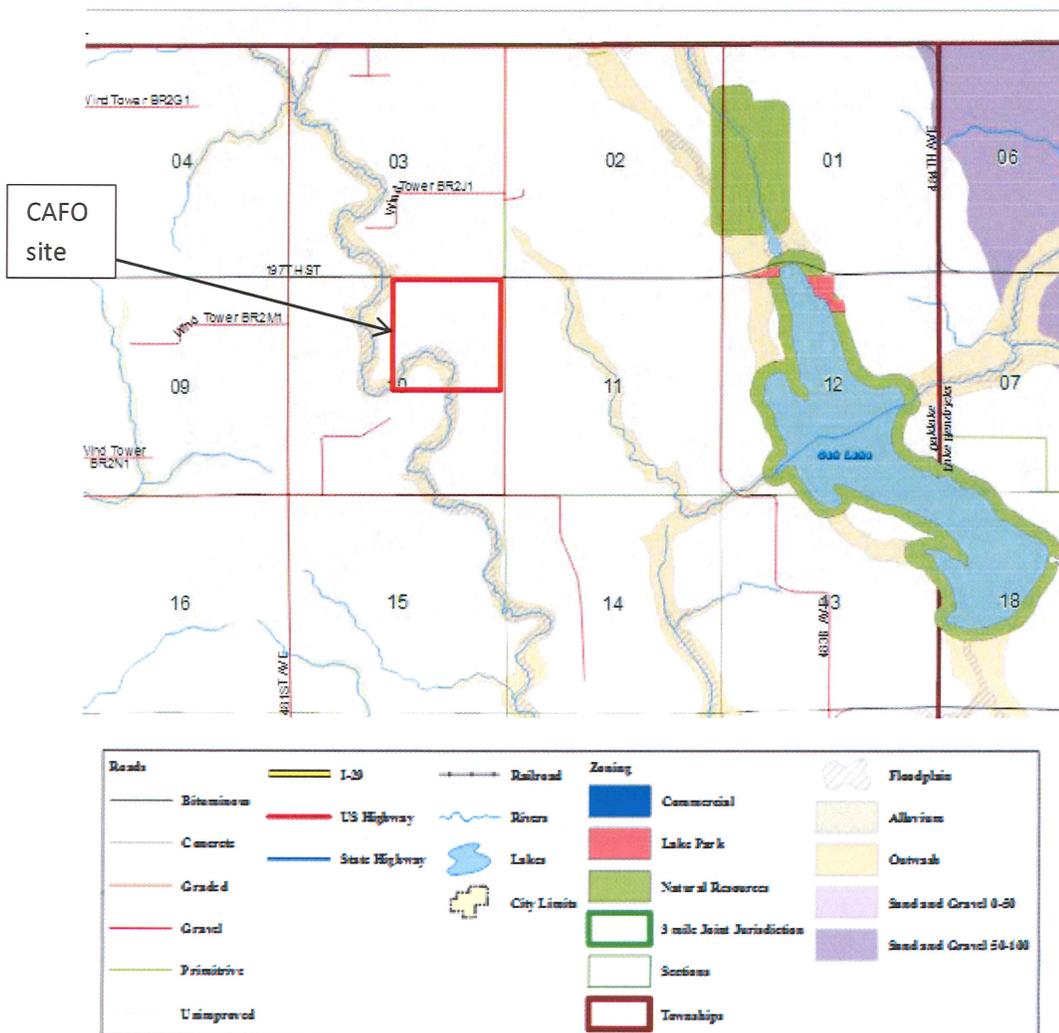


Figure 10. Oak Lake township map from the Brookings County website showing floodplain along the stream flowing through the site. Floodplain is indicated as hashed blue lines over beige outwash material. CAFO site outlined in red. <http://www.brookingscountysd.gov/DocumentCenter/View/95>

The stream that flows through the proposed site has been responsible for repeated flooding at the south end of the section (198th St) (Figures 12 and 13). This stream and others in the Deer Creek watershed district can convey pollutants and waste material into the Oak Lake-Deer Creek-Lake Hendricks basin, the Deer Creek-Lake Hendricks aquifer, Deer Creek, Lake Hendricks and the Lac qui Parle-Minnesota River basin.



Figure 12. Deer Creek tributary (blue arrow) on proposed site (outlined in yellow).

Site of flooding (orange arrow) in 2010. Brookings County, Beacon viewer.

<https://beacon.schneidercorp.com/Application.aspx?AppID=134&LayerID=1601&PageTypeID=1&PageID=914>

Flood events at levels that may qualify as 25-year events and result in overflow into surrounding surface and ground waters, which flow into Lake Hendricks, have occurred at least three times within the past 13 years: in 2001, 2005, and 2010 (Figure 13). In 2010, the stream leading from the proposed site flooded out the culverts at the south end of the section where the proposed CAFO is sited (Fig 13B).



Figure 13. A. Flooded stream at southern border of Section 10 in 2005. B. Flooding washed out culverts of stream immediately south of section 10 in 2010. C. Pollution on township road from overflow of feedlot  $\frac{1}{2}$  mile upstream in 2001. (Photos from N. Patrick, Oak Lake Twp)

Flooding has also occurred in Lake Hendricks due to increased inflow from Deer Creek, and resulted in extensive damage to infrastructure around the lake and in the city (Figure 14).



Figure 14. Flooding at Lake Hendricks in 2010.

The steep elevation differential between the CAFO site (at ~1950 ft) and the Oak Lake-Deer Creek-Lake Hendricks basin (1750-1800 ft) and consequent rapid flow of runoff and stream water prevents the settling out of pollutants and diminishes the capability of vegetation to filter out pollutants before entry into the lake and other surface waters.

The effects of excavation, storage pond filling, etc., during construction should also be considered due to the potential of these activities to increase flooding and contamination both on site and downstream.

In addition, a CAFO, by definition, is a facility “where crops, vegetation, forage growth, are not sustained over any portion of the lot or facility.” Vegetation reduces erosion, improves the ability of the ground to

retain water, slows the movement of water, and filters pollutants (Alldred and Baines 2016, Reddy et al 1999, Helmers et al 2008). The removal or degradation of vegetation associated with a CAFO increases the potential for flooding and for the entry of pollutants into waterways. This risk is exacerbated by the topography of this site.

The proximity of the buildings and manure storage ponds to a stream that is designated as a flood plain zone, and the potential for filling, grading, etc., during the construction of this facility to alter the floodplain and natural protective barriers, and the removal or degradation of vegetation resulting in greater risk of erosion and flooding, especially in the presence of the steep slopes of this site, all increase the risk of flooding and pose danger to health, safety, and property. These factors require the rejection of this CUP.

The Zoning Ordinance specifies that the county should act to reduce flood losses by “(1) Restricting or prohibiting uses which are dangerous to health, safety, and property due to water or erosion hazards; ... (3) Controlling the alteration of natural floodplains, stream channels, and natural protective barriers, which help accommodate or channel flood waters; (4) Controlling filling, grading, dredging, and other development which may increase flood damage;” (**Article 15:01.4, 15:2, p 45**)

The Brookings County Zoning Ordinance is currently undergoing revision. It would be prudent to adopt a 1,000-ft setback from flood zones for industrial operations including CAFOs, as advocated in the Minnesota Pollution Control Agency guidelines <https://www.pca.state.mn.us/sites/default/files/wq-f8-30.pdf> , and it would be advisable to impose a moratorium on new CUPs in these areas until the revisions have been adopted.

4. The topography of the site and surrounding area includes steep slopes, substantially increasing the risk of water pollution and flooding. The siting of a CAFO in such terrain is incompatible with other property in the area and adverse to the public interest.

This is a region of unusually steep topography (Figure 15), and water flow is fast. The site plan shows the storage ponds at ~1950' elevation. The southwest corners of Storage Ponds 1 and 3 are 300 to 400 ft from stream bed at 1880 ft. The drop off begins immediately adjacent to the southwest corners of these storage ponds, with a drop in elevation of ~70 ft over a horizontal distance of only 300-400 ft, i.e., a 17.5% to 23% slope.

Runoff rapidly moves into the streams of this watershed, which contributes to flooding, and also conveys pollutants, pathogens, bacteria, parasites, antibiotics, hormones, nutrients including nitrates and phosphorus, into Deer Creek and Lake Hendricks.

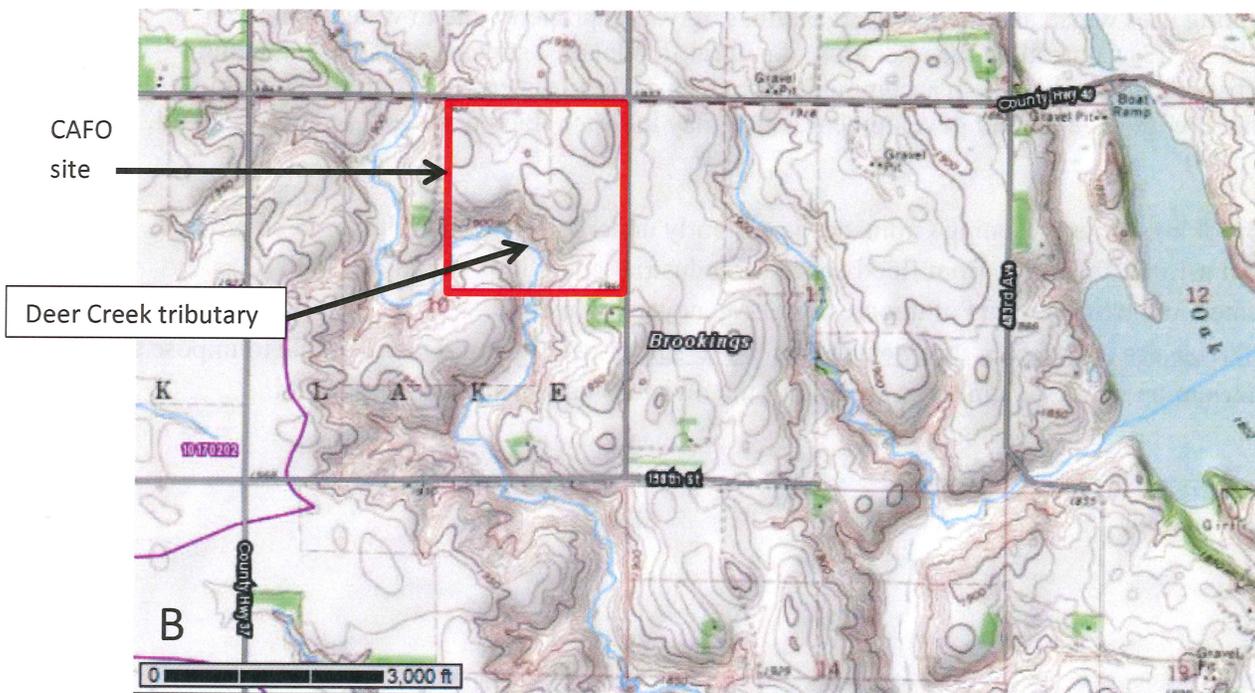


Figure 15. Topography of the site. Proposed CAFO site (outlined in red) and Deer Creek and Oak Lake tributaries (in blue). Note steep slopes (each line=10 ft change in elevation). (Natural Resource Conservation Service map)

One inch of rain on a 160 acre site equals over 4.3 million gallons; and 4 inches, the amount expected in a 25-year event, will be over 16 million gallons. Most of that will flow rapidly from the site into the stream in the southwest quadrant of the site, and into Deer Creek, carrying soil and pollutants. It should also be noted that the occurrence of 25-year events has become more frequent than 25 years in our region.

The topography of the site and the region, the steep slopes, pose an unacceptable increase in the risk of flooding and pollution of the waterways. This site is simply inappropriate for a CAFO, and the CUP should be denied.

The Planning and Zoning Board must consider each CUP application on a site specific basis, taking into consideration the topography of the proposed site. **“Each application for a new or expanded concentrated animal feeding operation (CAFO) will be reviewed by the County Zoning Commission on a site specific basis. The County Zoning Commission reserves the right to increase the minimum required setbacks and separation distance on a site specific review, based on one or more of the following considerations. ... B. Due to topography and prevailing wind direction, additional setback and separation distance is appropriate to safeguard air or water quality.”** (Brookings County Zoning Ordinance Article 22: 16, p 90)

In the case of this CUP application, the topography is such that the distance from the stream is insufficient to protect against the increased threat of pollution due to the steep slopes, increased water flow and speed, and high erosion potential. The CUP should be denied.

5. A well is located less than  $\frac{1}{4}$  mile from the proposed site (Figure 16). **Class A CAFOs cannot be located less than  $\frac{1}{2}$  mile from any well.** (Article 22:00-14, p 87)

A private well (Figure 16) is located approximately  $\frac{1}{4}$  mile from the proposed site. Waste materials and other pollutants may rapidly contaminate aquifers through wells. Placement of a CAFO within the minimum safe distance poses an unacceptable risk to public health.

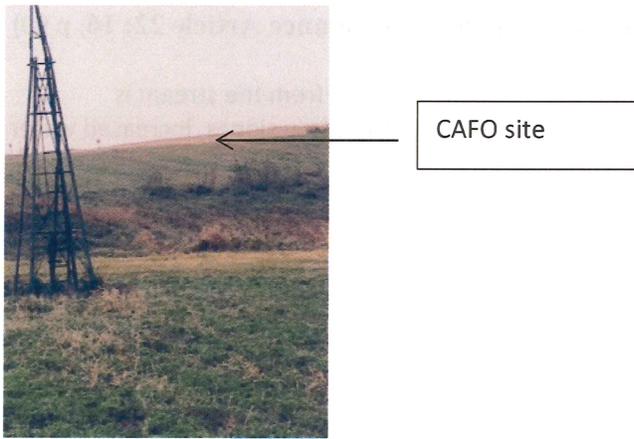


Figure 16. Well ca.  $\frac{1}{4}$  mile from proposed site. Photo taken October 27 2014 by B. Olson.

The minimum setback distance from a well for a Class A CAFO is 2,640 ft, according to the **Brookings County Zoning Ordinance, Article 22:00-14** (p 87 of the pdf).

6. There is significant potential for damage to the environment and wildlife of the area, via drainage into the Deer Creek basin and the aquifer bordering Oak Lake and Lake Hendricks, from nitrates, phosphorus, and other pollutants. The presence of a CAFO is incompatible with other property in the area and adverse to the public interest.

The Brookings County Comprehensive Land Use Plan 2016 states that **“It is the goal of Brookings County to preserve, protect, conserve, and enhance environmental resources including land, water, wetlands, lakes, rivers and streams, wildlife habitats, and recreational areas.”** Placing a CAFO in this location would undermine this goal.

Oak Lake, Deer Creek, Lake Hendricks and the surrounding area lie within the Prairie Coteau, part of the prairie pothole region. This is an important ecosystem, and breeding ground for over half the nation’s ducks (Johnson et al 2005). The Oak Lake field Station comprises approximately 570 acres of wetlands, tall grass prairie, pastures, and oak-dominated woods, and the spring-fed prairie pothole lake. The wetlands of Oak Lake and the Oak Lake-Lake Hendricks basin support over 144 species of birds (resident or transient), including ducks breeding in spring and summer and stopping for rest-over during migration. Species found at Oak Lake include the great blue heron, great egret, green heron, belted kingfisher, at least 7 species of raptor including osprey; American white pelican, Great horned owl, bald eagle (endangered), and many sparrows, warblers, etc.

The proposed CAFO site also contains wetlands (Figure 17).

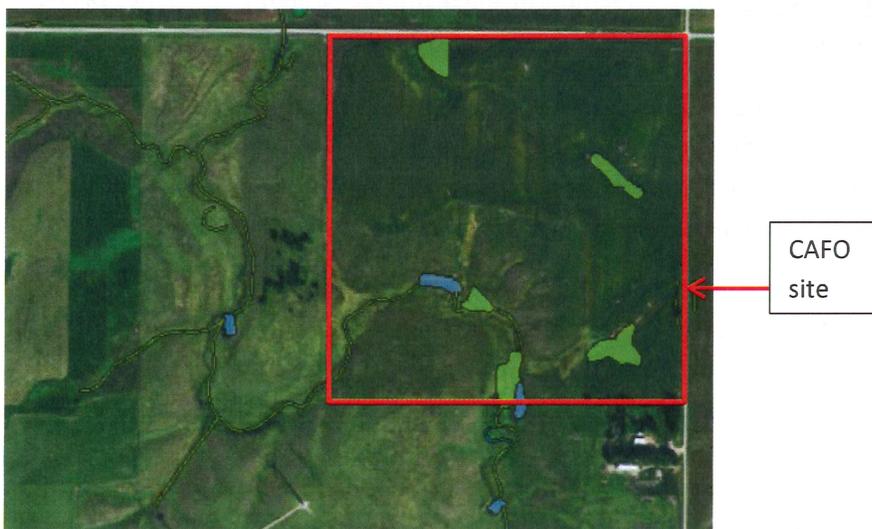


Figure 17. Wetlands (light green) on the CAFO site (outlined in red) and around the stream, from the Fish and Wildlife Service wetlands mapper <https://www.fws.gov/wetlands/Data/Mapper.html>

The Topeka shiner, a federally listed endangered species, is known to occur in Deer Creek and other streams in the area (SD GFP Topeka Shiner Management Plan; USDA NRCS 2010 <http://gfp.sd.gov/Wildlife/management/plans/docs/TopekaShinerManagementPlan-Revised.pdf>) (Figure 18). This fish has been collected by a landowner in a stream within ½ mile of the site, and is also likely to occur in other streams in fields on or near the site. The Topeka shiner is an indicator of stream health. In the late 1990s – early 2000s, Topeka shiner prevalence in SD appeared to be due to relatively fewer incursions and contamination of the prairie stream habitat. However, over the past decade, wetlands and prairie streams have substantially declined over its range. Consequently, there is a need to preserve the habitat of this and other species (Wall and Berry 2004). The SD DENR, in response to comments on the draft General Permit 09/02/2015, p 8-9 (comment 25) has said that if a CAFO will be within ¼ of a stream where the shiner is present, they must file an Endangered Species Action Plan; and the NDPEs permit will not allow impacts on endangered species.

The Oak Lake Field Station is also home to the rare Northern Red Belly snake (a monitored species in SD, protected in IA) (Cahoe and Troelstrup 2004), at the western limit of its range, and in one of the remaining pockets of habitat for this species.

The Dakota skipper and Poweshiek skipperling are native to the area and were recently listed as endangered species by the US Fish & Wildlife Service <http://www.fws.gov/midwest/Endangered/insects/dask/index.html>. Critical habitats for both the Dakota skipper and the Poweshiek skipperling have been designated as the area around the intersection of 483rd Ave and 198th St in Brookings County (<https://www.fws.gov/midwest/Endangered/insects/dask/fCHmaps/daskchSD.pdf> and <https://www.fws.gov/midwest/Endangered/insects/posk/fCHmaps/poskchSD.pdf>), i.e., between Oak Lake and the Deer Creek tributary that flows through the proposed CAFO site.

Another endemic species and candidate for listing is the Regal fritillary. Critical nectar sources for this species include violet, milkweed, coneflower and bergamot, which occur at the Oak Lake field station. The endangered American burying beetle, last documented here in the 1940s, is a potential inhabitant of the Oak Lake area (P. Johnson, SDSU, pers comm).

Amphibians, critical to the food chain, are declining in number and range due to habitat loss, pollution, etc., in SD and elsewhere (Naugle et al 2005). The Oak Lake-Lake Hendricks area is home to a number of important frog species (northern leopard frog, tree frogs, etc.). The use of pesticides for fly control can also affect other invertebrates in and around nearby fields and surface waters including Oak Lake, by drift and drainage, with subsequent effects on insectivorous animals including many birds, amphibians, reptiles, and mammals. The potential for environmental damage to this region will be significantly increased by the presence of a CAFO.

Both Lake Hendricks and Oak Lake include public lands and public access and recreational areas. Residents in the area as well as many individuals who live outside Oak Lake Township or Lake Hendricks use these waters for fishing, boating, swimming, wildlife observation, etc. A CAFO is inappropriate in such an area.

7. The siting of a CAFO in this location poses an increased risk to the public safety and to the environment, due to the potential for improper storage, handling, and application of manure.

Vast quantities of manure will be generated by this CAFO. Some will be applied on the remaining cultivated ground at the site (Field 1 of the applicant's NMP Spreadsheet B1, Appendix II). Most will be transported and applied to fields off site. Thus, the effects of the CAFO extend beyond the buildings and storage ponds, beyond the site, and beyond the section. In fact, the impacts of a CAFO extend not only to the land on which manure is applied, but to the streams, rivers, and lakes into which the waste material may flow.

Manure that is applied to fields can enter the water supply and tributaries through runoff or seepage, carrying waste material, nutrients, bacteria, parasites, pathogens, etc. into surface and ground water (Weida 2000), and this is exacerbated by steep slopes and hilly terrain.

The following account is typical of manure applications in the Oak Lake-Lake Hendricks area:

"The application is being done on a field that varies from a 2 to 5% grade, meaning the elevation changes 2 to 5 feet within a 100 foot distance of travel, which is not uncommon in our area, and can easily be higher. Each knife on the applicator creates a trench from one end of the field to the other, every 3 feet, a miniature waterway if you will, 8 to 12 inches deep and probably 3 inches wide. Let's say they are only filling the bottom of the trench with 4 inches of manure. Each trench would contain 1 gallon of manure every 19.4 inches. Every acre will contain 1202 lineal feet of trench. That equates to 750 gallons of manure applied per acre. Simply double this figure for every additional 4 inches of application depth in the trench. A typical 8 inch dragline will flow 400 to 600 gallons per minute. Enter the force of gravity. If too much liquid is injected in the trench, it simply runs downhill through each trench, every 3 feet, creating pools where the ground levels out, which most commonly in a field is a wetland area, tile inlet, drainage ditch, or a road ditch. Granted, some does get retained by the soil, but it can only handle a certain point of saturation. Now comes the point when the field is finished. Typically, the dragline pipe is fed with up to a 12 inch pipe leading from the lagoon site to the field, running down ditches, through culverts, and across fields. The pipe feeding the applicator is typically 6 inches to reduce weight, being fed from a pumping station located near the field. The pipeline needs to be unhooked from the applicator and most likely from a pumping station located where the pipeline enters the field. The pipeline is not flushed with water and injected before it is unhooked. Manure in the pipeline has to be discharged so it can be rolled up and transported. This discharge ends everywhere from the field to ditches and culverts. The pipeline normally will run several miles. An 8 inch pipe contains 1 gallon every 4.6 inches of pipe, which equates to 13,774 gallons per mile. A 12 inch pipe contains a gallon every 2.04 inches, which equates to 31,059 gallons per mile. I am sure that pressure is reduced in the pipeline before it is opened, but running through hills and valleys, the total volume in the pipeline might be reduced to half, but it still ends up in a pool or runs where it is unhooked and rolled up. One can only imagine the concentration of the manure at that point which is seen in the pictures. From there, with either rainfall or snowmelt, it gets washed downstream into our streams and lakes."

Consequences of excessive manure application and/or field slope are demonstrated in Figure 18.



Figure 18. Photographs of manure overflow following field application taken 10/29/14, 3-4 days after manure application onto fields at the intersection of HWY 30 and HWY 77. Photos by Joe Beech October 30 2014, via C Nygaard email 11/01/14)

The quality of streams and lakes in SD is declining. The SD DENR 2016 Surface Water Quality Report <http://denr.sd.gov/documents/16irdraft.pdf> found that only about 20% of all lakes and streams now support all beneficial uses. Stream impairments are primarily due to bacteria and suspended solids from erosion; lake impairments to excess nutrients, which enhance algal growth, and siltation. The DENR found that these impairments are primarily due to agricultural nonpoint source pollution.

DENR regulates manure applications because over application or improper transport and storage can lead to pollution of surface and ground water. However, tiling and drainage fall under the purview of counties, and DENR pays little attention to manure application in relation to these. Nor does DENR regulate CAFOs with regard to bacterial pollution. DENR leaves these issues to the counties and townships to regulate (2015 General Permit revisions, response to public comments, p 1). DENR also accepts field application rates that exceed crop needs for phosphorus, basing application rates on crop nitrogen needs. However, the phosphorus content of manure typically exceeds crop requirements, resulting in phosphorus build-up in lakes and streams, with concomitant algal blooms, anoxia, and death of fish and other wildlife (<http://denr.sd.gov/documents/16irdraft.pdf>).

Therefore, in considering additional CAFOs, counties must not rely solely on DENR to fully evaluate all potential impacts of a given CAFO on water quality and public safety; nor the cumulative effect of increasing numbers of CAFOs on the water quality and environment of a region.

From October 2009 to November 2016, DENR cited 39 CAFOs for violations of the General water pollution control permit (SD DENR 2016 CAFO Summary of Enforcement Actions). In many cases, there were multiple violations of various regulations. The most frequent types of violations included failure to properly maintain manure containment (including exceeding storage pond capacity) (14 infractions); improper discharges from manure containment or application systems (10 infractions); and improper field applications (including applying to non-approved fields, not conducting soil tests, applying at

improper rates or improper locations) (25 infractions). (Some infractions represent multiple incidents.) Among the facilities cited was Global Dairy (9/30/14), owned by Michael Crinion (<http://global-dairy.estimateonline.com/estimates/13272638-global-dairy>), for “Discharging pollutants from a manure application field by not complying with land application best management practices. Land applying manure or process wastewater on a field not in an operation’s approved nutrient management plan. Placing a used sand bedding stockpile outside the manure containment system.”

The risk of water pollution and the associated hazards to public health and environmental degradation, especially in this particular location, call for a rejection of this CUP.

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December 4, 2016

Mr. Michael Crinion  
Global Dairy LP  
46844 SD Hwy 28  
Estelline, SD 57234

Dear Mr. Crinion,

The purpose of this letter is to express support of South Dakota Dairy Producers for your efforts to grow the regional dairy industry. As you are well aware, the economic benefits of value-added processes which produce grains and forage for feed, and the eventual conversion of that feed to higher value products such as milk or cheese, produce a tremendous economic benefit for our region.

Industries, such as the dairy industry, result in high levels of capital investment, create quality employment opportunities for our graduates and residents, and support a myriad of related production and service businesses, many of which also require highly skilled employees. Brookings County, SDSU and the State of South Dakota have most certainly been benefactors of the positive impact of this industry for many years.

South Dakota dairy farmers clearly recognize the importance of additional dairy farms located along the eastern 1/3 of South Dakota that would attract additional processing thus providing greater competition for milk demand. SDDP has been very supportive of the county's efforts to carefully study and evaluate those locations within the county that are deemed appropriate for the development and expansion of feeding operations. We understand that your dairy proposal had been evaluated within the context of this prior research, approved for development, and then delayed due to some historical technicalities.

We support your efforts and Brookings County's efforts, to continue to grow this important industry in our region and encourage the Brookings County Planning Commission and Board of Commissioners to carefully examine your request and take action that will allow for continued sustainable economic growth of Brookings County's agricultural economy.

Sincerely,

A handwritten signature in black ink, appearing to read "Marv Post", is written over a white background.

Marv Post  
President- South Dakota Dairy Producers



December 5, 2016

Mr. Michael Crinion  
Global Dairy LP  
46844 SD Hwy 28  
Estiline, SD 57234

Dear Mr. Crinion,

This letter is to express support of the Brookings Area Chamber of Commerce for your efforts to continue to develop the dairy industry in our region. Eastern South Dakota benefits greatly from the dairy industry not only economically but also in quality of life. The Brookings area takes pride in the dairy industry and takes pride in the workforce and jobs that it creates benefiting the economic engine that fosters growth and prosperity throughout the region.

The dairy industry has created numerous quality jobs for individuals and families throughout the years. Industry moving into the Brookings area that are dependent on dairy production have proved well for the industry and have added an economic impact that has been positive for Brookings County and our region.

Your dairy proposal has been carefully evaluated by the Brookings County officials and has been deemed appropriate for the development and expansion of a new feed operation. Although there has been a delay in the process, our County officials understand and support the importance of agricultural producers and their impact to the economy and community.

We support your proposal to develop and expand a new operation within Brookings County. We ask that the Brookings County Planning Commission and Board of Commissioners examine your request and take action that will continue to grow an industry that provides a strong economic engine as well as quality employment for Brookings County.

Sincerely,

A handwritten signature in black ink, appearing to read "D. Merhib".

David Merhib  
Executive Director  
Brookings Area Chamber of Commerce

**From:** [estoil@itctel.com](mailto:estoil@itctel.com) [<mailto:estoil@itctel.com>]

**Sent:** Monday, December 05, 2016 1:34 PM

**To:** county development <[countydevelopment@brookingscountysd.gov](mailto:countydevelopment@brookingscountysd.gov)>

**Subject:** Global Dairy

To Whom It May Concern,

Global Dairy has proven itself to be very beneficial to the city of Estelline. Global supports the schools, small businesses, clubs, and local fundraisers. Global sets the standard for dairies in the United States. One drive past the Global Dairy and anyone can see the strides and effort they have put into making their facilities top notch. Global takes pride in their operation and Mike would welcome anyone who would like a tour. They truly set the bar for dairy production and we look forward to seeing our relationship with Global continue to grow.

Best Regards,

Estelline Community Oil



December 5, 2016

Brookings County Zoning Board  
520 Third St.  
Suite 210  
Brookings, SD 57006

To whom it may concern:

I have been made aware that Michael Crinion has applied for a CAFO permit in Brookings County. I write today in support of Mr. Crinion's application. I have personally known Mr. Crinion for nearly 10 years and, in that time, he has proven to be a very competent builder and operator of commercial dairy farms. I believe that Mr. Crinion implements all available best-practices into the design and engineering of his projects and takes to heart his responsibility to his neighbors and the environment. I believe that Mr. Crinion carefully studies the potential dairy locations available to him and uses an extensive list of criteria when selecting the most appropriate and feasible sites on which to build.

Our cheese factory in Milbank has enjoyed a long relationship with Mr. Crinion on a variety of projects. We value his dedication to the growth and prosperity of the South Dakota dairy industry. Dairy plays a significant role in the health and vitality of Northeastern South Dakota's economy. I ask and urge you to give this proposal every courtesy and consideration and take the appropriate actions to ensure that Brookings County's agriculture industry keeps moving forward.

Sincerely,

  
Jason Mischel

**AFFIDAVIT OF DAN SNODGRESS**

Dan Snodgress, being first duly sworn upon oath, testifies as follows:

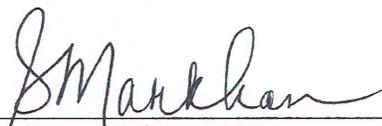
1. My parents, Darrell Snodgress and Ila Vivian Snodgress, owned land near the proposed site of Killeskillen's concentrated animal feeding operation ("CAFO"). On this parcel of land that my parents owned ("the Snodgress land") is a well. The well is less than 2,640 feet from the proposed site of Killeskillen's CAFO.
2. My father, Darrell Snodgress, passed away on August 7, 2016. While my mother, Ila Vivian Snodgress, owns the Snodgress land, I am authorized to act as her agent under her Power of Attorney.
3. On behalf of myself and my mother, I am opposed to Killeskillen being granted a variance or conditional use permit related to its proposed CAFO.
4. My family has previously discussed how it intends to use the Snodgress land. Presently, we rent the land to Dwayne Jurens who farms the land. While we intend to continue renting the land for Mr. Jurens to farm it, my family and I plan to construct a cabin on the Snodgress land for our friends and family to use for hunting on the Snodgress land and other land in the area. We would like to provide potable water to the cabin using the well that is on the Snodgress land.
5. I am very concerned about the water in the well becoming polluted by runoff or other contaminants from Killeskillen's proposed CAFO. I oppose Brookings County granting a variance to Killeskillen that would allow Killeskillen to locate its CAFO closer to our family's well than is allowed by the ordinances. I also oppose Brookings County granting a conditional use permit to Killeskillen to operate its CAFO at the proposed site.
6. Mitchell Peterson is authorized to present my concerns as reflected in this affidavit to Brookings County.

Dated this 5th day of December, 2016.

  
\_\_\_\_\_  
Dan Snodgress

Subscribed and sworn to before me this 5th day of December, 2016.



  
\_\_\_\_\_  
Notary Public, Alaska  
My commission expires: 10/01/20

December 5, 2016

To those on the Brookings County Planning and Zoning Commission-

I'm writing a letter to show my support of both the variance application and application for conditional use to build a Class A Concentrated Animal Feeding Operation that Michael Crinion has submitted on behalf of Killeskillen LLC to the Brookings County Planning and Zoning Commission. I am trained in animal husbandry and management, and I have a Ph.D. in Dairy Science from the University of Wisconsin-Madison. I moved to South Dakota in April 2014 for the primary reason of working in the dairy industry, which was healthy, growing and sustainable. I was proud to move to South Dakota because I felt the state embraced production agriculture in a positive manner. Brookings County has had tremendous economic development, and a good deal of the boost to the economy has been because of the dairy industry.

Regarding the variance application, it is obvious to me that the well is an old abandoned well that is not in use, and likely hasn't been used in quite a while. Under these circumstances, I'm in favor of granting the requested variance of 1240 feet from the distance stated in the Brookings County Zoning Ordinance. In addition, this abandoned well should be filled in with cement (or fill) and capped off, so that a young child doesn't fall into it by accident.

I am also in support of the application for a conditional use to build a Class A Concentrated Animal Feeding Operation for 5500 animal units of dairy cattle. Those at the state level have said that the state needs more dairy cows and that added dairy cows will continue to boost the local economies in South Dakota. Economic analyses conducted in Minnesota and Wisconsin have shown that each cow contributes over \$10,000 to the local economy each year (Minnesota was \$11,761 and Wisconsin was \$13,737). Many people in the community benefit from this economic impact from the farm to the table. South Dakota is an ideal location because of the presence of feed (corn, soybeans, alfalfa and ethanol co-products), the weather conditions, the local expertise of those in area, and the available capacity at the processing cooperatives.

There may be some nay-sayers that will use the "Not in my backyard!" argument. If everyone succeeded in stopping various projects, it would negatively impact our county, state and country economically, socially and environmentally. I encourage you to look beyond this argument and do what's best for those in Brookings county.

Sincerely,  
*Robin R. Rastani*

Robin R. Rastani, Ph.D., Dipl. ACAN  
Dairy Cow Nutritionist



2301 Research Park Way  
Brookings, SD 57006  
605-610-1026

December 5<sup>th</sup>, 2016

Mr. Michael Crinion  
Global Dairy, LP  
46844 SD Hwy 28  
Estelline, SD 57234

Dear Mr. Crinion,

I am writing this letter to express support for your efforts to expand the dairy industry in our region. Here at Novita Nutrition, LLC, we understand the economic benefits you and your establishment bring to our community at the local, state and national levels.

Growth provides our friends and neighbors with job opportunities. It also puts money back into our state and communities through heightened use of local markets and payment of taxes. Your industry also serves a broader purpose in reaching beyond our state's borders to provide a healthy food source at an affordable cost.

It is our hope that the Brookings County Planning Commission and Board of Commissioners will support your efforts to continue and grow in our region.

Sincerely,

A handwritten signature in blue ink that reads "Donald L. Endres".

Donald L. Endres