



DAKOTA ENVIRONMENTAL, INC.

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

February 16, 2016

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

Re: Animal Waste Management System
Norfeld Colony, Brookings County, SD
DEC Project No. 23034

Dear Mr. Hill:

Please find included with this letter thirteen copies of information regarding a proposed expansion of the above referenced facility. These materials are provided in conjunction with the conditional use application for expansion of the existing confined animal feeding operation. The appendices following this letter are intended to address the information requirements of section 8, page 22.00-19 of the Brookings County Zoning Ordinance, and are titled accordingly to the items listed on that page.

Appendix B includes the site plan for the proposed facility, as well as additional drawings showing details of the proposed construction. The proposed facility will consist of a swine farrowing through nursery operation, in which sows are bred and farrowed, and the weaned piglets are fed to around 50 pounds before being sold and shipped from the site. All swine would be housed in one barn, which would utilize shallow concrete pits below slatted floors. Sewers beneath the pits floors would allow the pits to be drained periodically. An earthen storage pond would provide storage of manure and wastewater.

Appendix C 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 structure. The proposed population would consist of 252 farrowing sows (with litters), 998 gestating sows, 200 gilts being raised as replacement stock, and 5,600 nursery pigs. This equates to a total of 1,275 animal units as defined by the Ordinance. The calculated volume includes manure, as well as a significant allowance for additional water, such as spilled drinking water, and water used in washing the barns and pits. All waste at the facility will be handled as a liquid.

The storage volume available in the pond design exceeds 365 days of manure and wastewater production for the proposed population. Additional volume is also provided in the pond for residual volume, stormwater events, annual precipitation on the pond, and freeboard of two feet. The 100 year/24 hour storm volume was used in sizing of the storage pond.

Appendix D consists of a portion of the current Nutrient Management Plan for the facility, which has been modified to include the proposed swine population. The SD-CPA-7 spreadsheet

contains details of the existing and proposed populations, storage and application methods, and the land available for application. The spreadsheet indicates adequate land has been secured to apply manure from the facility in accordance with General Permit requirements. The existing facility currently operates under an approved Nutrient Management Plan as part of the existing DENR General Permit coverage. Copies of manure land application agreements allowing manure from the facility to be applied to nearby fields are included in the Plan currently on file at DENR, as well as individual field maps, soils tests, annual records, etc.

Appendix E contains the Operation and Maintenance Manual for the proposed facility, which details the operational, upkeep, and inspection requirements for the facility, as well as best management practices for operation. The existing turkey confinement operates under a similar document which has been reviewed and approved by DENR.

Appendix F 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. A mature shelterbelt is in place to the north and northwest of the proposed site, with adequate space available for additional plantings.

Appendix G contains a map showing the required setback of 2,640 feet from all nearby occupied residences not owned by the applicant. The perimeter of the potential area of development is not crossed by these setbacks. A search of available databases indicated wells to be present in the immediate area of the residences shown, thus the setbacks are labeled accordingly. It is believed all other setbacks are met, as we are unaware of any listed features being present within the prescribed distances. The required setbacks from 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.

It should be noted that the setbacks for the facility are shown for Class A operation due to the presence of the existing turkey confinement, which consists of 80,000 turkeys, or 1,440 animal units. This equates to a total of 2,715 animal units at the site.

Items H and I on the Ordinance concern the requirement for DENR General Permit review and approval for the proposed facility. The existing turkey confinement on site was subject to this process before construction and currently operates under the DENR General Permit in good standing. The proposed facility will be submitted to and reviewed by DENR if approval to proceed is obtained from Brookings County.

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

The site map indicates the location of the soil borings performed at the site, for which the boring logs and laboratory soils testing data from samples obtained in the borings are included. The findings of these borings indicate the soils to consist of weathered till consisting predominately of brown to olive sandy clay. Boring #1, which was located at a lower elevation than the remaining borings, encountered unweathered till at a depth of 22 feet, though the remaining borings showed indications that unweathered till was not far below the termination of the borings.

No large masses of granular soils of the types associated with aquifers were encountered, confirming the studies and maps referenced below. Water was encountered only in boring #1, at an elevation well removed from the proposed pond. The water encountered in this boring is

believed to be associated with surficial alluvium in the nearby drainage, from which the proposed pond is well removed.

Laboratory testing from samples from the borings indicates the physical properties of the soils across the site to be consistent, as well as in accordance with DENR requirements for earthen containments. Results from this testing are included. It should be noted that the soils encountered are similar to those previously encountered during design and permitting of existing waste storage facilities, such as the domestic wastewater treatment lagoon.

The origin of the area 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 mapped by studies and local well logs as up to 500 feet thick above the bedrock, which is the impermeable Pierre shale.

The publication titled "Water Resources of Brookings and Kingsbury Counties, South Dakota" (US Geological Survey, 1989) was consulted regarding shallow aquifers in the area. According to the study, the site is not located over the Big Sioux aquifer, which is nearest the land surface in this area. The study indicates the site to be located over the Rutland and Altamont aquifers, and possibly a poorly defined extension of the Howard aquifer, but none of these aquifers are encountered until at least 270 feet beneath the land surface. This corresponds with the included 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.

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).

Item K has been performed by the applicant. It is their intent to utilize the rural water system to supply the proposed facility.

We hope you will find the included information helpful as you evaluate this application. Based on our 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 B

SITE PLAN / PLANS AND SPECIFICATIONS

NORFELD COLONY AWMS SWINE CONFINEMENT ANIMAL WASTE MANAGEMENT SYSTEM ISSUED 2/10/16

PRODUCER: NORFELD COLONY
 ADDRESS: 20426 482nd AVENUE
 WHITE, SD 57276
 PHONE: (605) 629-6978
 SITE LOCATION: SW 1/4 of Section 14, T111N R48W
 COUNTY: BROOKINGS

SHEET INDEX	
DWG. NO.	DESCRIPTION
1	TITLE PAGE
2	AREA/VICINITY MAP
3	SITE PLAN
4	BUILDING PIT PLAN
5	PIT SECTIONS
6	POND PLAN
7	POND SECTIONS
8	DETAILS
9	GENERAL NOTES & SPECIFICATIONS
10	CONCRETE NOTES

LEGEND

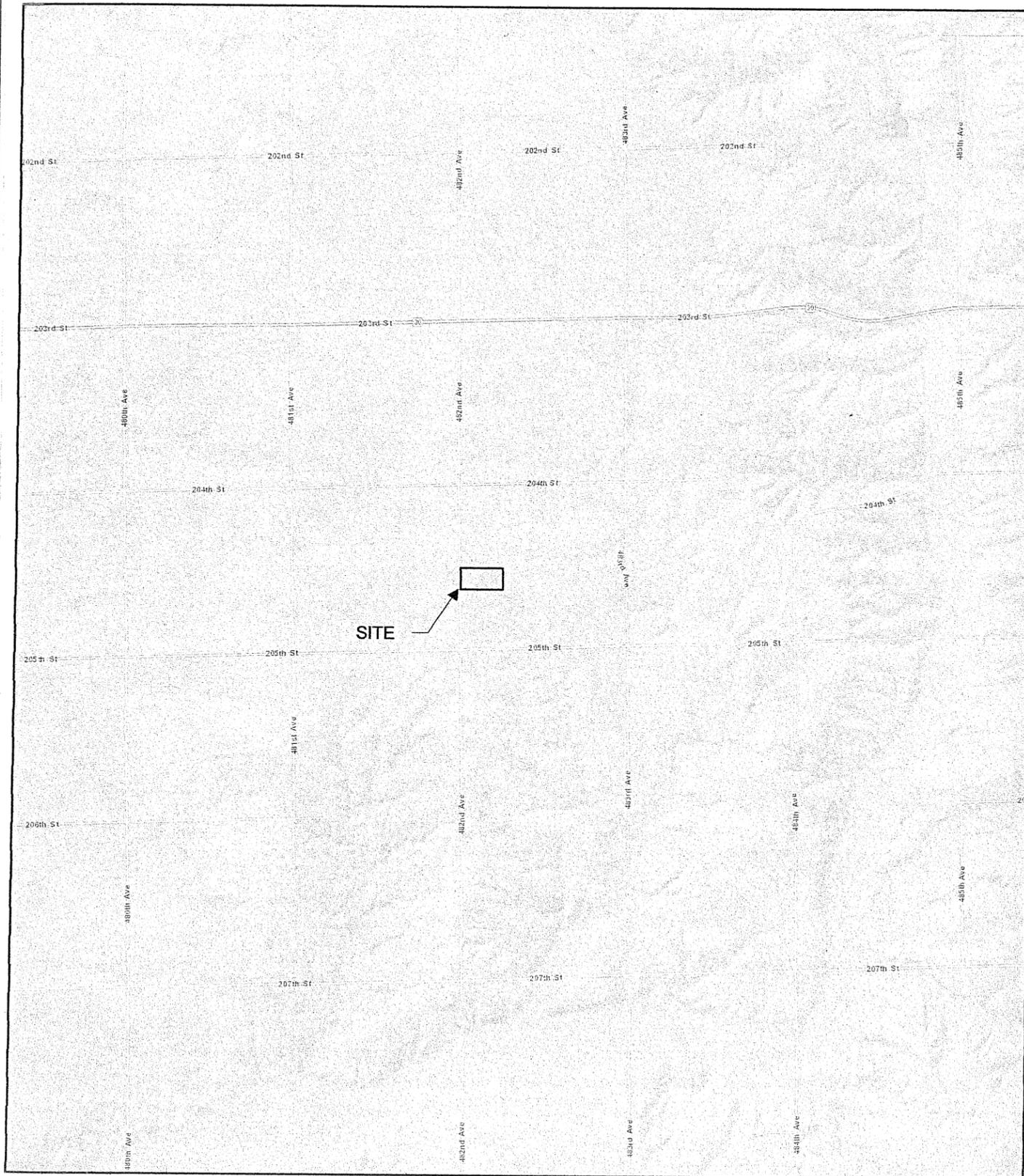
<ul style="list-style-type: none"> CONCRETE ROCK SELECT GRANULAR FILL EXISTING EARTH COMPACTED FILL TOPSOIL WETLAND CLEANOUT DEPTH MARKER LOCATION SPLASH PAD RESIDENCE 	<ul style="list-style-type: none"> CULVERT MW MONITORING WELL POWER POLE PROPERTY LINE DRAINAGE SWALE EXISTING CONTOUR LINE PROPOSED CONTOUR LINE BM BENCHMARK OR CONTROL POINT X 1270.00 NEW SPOT ELEVATION SBx SOIL BORING ELEVATION FENCE 	<ul style="list-style-type: none"> SECTION NO. SECTION TAKEN FROM DRAWING NO. SECTION LOCATED ON DRAWING NO.
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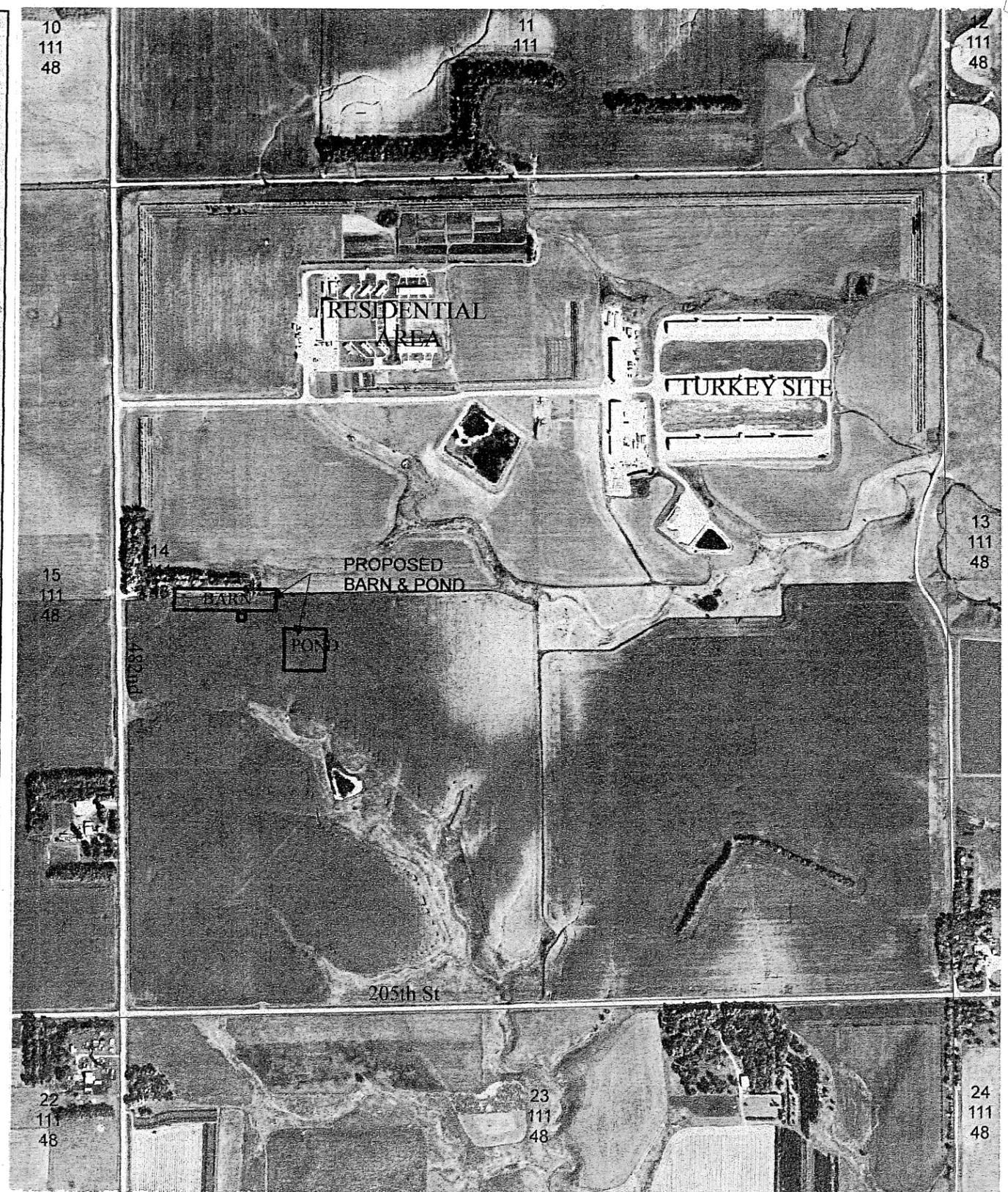
Brian H. Friedrichsen, P.E.

I hereby certify that these plans were prepared by me, or prepared under my direct supervision; and that I am a duly Registered Professional Engineer under the Laws of the State of South Dakota.

REV. DATE	DESCRIPTION	BY	CHKD		
DATE: 2/10/16	DRAWN: TB	CHECKED: BF			
TITLE PAGE			NORFELD COLONY AWMS		
DAKOTA ENVIRONMENTAL CONSULTANTS INCORPORATED					
P.O. BOX 636 HURON, SD 57350 605-352-5610					
JOB NO:					
23034					
SCALE:					
NTS					
DWG:					
1					

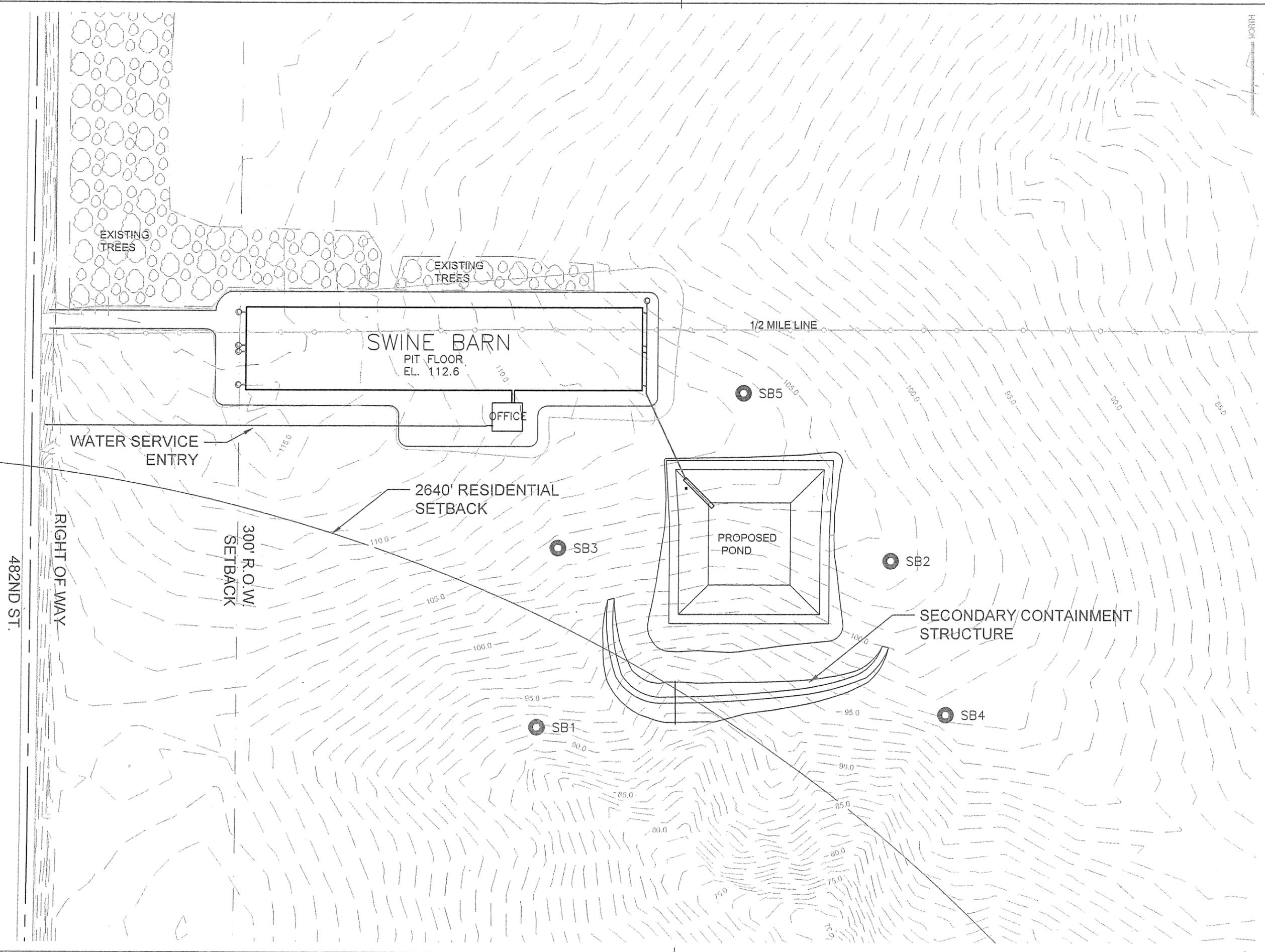


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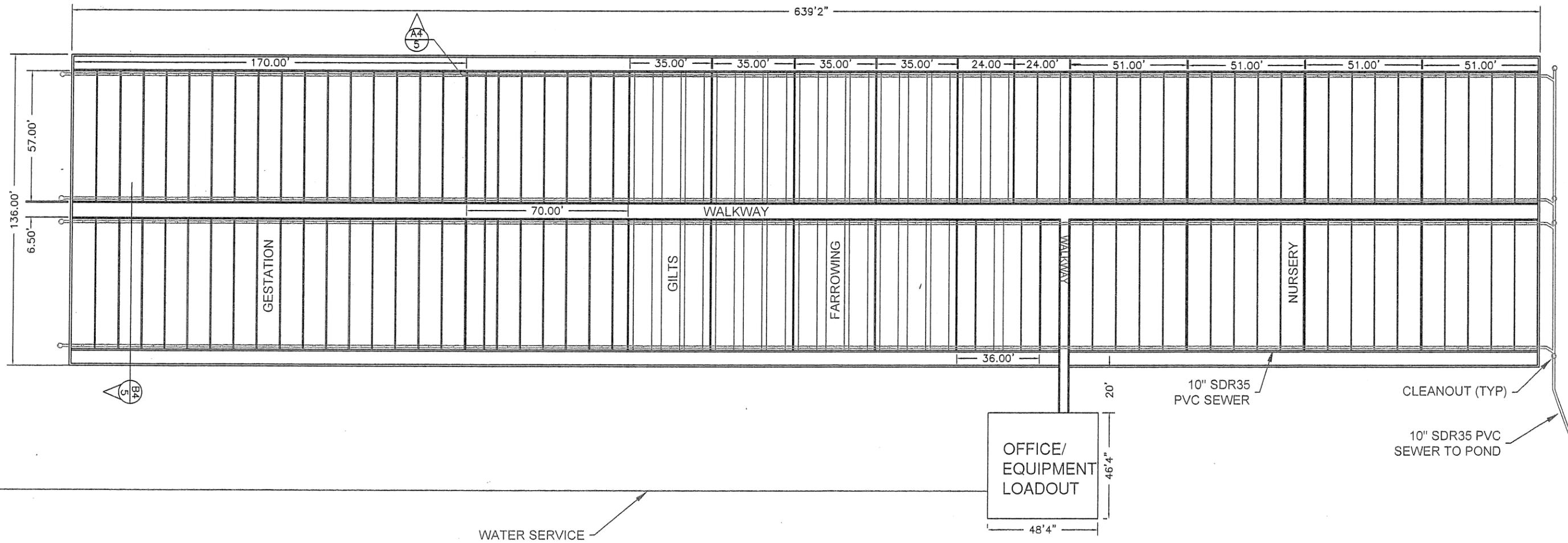


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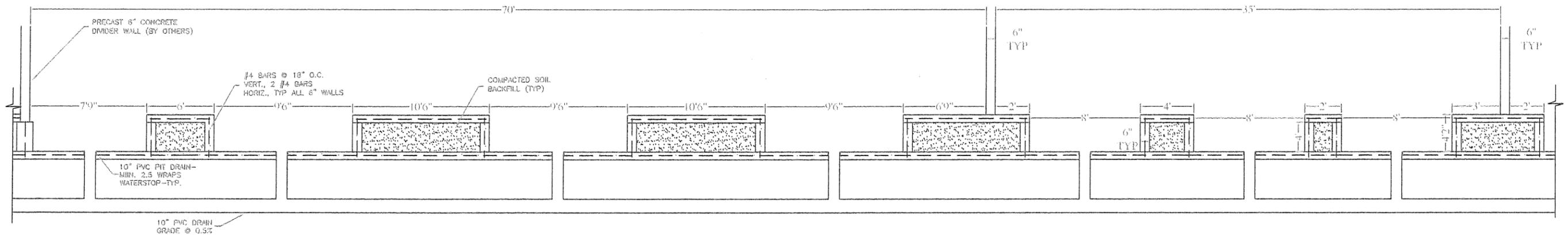
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SCALE:		AS NOTED	
DWG:		2	
P.O. BOX 636 HURON, SD 57350		605-352-5610	



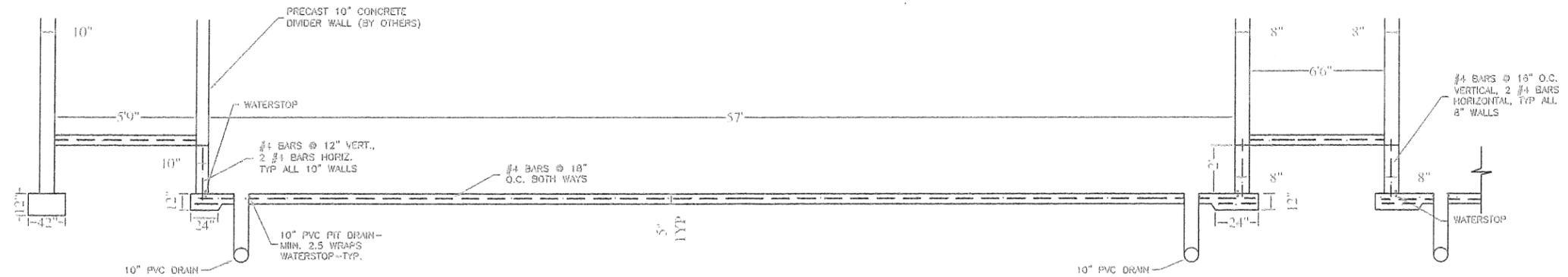
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NORFELD COLONY AWMS			SCALE: 1" = 150'		
DAKOTA ENVIRONMENTAL CONSULTANTS INCORPORATED			DWG: 3		
P.O. BOX 636 HURON, SD 57350			605-352-5610		



BUILDING PIT PLAN		REV.	DATE	DESCRIPTION	BY	CHKD
NORFELD COLONY AWMS		DATE:	2/10/16	DRAWN:	TB	BF
DAKOTA ENVIRONMENTAL CONSULTANTS INCORPORATED		P.O. BOX 636 HURON, SD 57350 605-352-5610				
		JOB NO: 23034				
		SCALE: NTS				
		DWG: 4				



(A4/5) GILT FARROWING ROOMS
TRANSVERSE SECTION



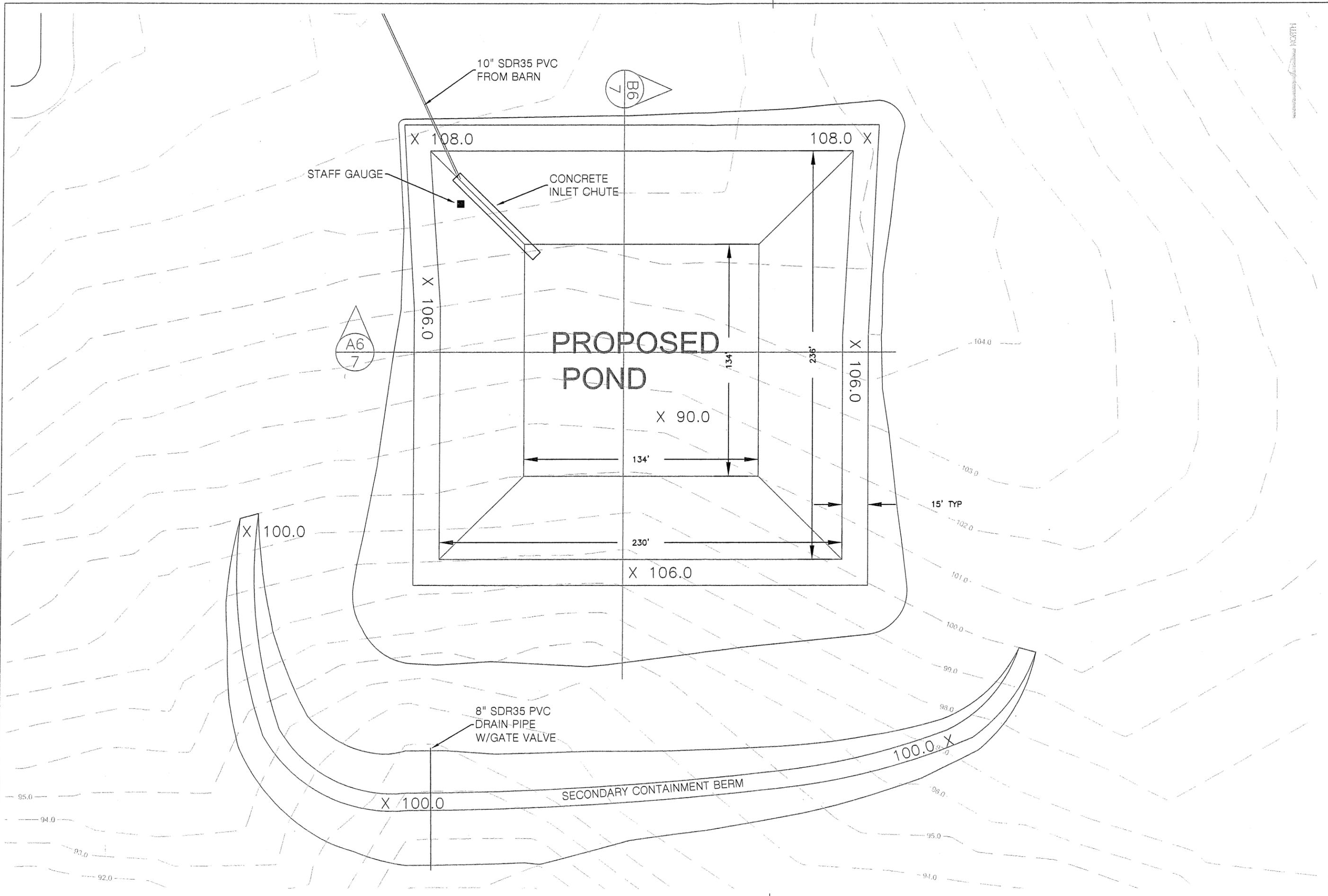
(B4/5) GESTATION ROOM
LONGITUDINAL SECTION

REV.	DATE	DESCRIPTION	BY	CHKD
	2/10/16	DRAWN: TB		
			CHECKED: BF	

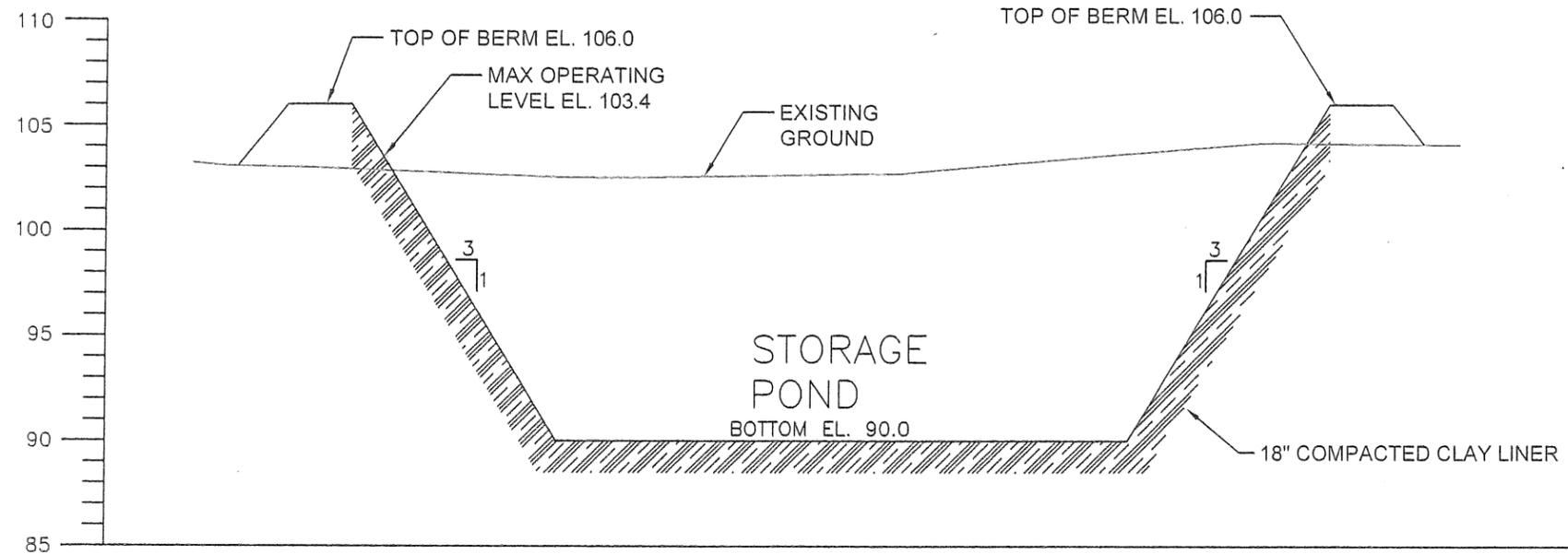
TYPICAL PIT SECTIONS
 NORFELD COLONY AWMS
 DAKOTA ENVIRONMENTAL CONSULTANTS INCORPORATED
 P.O. BOX 636 HURON, SD 57350 605-352-5610



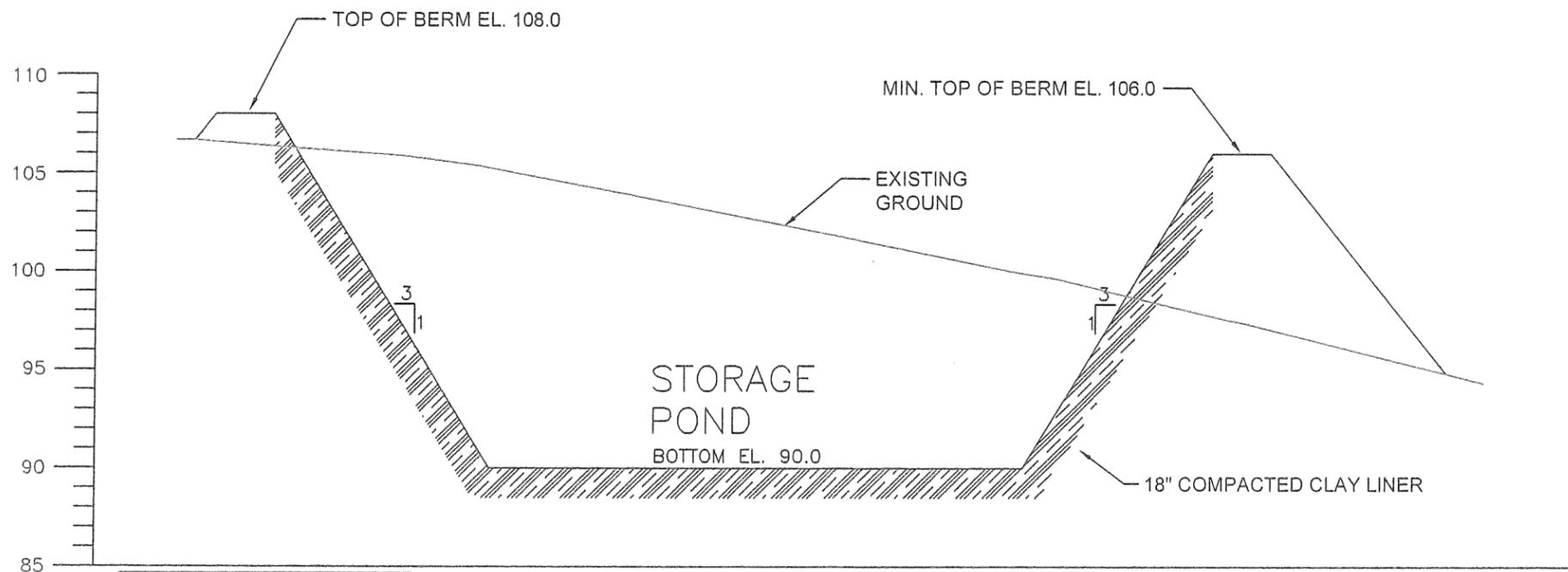
JOB NO:	23034
SCALE:	NTS
DWG:	5



POND PLAN		REV.	DATE	DESCRIPTION	BY	CHKD
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DAKOTA ENVIRONMENTAL CONSULTANTS INCORPORATED		P.O. BOX 636 HURON, SD 57350		605-352-5610		
		JOB NO:		23034		
		SCALE:		1"=50'		
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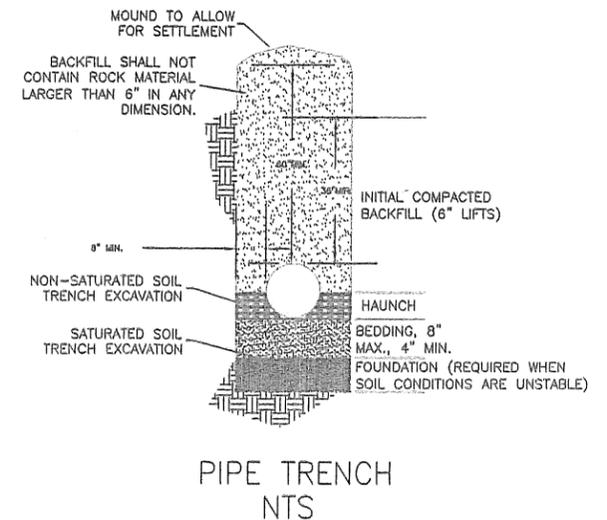
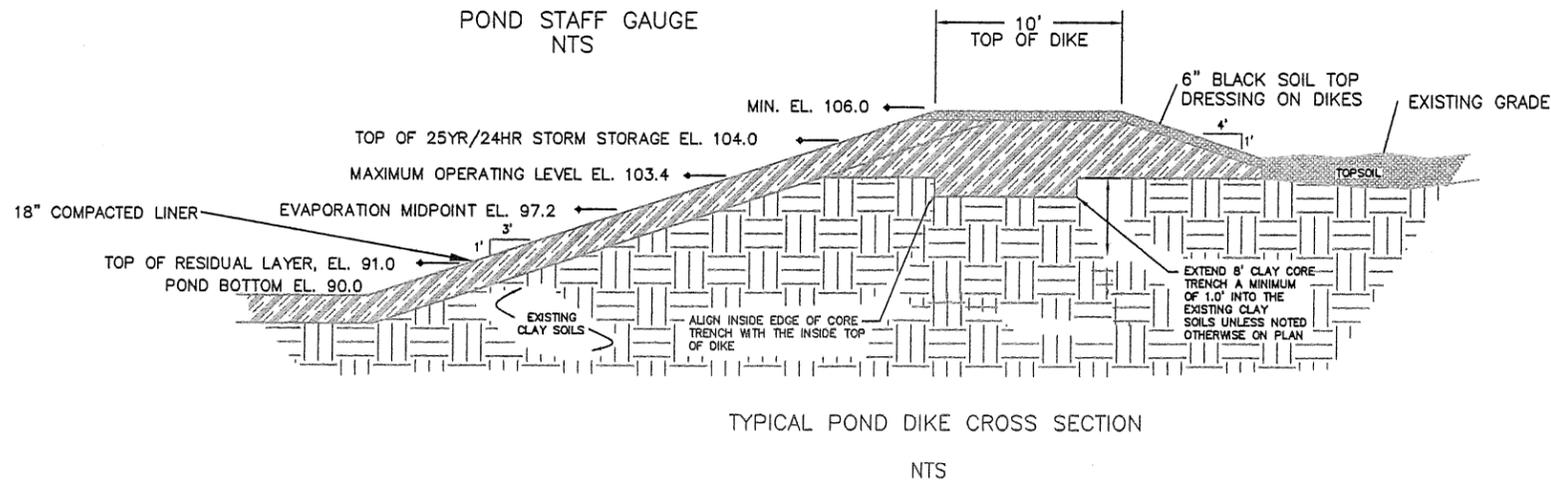
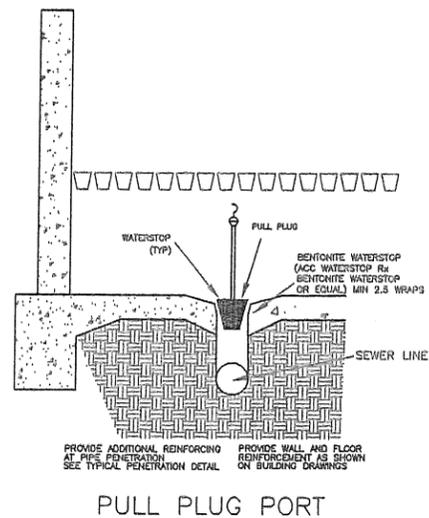
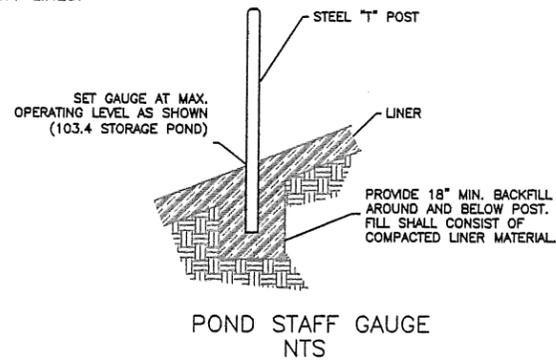
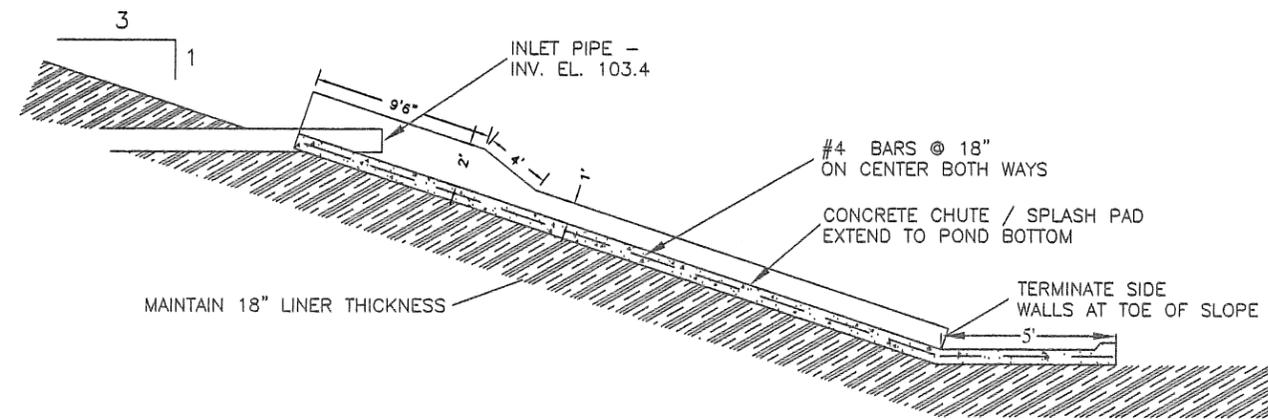
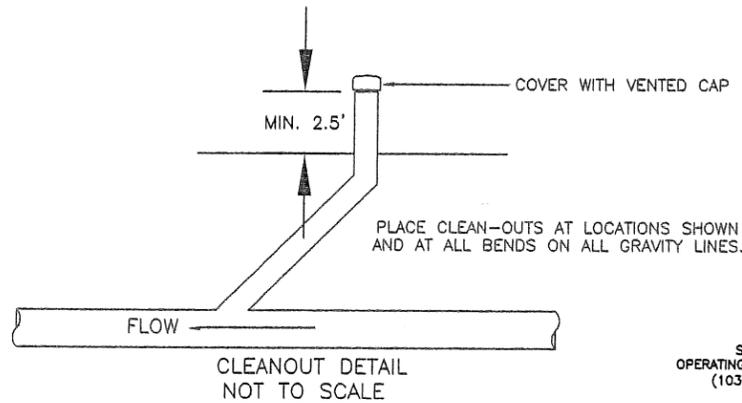
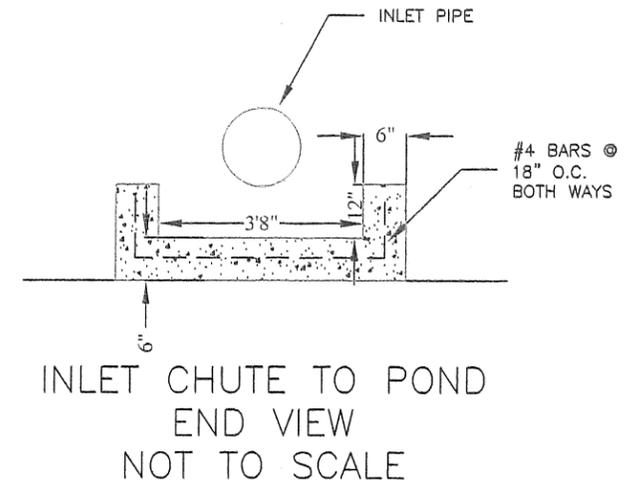
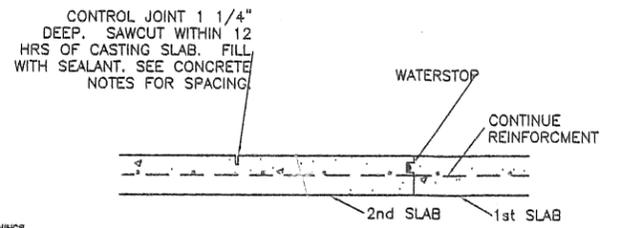
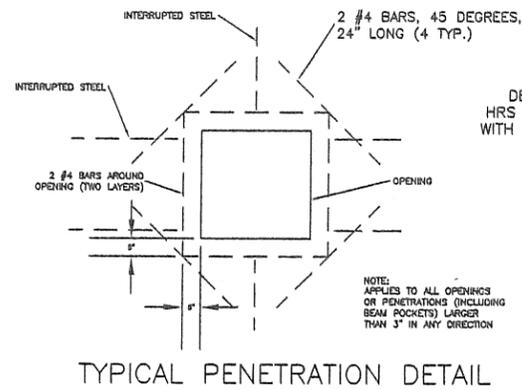
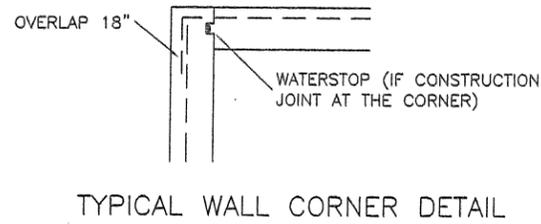
(A6/7) STORAGE POND TRANSVERSE SECTION



HORIZ. 1"=40'
VERT. 1"=8'

(B6/7) STORAGE POND LONGITUDINAL SECTION

REV.	DATE	DESCRIPTION	BY	CHKD
	2/10/16		TB	BF
POND SECTIONS				
NORFELD COLONY AWMS				
DAKOTA ENVIRONMENTAL CONSULTANTS INCORPORATED				
				
JOB NO: 23034				
SCALE: AS NOTED				
DWG: 7				
P.O. BOX 636 HURON, SD 57350 605-352-5610				



REV.	DATE	DESCRIPTION	BY	CHKD
	2/10/16			
DRAWN: TB			CHECKED: BF	
DETAILS				
NORFELD COLONY AWMS				
DAKOTA ENVIRONMENTAL CONSULTANTS INCORPORATED				
P.O. BOX 636 HURON, SD 57350 605-352-5610				
JOB NO: 23034				
SCALE: NTS				
DWG: 8				

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 1.0×10^{-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:
 $L = (N \times D \times (P)^{1/2}) / 1850$
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.

	CHKD				
	BY	CHECKED:	DRAWN:	DATE:	P.O. BOX 636 HURON, SD 57350 605-352-5610
		BF	TB	2/10/16	
GENERAL NOTES & SPECIFICATIONS		NORFELD COLONY AWMS			
DAKOTA ENVIRONMENTAL CONSULTANTS INCORPORATED		DAKOTA ENVIRONMENTAL CONSULTANTS INCORPORATED			
					
JOB NO: 23034					
SCALE: NTS					
DWG: 9					

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; and one set of 2 cylinders for each 500 linear feet of exterior pit walls.
 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 2000 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.

CONCRETE NOTES	NORFELD COLONY AWMS	DAKOTA ENVIRONMENTAL CONSULTANTS INCORPORATED	DATE: 2/10/16	DRAWN: TB	CHECKED: BF	CHKD
						
JOB NO:			23034			
SCALE:			NTS			
DWG:			10			
P.O. BOX 636 HURON, SD 57350 605-352-5610						

APPENDIX C
DESIGN CALCULATIONS

NORFELD COLONY AWMS
SWINE WASTE VOLUME CALCULATIONS

All waste production for all animal types based on Midwest Plan Service - 18, Manure Management System Series (MWPS, 2004)
Table references are to above.

Animal Units	Symbol	Sow & Lit.	Gest. Sow	Gilts	Nursery	Equation or comment
Animal type						
Average animal weight, lbs	W	375	300	275	30	
Number of animals	N	252	998	200	5,600	
Manure volume						
Volume of daily manure per animal, ft ³ /animal/day	DVM	0.28	0.11	0.22	0.04	Table 6
Storage period, days	D	365	365	365	365	
Volume of manure production for period, ft ³	VMD	25,754	40,070	16,060	73,584	VMD=N*DVM*D
Total manure production for period, ft ³	TVM	155,468				Sum of animal types
Wastewater volume						
Daily wastewater volume per Animal, oz./animal/day	DWW	16	16	16	16	Accounts for waterer overflow, incidental spillage, etc.
Wastewater volume for storage period, ft ³	WWD	1,537	6,087	1,220	34,155	WWD=DWW*N*D
Total wastewater volume for storage period, ft ³	TWW	42,999				Sum of animal types
Clean water volume						
12. Clean water added during treatment period, ft ³	CW	116,601	Wash water, flush water, and pull-plug pit recharge water. (assumed at 75% of manure volume)			
Waste Volume						
Waste volume for treatment period, ft ³	WV	315,068				Sum of above



NORFELD COLONY AWMS
STORAGE POND VOLUME CALCULATIONS

POND DESIGN VOLUME AND ELEVATION SUMMARY

DESCRIPTION	EQN.		DEPTH (FT)	ELEV.	ACTUAL DESIGN USED
Existing Grade	G			100.00	
Inside Top of Berm Width (ft)	W	230			
Inside Width Slope, horizontal feet per foot drop	SW	3			
Inside Top of Berm Length (ft)	L	230			
Inside Length Slope, horizontal feet per foot drop	SL	3			
Constructed Top of Berm, including settlement	E+S			106.00	106.0
Settlement, % of embankment height	S=%(E-G)	0%	0.00		
Reference Elevation, operational top of berm (acres & elev. - ft.)	E	1.21		106.00	
Freeboard (in)	F	24	2.00		
Surface Area at Top of 100yr/24hr storm (acres/elev)	AS=E-F	1.09		104.00	
100yr/24hr Rainfall (in)	R	5.9			
Surface Area at Inside Top of Berm, incl. Contributing area (ac)	OB	1.27			
Volume of 100yr/24hr Rainfall (cf)	VR=R*OB	27,294			
Volume Provided for 100yr/24hr Rainfall (cf)	avg(AS,O)*(AS-O)	28,047	0.60		
Maximum Surface Area and Operating Level (acres/elev)	O=E-F-R	1.06		103.40	103.40
Mean Annual Rainfall (in)	MAR	25.52			
Direct Mean Annual Rainfall within berms (cf)	DM=OB*MAR	118,059			
Mean Annual Lake Evaporation (in)	ME	33.5			
Evaporation Midpoint (elev)				97.20	
Surface Area at Evaporation Midpoint (ac)	ESA	0.72			
Net Evaporation at Midpoint (cf)	NE=ME*ESA	87,658			
Net Moisture used for design (evap[-] or rain[+]) (cf)	M	30,401	0.71		
Apparent Operation Level considering Net Moisture adj.	A=O-M	1.01		102.69	
Volume Provided for Net Moisture (cf)	avg(O,A)*(O-A)	31,995			
Waste Storage Depth (ft) excluding residual depth	D	12.40			
Surface area at top of residual layer (acres/elev)	SS=O-D	0.45		91.00	
Net Storage Depth provided	D-M	11.7	11.7		
Total Storage Volume from Net Storage Depth (cf)		363,085			
Total Storage Volume Required, from Volume Balance Calcs (cf)		315,068			
Residual Layer Depth (in)	SD	12	1.00		
Top of Liner, surface area, acres	SS-SD	0.41		90.00	90.0



APPENDIX D

NUTRIENT MANAGEMENT PLAN

INITIAL NUTRIENT MANAGEMENT PLAN
FOR
SOUTH DAKOTA ANIMAL FEEDING OPERATIONS

Spreadsheet line #		Field ID (include maps to illustrate location)		Crops and Yield in Rotation:												27. Est. soil NO ₃ -N (lbs.)	28. Legume N credits (lbs.)			29. Additional N needed for crops: (lbs.)				30. Total manure N allowed per field (lbs.)	
				Prior year			Year 1			Year 2			Year 3				Year 1	Year 2	Year 3	Avg					
Tract	Field	Crop	Yield	Crop	Yield	Crop	Yield	Crop	Yield	Crop	Yield	Crop	Yield	Crop	Yield	Crop	Yield	Year 1	Year 2	Year 3	Avg	Year 1	Year 2	Year 3	Avg
1		Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	0	44	0	126	106	126	119	13,946
2		Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	0	44	0	126	106	126	119	10,728
3																		#####	#####	#####	#N/A	#N/A	#N/A	#N/A	
4		Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	0	44	0	126	106	126	119	17,308
5																		#####	#####	#####	#N/A	#N/A	#N/A	#N/A	
6		Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	0	44	0	126	106	126	119	23,208
7		Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	0	44	0	126	106	126	119	33,054
8		Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	0	44	0	126	106	126	119	18,118
9		Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	0	44	0	126	106	126	119	13,791
10		Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	0	44	0	126	106	126	119	8,702
11		Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	0	44	0	126	106	126	119	10,013
12		Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	0	44	0	126	106	126	119	13,756
13		Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	0	44	0	126	106	126	119	7,080
14		Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	0	44	0	126	106	126	119	4,494
15		Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	0	44	0	126	106	126	119	8,427
16		Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	0	44	0	126	106	126	119	7,331
17		Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	0	44	0	126	106	126	119	17,165
18		Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	0	44	0	126	106	126	119	26,343
19		Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	0	44	0	126	106	126	119	4,172
20		Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	0	44	0	126	106	126	119	8,527
21		Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	0	44	0	126	106	126	119	8,864
22		Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	Corn (bu)	158	Soybean (bu)	44	0	44	0	126	106	126	119	30,634
23		Soybean (bu)	54	Corn (bu)	168	Soybean (bu)	54	Corn (bu)	168	Soybean (bu)	54	Corn (bu)	168	Soybean (bu)	54	Corn (bu)	168	54	0	54	108	0	108	72	6,913
24																									
25																									

Total N recommendation: 292,578

Operator: Norfield Colony
Date: 10/16; updated Feb. 26

INITIAL NUTRIENT MANAGEMENT PLAN
FOR
SOUTH DAKOTA ANIMAL FEEDING OPERATIONS

Spreadsheet #	Field ID (Include maps to illustrate location)	Tract	Field	RUSLE predicted soil loss (SD-CPA-29) (tons)		Phosphorus Soil Test			Phosphorus removal estimate				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	Bray-1	Date (M/Y)	ppm	Olsen	Bray-1	Date (M/Y)	Year 1	Year 2			
1			1	1.3	19	0	Nov-09	34	55	34	41	4,799	4	Nitrogen need	117.0
2			2	1.3	17	0	Nov-09	34	55	34	41	3,692	4	Nitrogen need	90.0
3						0		#####	#####	#####					
4			4	0.36	20	0	Mar-06	34	55	34	41	5,956	3	Nitrogen need	145.2
5						0		#####	#####	#####					
6			6	1.3	16	0	Mar-06	34	55	34	41	7,987	4	Nitrogen need	194.7
7			7	1.3	15	0	Mar-06	34	55	34	41	11,375	4	Nitrogen need	277.3
8			8	1	16	0	Oct-14	34	55	34	41	6,235	4	Nitrogen need	152.0
9			9	1.3	35	0	Mar-06	34	55	34	41	4,746	2	Nitrogen need	115.7
10			10	1.3	17	0	Mar-06	34	55	34	41	2,994	4	Nitrogen need	73.0
11			11	1.3	10	0	Oct-05	34	55	34	41	3,446	5	Nitrogen need	84.0
12			12	1.3	11	0	Mar-06	34	55	34	41	4,734	4	Nitrogen need	115.4
13			13	1.3	17	0	Mar-06	34	55	34	41	2,437	4	Nitrogen need	59.4
14			14	0.36	9	0	Mar-06	34	55	34	41	1,546	5	Nitrogen need	37.7
15			15	1.3	26	0	Oct-05	34	55	34	41	2,900	3	Nitrogen need	70.7
16			16	1.3	26	0	Oct-05	34	55	34	41	2,523	3	Nitrogen need	61.5
17			17	1	9	0	Oct-14	34	55	34	41	5,907	5	Nitrogen need	144.0
18			18	0.69	8	0	Oct-14	34	55	34	41	9,065	5	Nitrogen need	221.0
19			19	0.69	5	0	Oct-14	34	55	34	41	1,436	5	Nitrogen need	35.0
20			20	0.83	7	0	Nov-07	34	32	55	41	3,082	5	Nitrogen need	76.0
21			21	0.84	11	0	Nov-07	34	32	55	41	3,204	5	Nitrogen need	79.0
22			22	1.2	9	0	Oct-12	34	55	34	41	10,542	5	Nitrogen need	257.0
23			23	0.92	6	0	Sep-15	59	42	59	53	5,115	11	Nitrogen need	96.4
24						0									
25						0									
												Total Acres		2,502.0	
												Total lbs of N and P2O5 available for crops:		198,368	
												Total lbs of N and P2O5 required by fields:		292,578	
												N		373,268	
												P2O5		103,720	

Adequate acres are available based on Nitrogen analysis
However, P2O5 is in excess of removal. At this rate, it will take approximately 7 years to build all listed fields up to 50 ppm P (Olsen).

APPENDIX E

MANURE MANAGEMENT AND OPERATION PLAN

OPERATION AND MAINTENANCE MANUAL

for the

NORFELD COLONY SWINE CONFINEMENT ANIMAL WASTE MANAGEMENT SYSTEM

BROOKINGS COUNTY, SOUTH DAKOTA

February 10, 2016

DEC Project No. 23034

Producer: Norfeld Colony
c/o Joe Stahl

Address: 20426 – 482nd Ave.
White, SD 57276-6613

Phone: (605) 629-6978

Project Location: SW 1/4 of Section 14, T111N 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. Constructed pond liner bottom 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 pond.
- ___ 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. Land apply from the pond as needed to maintain adequate freeboard and storage capacity. The liquid level is not to exceed the maximum operating depth marker. 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.
- ___ 6. The contents of the storage ponds should be agitated during removal of wastes to prevent buildup of solids and sludge.
- ___ 7. Prepare an annual nutrient management plan based on actual analysis of nutrient levels in both the manure and the soil.
- ___ 8. 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.
- ___ 9. Do not apply waste on snow or frozen ground unless unavoidable. Consult the General Permit for conditions that must be followed in these circumstances.
- ___ 10. Do not apply waste material immediately after rain or within twelve hours of forecasted rain unless it can be immediately incorporated into the soil.
- ___ 11. 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.
- ___ 12. Keep records of the fields, days, temperature and wind direction when manure was applied using the form supplied with this manual.
- ___ 13. All provisions of the General Water Pollution Control Permit for Concentrated Animal Feeding Operations must be followed. The producer should be familiar with the permit in entirety.

- ____ 14. 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.
- ____ 15. 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. Grade must maintain a slope away from the buildings and lagoon 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 the 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 the pits or lagoon to prevent root damage to the structures.
- ____ 8. Apply herbicide as needed to retard growth of vegetation on the inside of the lagoon embankment 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 F

MANAGEMENT PLAN FOR FLY AND ODOR CONTROL

MANAGEMENT PLAN FOR FLY AND ODOR CONTROL

for the
**NORFELD COLONY
SWINE CONFINEMENT
ANIMAL WASTE MANAGEMENT SYSTEM**

BROOKINGS COUNTY, SOUTH DAKOTA

February 10, 2016

DEC Project No. 23034

Producer: Norfeld Colony
c/o Joe Stahl

Address: 20426 – 482nd Ave.
White, SD 57276-6613

Phone: (605) 629-6978

Project Location: SW 1/4 of Section 14, T111N R48W, Brookings County, SD

This plan is provided to describe the Best Management Practices (BMPs) that will be implemented to minimize any nuisance created by flies and odors from the proposed swine confinement. 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

All waste produced by the swine will be captured in shallow pits beneath the buildings. The manure and wastewater will be periodically drained from the pits and stored in an earthen storage pond. All transfer structures leading to the pond will be buried.

The configuration of the building and pits will minimize odors by allowing the animals to remain dry. The slatted floors above the shallow pits will remove the waste from contact with the animals as soon as possible. The ventilation air being moved through the growing area will therefore have minimal contact with manure before being exhausted.

Improved feeding and nutrition programs in the swine industry constantly seek to increase feed conversion, which in turn helps to limit manure solids, which are the primary odor producing component of manure.

The proposed storage pond was designed in accordance with state law to provide adequate storage capacity as well as minimize the odors as much as possible. Bacteriological additives are commonly added to swine confinement pits and storage ponds to enhance digestion of the manure and solids in the manure. These additives have been observed to reduce odor production at sites where they are utilized.

The site has been selected to meet the applicable zoning ordinances and permit requirements for confined animal feeding operations. These include specific separation distances from residences, churches, schools, businesses, and municipalities. These distances were established to prevent any nuisance to surrounding features from facilities of this type.

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 as fertilizer.

The proposed buildings will include the use of chimney ventilation. In this method, the circulated air is exhausted from vertical chimneys at the peak of the barn by fans. The major benefit of using a chimney ventilation system is that it tends to be more efficient than a wall fan system due to decreased turbulence. Air exhausted in this manner is directed vertically, allowing better mixing and dispersion with outside air than in a side fan ventilation system.

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. An existing shelterbelt is in place to the north and northwest of the proposed facility, while adequate space will remain between the facility and the property lines for planting of additional shelterbelts.

Trees and vegetation also serve as habitat for species such as birds, which prey upon insects or insect larvae. For areas around the barn, pesticide, especially in powdered form, can also be used to control insects. Timing of manure application in the spring and fall of the year will generally result in this activity occurring during periods of cooler weather when both insects and odor causing microbiological organisms are less active. The use of professional pest control services which utilize sprays or fogging to eliminate insects is also a potential practice for use.

Rodent control will be aided by the fact that the configuration of the buildings and pits offers little shelter for these animals. Control of rodents is also in the best interests of the operation for reasons of sanitation and biosecurity. For areas around the building walls, solid poison can be used to control rodents and keep burrowing from occurring near the concrete. Professional pest control services are also available.

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 proposed building and storage structure have adequate capacity to contain in excess of 365 days worth of manure and wastewater production from the facility. The ventilation of the barns will be reduced in the wintertime to minimize the amount of cold outside air into the barn resulting in reduced odors at this time. Cold temperatures will accomplish insect control during this period as well.

To best control odor, the times for manure land application should 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 source 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. All manure produced by the proposed operation will be liquid form, therefore application is anticipated to be by injection.

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. These records are reviewed annually by the South Dakota DENR for compliance.

III. Disposal of Dead Animals

The producer has previously received approval from the South Dakota DENR and Animal Industry Board to compost carcasses on the manure stacking pad currently in place near the existing turkey confinement. Carcasses are composted in accordance with procedures that have been reviewed and approved by the above agencies.

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 G

SETBACK MAP

NORFELD COLONY SETBACK MAP



1 inch = 600 feet

APPENDIX J

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



SOIL BORING LOG

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

Boring #

SB 1

Soil Description	WL	Depth	Geo.	Elevation	Sample ID	USCS
Topsoil		0.0		91.4	SB1 0'-3.5'	OL
		0.5		90.9		
		1.0		90.4		
		1.5	Topsoil	89.9		
		2.0		89.4		
		2.5		88.9		
		3.0		88.4		
Well graded clayey sand, light brown, moist		3.5		87.9	SB1 3.5'-6'	SC
		4.0		87.4		
		4.5		86.9		
		5.0		86.4		
		5.5		85.9		
Sandy clay, brown, moist, medium stiff to stiff		6.0		85.4	SB1 6'-8'	
		6.5		84.9		
		7.0		84.4		
Sandy clay, brown, wet, soft to medium stiff		7.5		83.9	SB1 8'-9'	
		8.0		83.4		
Sandy clay, brown, moist, medium stiff	TOB	8.5		82.9	SB1 9'-17'	CL
		9.0		82.4		
		9.5		81.9		
		10.0		81.4		
		10.5	Weathered Till	80.9		
		11.0		80.4		
		11.5		79.9		
		12.0		79.4		
		12.5		78.9		
		13.0		78.4		
		13.5		77.9		
		14.0		77.4		
		14.5		76.9		
		15.0		76.4		
		15.5		75.9		
	16.0		75.4			
	16.5		74.9			
	17.0		74.4			
	17.5		73.9			
	18.0		73.4			
	18.5		72.9			
	19.0		72.4			
	19.5		71.9			
	20.0		71.4			
	20.5		70.9			
	21.0		70.4			
	21.5		69.9			
	22.0		69.4			
	22.5		68.9			
	23.0		68.4			
	23.5		67.9			
	24.0	Unweathered Till	67.4			
	24.5		66.9			
	25.0		66.4			
	25.5		65.9			

NOTES: Water level 8' @ time of boring.	Water Level: 8' @ TOB	DEC #	Date of Boring: 11/2/2015
	Method: Split Spoon	23034	Page: 1 of 2
	Driller: TB	Chkd by: BF	Elevation: 91.4
	Sampler: RR	Project: Norfeld Swine AWMS	
	Recorded By: RR		
	Entered By/Date: RR 11/18/2015		



SOIL BORING LOG

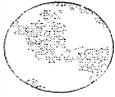
Dakota Environmental Consultants, Inc. P.O. Box 636 Huron, SD 57350 (605) 352-5610

Boring #

SB 1

Soil Description	WL	Depth	Geo.	Elevation	Sample ID	USCS		
Sandy clay, gray, unweathered, moist, medium stiff		26.0		65.4				
		26.5		64.9				
		27.0		64.4				
		27.5	Unweathered	63.9	SB1 22'-30'	CL		
		28.0	Till	63.4				
		28.5		62.9				
		29.0		62.4				
		29.5		61.9				
END OF BORING		30.0		61.4				
		30.5		60.9				
		31.0		60.4				
		31.5		59.9				
		32.0		59.4				
		32.5		58.9				
		33.0		58.4				
		33.5		57.9				
		34.0		57.4				
		34.5		56.9				
		35.0		56.4				
		35.5		55.9				
		36.0		55.4				
		36.5		54.9				
		37.0		54.4				
		37.5		53.9				
		38.0		53.4				
		38.5		52.9				
		39.0		52.4				
		39.5		51.9				
		40.0		51.4				
		40.5		50.9				
		41.0		50.4				
		41.5		49.9				
		42.0		49.4				
		42.5		48.9				
		43.0		48.4				
		43.5		47.9				
		44.0		47.4				
		44.5		46.9				
		45.0		46.4				
		45.5		45.9				
		46.0		45.4				
		46.5		44.9				
		47.0		44.4				
		47.5		43.9				
		48.0		43.4				
		48.5		42.9				
		49.0		42.4				
		49.5		41.9				
		50.0		41.4				
		50.5		40.9				
		51.0		40.4				
		51.5		39.9				

NOTES: Water level 8' @ time of boring.	Water Level: 8' @ TOB	DEC #	Date of Boring: 11/2/2015
	Method: Split Spoon	23034	Page: 2 of 2
	Driller: TB	Chkd by: BF	Elevation: 91.4
	Sampler: RR	Project:	
	Recorded By: RR	Norfeld Swine AWMS	
Entered By/Date: RR 11/18/2015			



SOIL BORING LOG

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

Boring #

SB 2

Soil Description	WL	Depth	Geo.	Elevation	Sample ID	USCS
Topsoil		0.0	Topsoil	103.8	SB2 0'-0.5'	OL
		0.5		103.3		
		1.0		102.8		
		1.5		102.3		
		2.0		101.8		
		2.5		101.3		
		3.0		100.8		
		3.5		100.3		
		4.0		99.8		
		4.5		99.3		
Sandy clay, brown, moist, stiff		5.0		98.8	SB2 0.5'-20'	CL
		5.5		98.3		
		6.0		97.8		
		6.5		97.3		
		7.0		96.8		
		7.5		96.3		
		8.0		95.8		
		8.5		95.3		
		9.0		94.8		
		9.5		94.3		
		10.0		93.8		
		10.5		93.3		
		11.0		92.8		
		11.5		92.3		
		12.0		91.8		
		12.5	Weathered Till	91.3		
		13.0		90.8		
		13.5		90.3		
		14.0		89.8		
		14.5		89.3		
Sandy clay/clayey sand, brown, moist, soft		15.0		88.8	SB2 20'-23'	CL/SC
		15.5		88.3		
		16.0		87.8		
		16.5		87.3		
		17.0		86.8		
		17.5		86.3		
		18.0		85.8		
		18.5		85.3		
		19.0		84.8		
		19.5		84.3		
Sandy clay, gray/brown, moist, medium stiff to stiff		20.0		83.8	SB2 23'-30'	CL
		20.5		83.3		
		21.0		82.8		
		21.5		82.3		
		22.0		81.8		
		22.5		81.3		
		23.0		80.8		
	23.5		80.3			
	24.0		79.8			
	24.5		79.3			
	25.0		78.8			
	25.5		78.3			

NOTES: Water level @ time of boring: None	Water Level: None @ TOB	DEC #	Date of Boring: 11/2/2015
	Method: Split Spoon	23034	Page: 1 of 2
	Driller: TB	Chkd by: BF	Elevation: 103.8
	Sampler: RR	Project: Norfeld Swine AWMS	
	Recorded By: RR		
	Entered By/Date: RR 11/18/15		



SOIL BORING LOG

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

Boring #

SB 2

Soil Description	WL	Depth	Geo.	Elevation	Sample ID	USCS	
Sandy clay, gray/brown, moist, medium stiff to stiff		26.0		77.8	SB2 23'-30'	CL	
		26.5		77.3			
		27.0		76.8			
		27.5		76.3			
		28.0	Weathered	75.8			
		28.5	Till	75.3			
		29.0		74.8			
		29.5		74.3			
	END OF BORING		30.0				73.8
			30.5				73.3
		31.0		72.8			
		31.5		72.3			
		32.0		71.8			
		32.5		71.3			
		33.0		70.8			
		33.5		70.3			
		34.0		69.8			
		34.5		69.3			
		35.0		68.8			
		35.5		68.3			
		36.0		67.8			
		36.5		67.3			
		37.0		66.8			
		37.5		66.3			
		38.0		65.8			
		38.5		65.3			
		39.0		64.8			
		39.5		64.3			
		40.0		63.8			
		40.5		63.3			
		41.0		62.8			
		41.5		62.3			
		42.0		61.8			
	42.5		61.3				
	43.0		60.8				
	43.5		60.3				
	44.0		59.8				
	44.5		59.3				
	45.0		58.8				
	45.5		58.3				
	46.0		57.8				
	46.5		57.3				
	47.0		56.8				
	47.5		56.3				
	48.0		55.8				
	48.5		55.3				
	49.0		54.8				
	49.5		54.3				
	50.0		53.8				
	50.5		53.3				
	51.0		52.8				
	51.5		52.3				

NOTES: Water level @ time of boring: None	Water Level:	None @ TOB	DEC #	Date of Boring:	11/3/2015	
	Method:	Split Spoon	23034	Page:	2 of 2	
	Driller:	TB		Chkd by:	BF	Elevation:
	Sampler:	RR	Project:			
	Recorded By:	RR	Norfeld Swine AWMS			
	Entered By/Date:	RR 11/18/2015				



SOIL BORING LOG

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

Boring #

SB 3

Soil Description	WL	Depth	Geo.	Elevation	Sample ID	USCS
Topsoil		0.0	Topsoil	104.3	SB3 0'-0.5'	OL
Sandy clay, brown, dry, hard		0.5		103.8	SB3 0.5'-3'	
		1.0		103.3		
		1.5		102.8		
		2.0		102.3		
		2.5		101.8		
		3.0		101.3		
Sandy clay, brown, moist, stiff to very stiff		3.5		100.8	SB3 3'-6'	
		4.0		100.3		
		4.5		99.8		
		5.0		99.3		
		5.5		98.8		
		6.0		98.3		
Sandy clay, brown/olive, stiff to very stiff		6.5		97.8	SB3 6'-23.5'	CL
		7.0		97.3		
		7.5		96.8		
		8.0		96.3		
		8.5		95.8		
		9.0		95.3		
		9.5		94.8		
		10.0		94.3		
		10.5		93.8		
		11.0		93.3		
		11.5		92.8		
		12.0		92.3		
		12.5	Weathered Till	91.8		
		13.0		91.3		
		13.5		90.8		
		14.0		90.3		
		14.5		89.8		
		15.0		89.3		
	15.5		88.8			
	16.0		88.3			
	16.5		87.8			
	17.0		87.3			
	17.5		86.8			
	18.0		86.3			
	18.5		85.8			
	19.0		85.3			
	19.5		84.8			
	20.0		84.3			
	20.5		83.8			
	21.0		83.3			
	21.5		82.8			
	22.0		82.3			
	22.5		81.8			
	23.0		81.3			
	23.5		80.8			
Sandy clay, dark brown/gray, stiff		24.0		80.3	SB3 23.5'-36'	
		24.5		79.8		
		25.0		79.3		
		25.5		78.8		

NOTES: Water level @ time of boring: None

Water Level: None @ TOB	DEC #	Date of Boring: 11/3/2015
Method: Split Spoon	23034	Page: 1 of 2
Driller: TB	Chkd by: BF	Elevation: 104.3
Sampler: RR	Project: Norfeld Swine AWMS	
Recorded By: RR		
Entered By/Date: RR 11/18/2015		



SOIL BORING LOG

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

Boring #

SB 3

Soil Description	WL	Depth	Geo.	Elevation	Sample ID	USCS
Sandy clay, dark brown/gray, stiff		26.0		78.3	SB3 23.5'-36'	CL
		26.5		77.8		
		27.0		77.3		
		27.5		76.8		
		28.0		76.3		
		28.5		75.8		
		29.0		75.3		
		29.5		74.8		
		30.0		74.3		
		30.5		73.8		
		31.0		73.3		
		31.5		72.8		
		32.0		72.3		
		32.5		71.8		
		33.0		71.3		
		33.5		70.8		
	Sandy clay, gray/dark brown, moist, stiff		34.0	Weathered Till		
		34.5	69.8			
		35.0	69.3			
		35.5	68.8			
		36.0	68.3			
		36.5	67.8			
		37.0	67.3			
		37.5	66.8			
		38.0	66.3			
		38.5	65.8			
Sandy clay, dark gray, very slight weathering, moist, stiff		39.0		65.3	SB3 42'-50'	CL
		39.5		64.8		
		40.0		64.3		
		40.5		63.8		
		41.0		63.3		
		41.5		62.8		
		42.0		62.3		
		42.5		61.8		
		43.0		61.3		
		43.5		60.8		
		44.0		60.3		
		44.5		59.8		
		45.0		59.3		
END OF BORING		45.5		58.8		
		46.0		58.3		
		46.5		57.8		
		47.0		57.3		
		47.5		56.8		
NOTES: Water level @ time of boring: None		48.0		56.3		
		48.5		55.8		
		49.0		55.3		
		49.5		54.8		
		50.0		54.3		
		50.5		53.8		
		51.0		53.3		
		51.5		52.8		
Water Level: None @ TOB		DEC #		Date of Boring: 11/3/2015		
Method: Split Spoon		23034		Page: 2 of 2		
Driller: TB		Chkd by: BF		Elevation: 104.3		
Sampler: RR		Project:				
Recorded By: RR		Norfeld Swine AWMS				
Entered By/Date: RR 11/18/2015						



SOIL BORING LOG

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

Boring #

SB 4

Soil Description	WL	Depth	Geo.	Elevation	Sample ID	USCS
Topsoil		0.0		97.3		
		0.5	Topsoil	96.8	SB4 0'-1'	OL
		1.0		96.3		
Well graded clayey sand, brown, moist		1.5		95.8	SB4 1'-2'	SC
		2.0		95.3		
Sandy clay, brown, moist, hard		2.5		94.8		
		3.0		94.3	SB4 2'-4'	
		3.5		93.8		
		4.0		93.3		
		4.5		92.8		
		5.0		92.3		
		5.5		91.8		
		6.0		91.3		
		6.5		90.8		
		7.0		90.3		
		7.5		89.8		
		8.0		89.3		
		8.5		88.8		
		9.0		88.3		
		9.5		87.8		
		10.0		87.3		
		10.5	Weathered Till	86.8		
		11.0		86.3		
		11.5		85.8		
Sandy clay, brown/olive, moist, very stiff		12.0		85.3	SB4 4'-22'	
		12.5		84.8		
		13.0		84.3		
		13.5		83.8		
		14.0		83.3		
		14.5		82.8		
		15.0		82.3		
		15.5		81.8		
		16.0		81.3		
		16.5		80.8		
		17.0		80.3		
		17.5		79.8		
		18.0		79.3		
		18.5		78.8		
		19.0		78.3		
		19.5		77.8		
		20.0		77.3		
		20.5		76.8		
		21.0		76.3		
		21.5		75.8		
		22.0		75.3		
		22.5		74.8		
		23.0		74.3		
		23.5		73.8		
Sandy clay, dark brown/gray, moist, medium stiff		24.0		73.3	SB4 22'-30'	
		24.5		72.8		
		25.0		72.3		
		25.5		71.8		

NOTES: Water level @ time of boring: None	Water Level: None @ TOB	DEC #	Date of Boring: 11/3/2015
	Method: Split Spoon	23034	Page: 1 of 2
	Driller: TB	Chkd by: BF	Elevation: 97.3
	Sampler: RR	Project:	
	Recorded By: RR	Norfeld Swine AWMS	
	Entered By/Date: RR 11/18/2015		



SOIL BORING LOG

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

Boring #

SB 4

Soil Description	WL	Depth	Geo.	Elevation	Sample ID	USCS	
Sandy clay, dark brown/gray, moist, medium stiff		26.0		71.3	SB4 22'-30'	CL	
		26.5		70.8			
		27.0	Weathered	70.3			
		27.5	Till	69.8			
		28.0		69.3			
		28.5		68.8			
		29.0		68.3			
		29.5		67.8			
	END OF BORING		30.0				67.3
			30.5				66.8
		31.0		66.3			
		31.5		65.8			
		32.0		65.3			
		32.5		64.8			
		33.0		64.3			
		33.5		63.8			
		34.0		63.3			
		34.5		62.8			
		35.0		62.3			
		35.5		61.8			
		36.0		61.3			
		36.5		60.8			
		37.0		60.3			
		37.5		59.8			
		38.0		59.3			
		38.5		58.8			
		39.0		58.3			
		39.5		57.8			
		40.0		57.3			
		40.5		56.8			
		41.0		56.3			
		41.5		55.8			
		42.0		55.3			
		42.5		54.8			
		43.0		54.3			
		43.5		53.8			
	44.0		53.3				
	44.5		52.8				
	45.0		52.3				
	45.5		51.8				
	46.0		51.3				
	46.5		50.8				
	47.0		50.3				
	47.5		49.8				
	48.0		49.3				
	48.5		48.8				
	49.0		48.3				
	49.5		47.8				
	50.0		47.3				
	50.5		46.8				
	51.0		46.3				
	51.5		45.8				

NOTES: Water level @ time of boring: None	Water Level: None @ TOB	DEC #	Date of Boring: 11/3/2015
	Method: Split Spoon	23034	Page: 2 of 2
	Driller: TB	Chkd by: BF	Elevation: 97.3
	Sampler: RR	Project:	
	Recorded By: RR	Norfeld Swine AWMS	
	Entered By/Date: RR 11/18/2015		



SOIL BORING LOG

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

Boring #

SB 5

Soil Description	WL	Depth	Geo.	Elevation	Sample ID	USCS	
Topsoil		0.0	Topsoil	106.6	SB5 0'-0.5'	OL	
Sandy clay, brown, moist, very stiff		0.5		106.1	SB5 0.5'-12'	CL	
		1.0		105.6			
		1.5		105.1			
		2.0		104.6			
		2.5		104.1			
		3.0		103.6			
		3.5		103.1			
		4.0		102.6			
		4.5		102.1			
		5.0		101.6			
		5.5		101.1			
		6.0		100.6			
		6.5		100.1			
		7.0		99.6			
		7.5		99.1			
Sandy clay, brown/olive, moist, very stiff		8.0	Weathered Till	98.6	SB5 12'-22'	CL	
		8.5					98.1
		9.0					97.6
		9.5					97.1
		10.0					96.6
		10.5					96.1
		11.0					95.6
		11.5					95.1
		12.0					94.6
		12.5					94.1
		13.0					93.6
		13.5					93.1
		14.0					92.6
		14.5					92.1
		15.0					91.6
	15.5		91.1				
Sandy clay, dark brown/gray, moist, stiff to very stiff		16.0		90.6	SB5 22'-30'	CL	
		16.5		90.1			
		17.0		89.6			
		17.5		89.1			
		18.0		88.6			
		18.5		88.1			
		19.0		87.6			
		19.5		87.1			
		20.0		86.6			
		20.5		86.1			
	21.0		85.6				
	21.5		85.1				
	22.0		84.6				
	22.5		84.1				
	23.0		83.6				
	23.5		83.1				
	24.0		82.6				
	24.5		82.1				
	25.0		81.6				
	25.5		81.1				

NOTES: Water level @ time of boring: None	Water Level: None @ TOB	DEC #	Date of Boring: 11/3/2015
	Method: Split Spoon	23034	Page: 1 of 2
	Driller: TB	Chkd by: BF	Elevation: 106.6
	Sampler: RR	Project: Norfeld Swine AWMS	
	Recorded By: RR		
	Entered By/Date: RR 11/18/2015		



SOIL BORING LOG

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

Boring #

SB 5

Soil Description	WL	Depth	Geo.	Elevation	Sample ID	USCS
Sandy clay, dark brown/gray, moist, stiff to very stiff		26.0		80.6	SB5 22'-30'	CL
		26.5		80.1		
		27.0		79.6		
		27.5	Weathered	79.1		
		28.0	Till	78.6		
		28.5		78.1		
		29.0		77.6		
		29.5		77.1		

Soil Description	WL	Depth	Geo.	Elevation	Sample ID	USCS
END OF BORING		30.0		76.6		
		30.5		76.1		
		31.0		75.6		
		31.5		75.1		
		32.0		74.6		
		32.5		74.1		
		33.0		73.6		
		33.5		73.1		
		34.0		72.6		
		34.5		72.1		
		35.0		71.6		
		35.5		71.1		
		36.0		70.6		
		36.5		70.1		
		37.0		69.6		
		37.5		69.1		
		38.0		68.6		
		38.5		68.1		
		39.0		67.6		
		39.5		67.1		
		40.0		66.6		
		40.5		66.1		
		41.0		65.6		
	41.5		65.1			
	42.0		64.6			
	42.5		64.1			
	43.0		63.6			
	43.5		63.1			
	44.0		62.6			
	44.5		62.1			
	45.0		61.6			
	45.5		61.1			
	46.0		60.6			
	46.5		60.1			
	47.0		59.6			
	47.5		59.1			
	48.0		58.6			
	48.5		58.1			
	49.0		57.6			
	49.5		57.1			
	50.0		56.6			
	50.5		56.1			
	51.0		55.6			
		51.5		55.1		

NOTES: Water level @ time of boring: None	Water Level: None @ TOB	DEC #	Date of Boring: 11/3/2015
	Method: Split Spoon	23034	Page: 2 of 2
	Driller: TB	Chkd by: BF	Elevation: 106.6
	Sampler: RR	Project:	
	Recorded By: RR	Norfeld Swine AWMS	
	Entered By/Date: RR 11/18/2015		

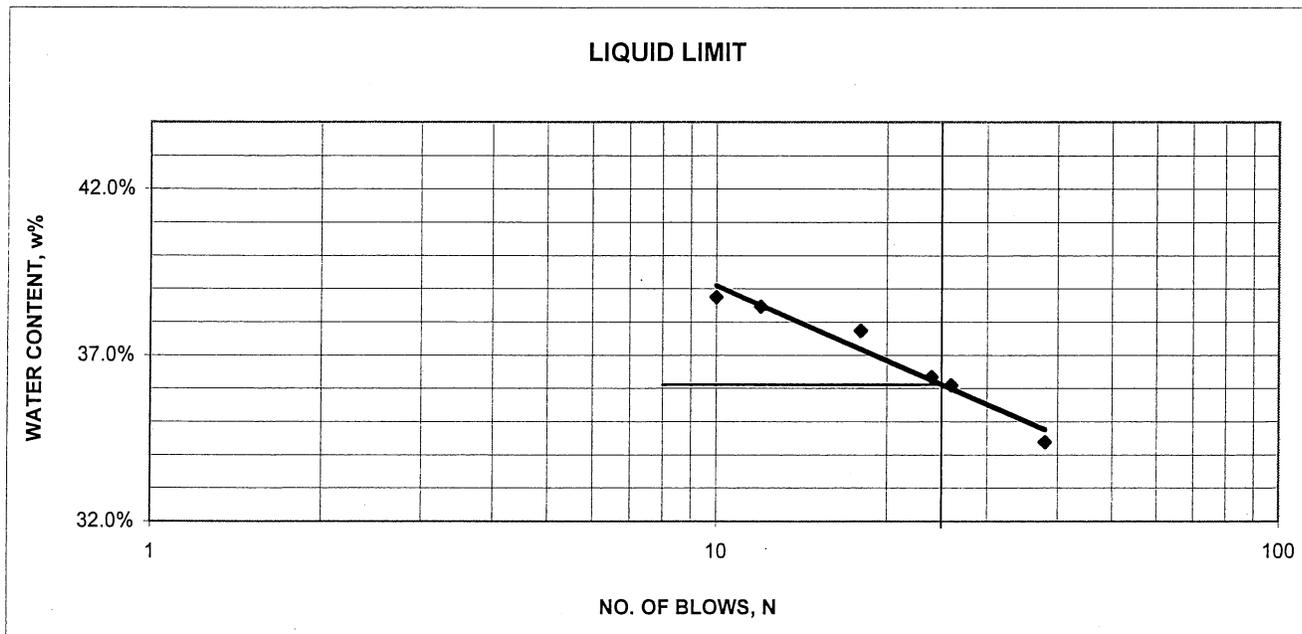


ATTERBERG LIMITS

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

Project Norfeld Colony Swine AWMS Job No. 23034
 Location of Project Brookings County Test No. 23034-PL-1
 Description of Soil Sandy clay, brown (CL) SB3 18-20' Test Method ASTM: D4318, Multipoint
 Tested By RR Test Date 12/9/2015 Reviewed by BF

Can no.	II	E	Y	U	AA	J
Mass of wet soil + can	21.29	20.76	20.73	21.95	20.78	21.03
Mass of dry soil + can	19.75	19.45	19.28	20.15	19.28	19.36
Mass of can	15.27	15.82	15.29	15.38	15.38	15.05
Mass of dry soil	4.48	3.63	3.99	4.77	3.90	4.31
Mass of moisture	1.54	1.31	1.45	1.80	1.50	1.67
Water Content, w%	34.4%	36.1%	36.3%	37.7%	38.5%	38.7%
No of Blows, N	38	26	24	18	12	10



Plastic Limit Data

Can no.	P	F	Average	
Mass of wet soil & can	19.89	19.62		Liquid limit 36
Mass of dry soil & can	19.18	18.94		Plastic limit 21
Mass of can	15.80	15.81		Plasticity Index 15
Mass of dry soil	3.38	3.13		
Mass of Moisture	0.71	0.68		
Water Content, w% = wp	21.0%	21.7%	21.4%	% retained on #200 sieve <u>37.8%</u>
% retained on #40 sieve (est.)	<u>10</u>			

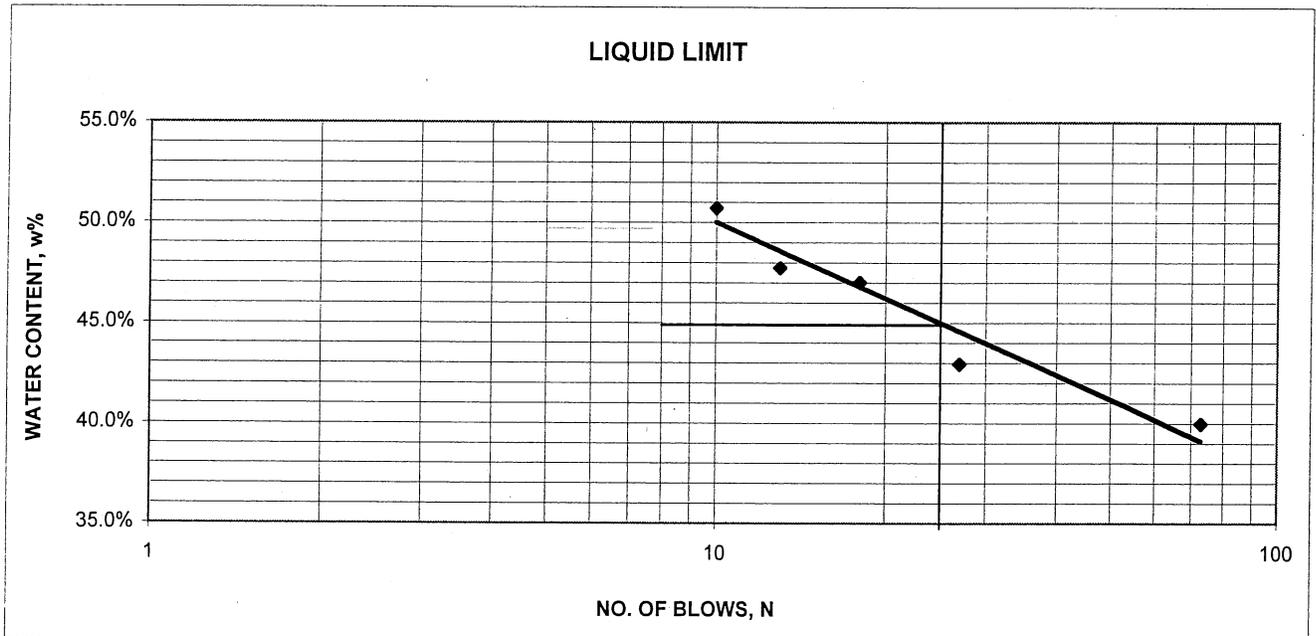


ATTERBERG LIMITS

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

Project Norfeld Colony Swine AWMS Job No. 23034
 Location of Project Brookings County Test No. 23034-PL-2
 Description of Soil Sandy clay, brown (CL) SB2 12.5-15' Test Method ASTM: D4318, Multipoint
 Tested By RR Test Date 1/14/2016 Reviewed by BF

Can no.	J	U	Y	EE	Q	Q
Mass of wet soil + can	21.60	22.67	20.00	21.42	21.54	21.54
Mass of dry soil + can	19.73	20.45	18.51	19.42	19.38	19.38
Mass of can	15.05	15.28	15.34	15.23	15.12	15.12
Mass of dry soil	4.68	5.17	3.17	4.19	4.26	4.26
Mass of moisture	1.87	2.22	1.49	2.00	2.16	2.16
Water Content, w%	40.0%	42.9%	47.0%	47.7%	50.7%	50.7%
No of Blows, N	73	27	18	13	10	10



Plastic Limit Data

Can no.	F	P	Average
Mass of wet soil & can	20.43	20.00	
Mass of dry soil & can	19.57	19.22	
Mass of can	15.80	15.81	
Mass of dry soil	3.77	3.41	
Mass of Moisture	0.86	0.78	
Water Content, w% = wp	22.8%	22.9%	22.8%

Liquid limit 45
 Plastic limit 23
 Plasticity Index 22

% retained on #200 sieve 41.9%

% retained on #40 sieve (est.) 10



ATTERBERG LIMITS

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

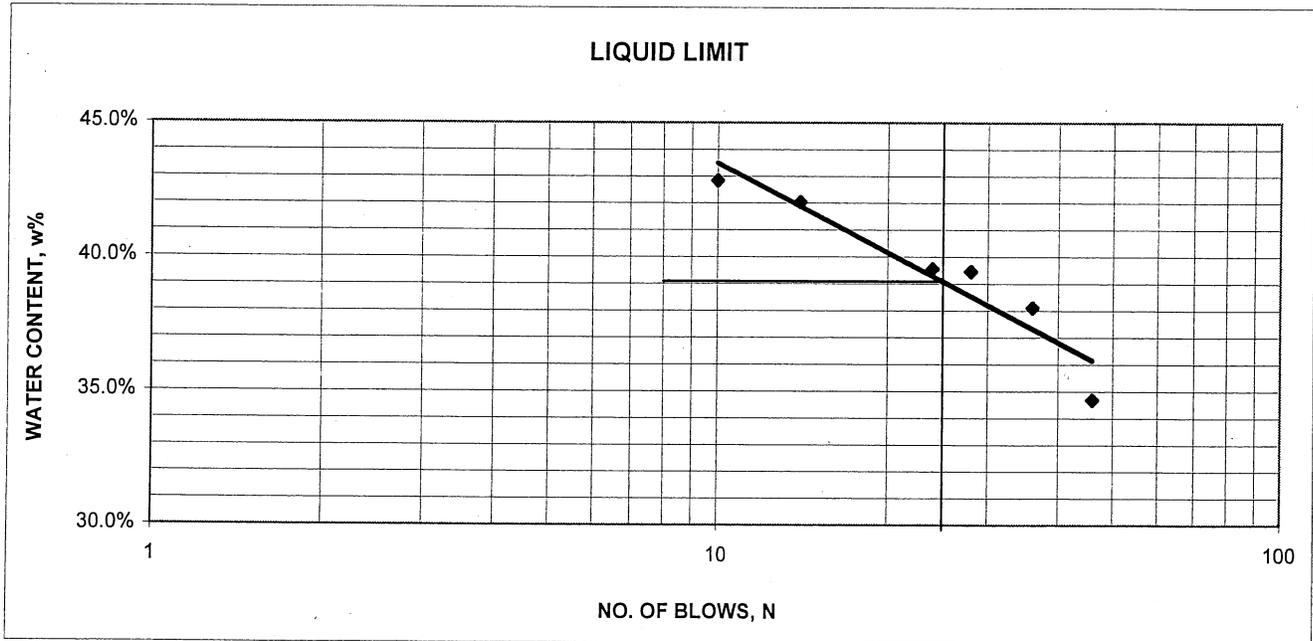
Project Norfeld Colony Swine AWMS Job No. 23034

Location of Project Brookings County Test No. 23034-PL-3

Description of Soil Sandy clay, brown (CL) SB5 16'-18' Test Method ASTM: D4318, Multipoint

Tested By RR Test Date 1/14/2016 Reviewed by BF

Can no.	R	AA	CC	HH	M	O
Mass of wet soil + can	21.43	24.83	21.96	21.09	21.90	22.60
Mass of dry soil + can	19.80	22.22	20.09	19.50	19.95	20.54
Mass of can	15.10	15.37	15.35	15.48	15.31	15.73
Mass of dry soil	4.70	6.85	4.74	4.02	4.64	4.81
Mass of moisture	1.63	2.61	1.87	1.59	1.95	2.06
Water Content, w%	34.7%	38.1%	39.5%	39.6%	42.0%	42.8%
No of Blows, N	46	36	28	24	14	10



Plastic Limit Data

Can no.	E	B	Average
Mass of wet soil & can	20.65	20.61	
Mass of dry soil & can	19.81	19.65	
Mass of can	15.81	15.11	
Mass of dry soil	4.00	4.54	
Mass of Moisture	0.84	0.96	
Water Content, w% = wp	21.0%	21.1%	21.1%

Liquid limit 39
 Plastic limit 21
 Plasticity Index 18

% retained on #200 sieve 37.9%

% retained on #40 sieve (est.) 10



PERMEABILITY TEST

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

Project Norfeld Colony Swine AWMS Project No. 23034
 Location of
 Project NE 1/4 Section 14 T111N R48W, Brookings County Test No. 23034-PM-1
 Origin of
 Soil SB3 16-18'
 Description
 of Soil Sandy clay, brown/olive (CL) Determined by Practice, ASTM D2488
 Test
 Method Increasing tailwater Preparation Method In situ
 Method of Compaction Manual Permeant Tap water

SPECIMEN DATA

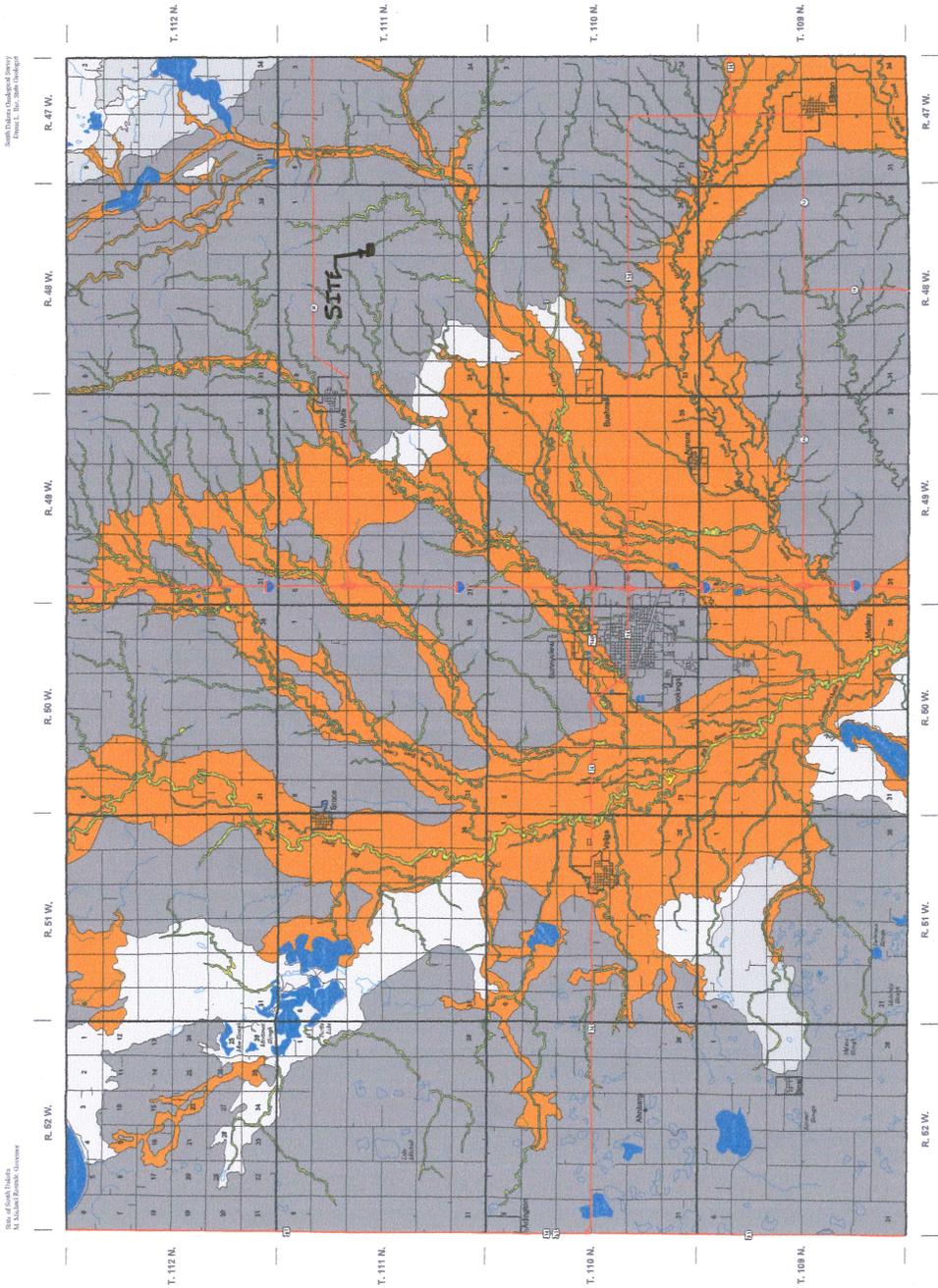
Max. Proctor Density N/A Proctor Chart No. N/A
 Dry Unit Weight 116.5 Moisture Content 17.4%
 Diameter (cm) 6.35 Length (in) 2.13
 Cross Sect. Area (cm²) 31.67

RESULTS

Hydraulic Gradient 31.83 to 45.73
 Average Hydraulic Conductivity (k) 7.12E-08 cm/sec at NA of Max. Proctor Density
 Tested By TB Date 1/27/2016

NOTES: Sample was obtained by pushing a thin wall tube into the native soils.

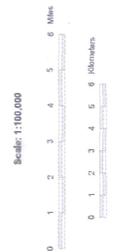
First Occurrence of Aquifer Materials in Brookings County, South Dakota



South Dakota Geological Survey
From: L. H. Schultz, 1924



Inset map of South Dakota showing the location of Brookings County



Department of Environment and Natural Resources
Division of Financial and Technical Assistance
Geological Survey
Aquifer Materials Map 18
Layne D. Schultz, 2004

Explanation

This map is intended for use as a tool to aid in identifying areas underlain by aquifer material. The aquifer materials shown on this map are categorized below. This map does not show the aquifer material that would be first encountered in a well. Within the boundaries of any given map unit, there may be localized areas where aquifer material is absent. This map is intended to show the general distribution of aquifer materials. The map is not intended to distinguish between saturated and unsaturated material. Therefore, not all of the areas defined on this map may be an aquifer. Site-specific information should always be examined prior to making land management or water development decisions.

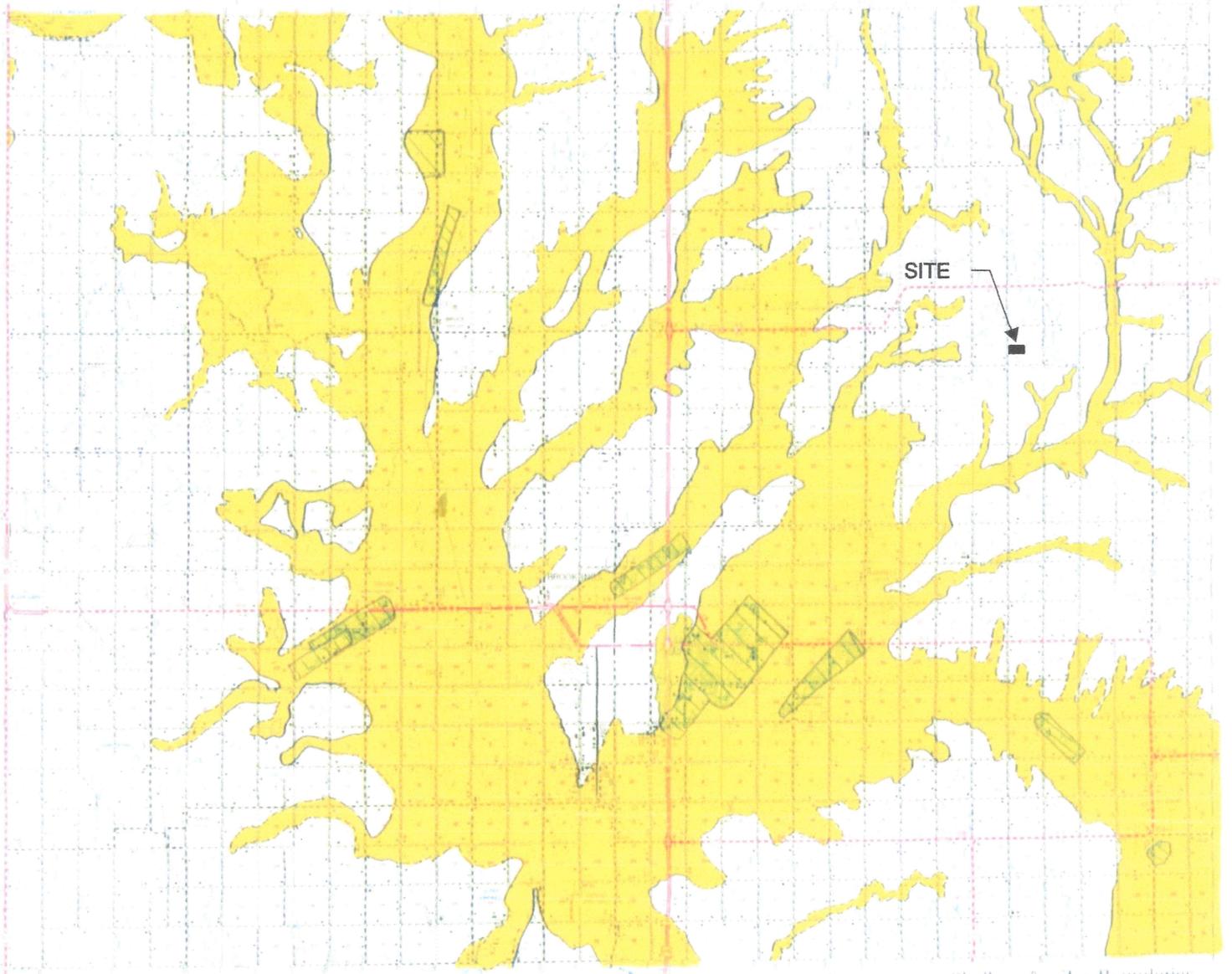
	Alluvium: Composites of clay and silt with minor amounts of sand and gravel		River or stream
	Sand and Gravel: First occurrence is generally at land surface		Lake
	Sand and Gravel: First occurrence is generally below land surface; may not be uniform in depth and thickness and may be discontinuous in lateral extent		Slough or intermittent lake
	Sand and Gravel: May not be uniform in depth and thickness and may be discontinuous in lateral extent		Major highway
	Sand and Gravel: May not be uniform in depth and thickness and may be discontinuous in lateral extent		Road
	First occurrence is generally greater than 50 feet and less than or equal to 100 feet below land surface		Township boundary
	First occurrence is generally greater than 100 feet below land surface		

For township section numbering system, see T. 112 N., R. 52 W.

- This map was developed from hydrologic logs and published maps. The major sources of information are:
- Beard, A. 1906. *Ground-water investigations for the City of Brookings*. South Dakota Geological Survey Special Report 45, 51 p.
 - 1917. *Ground-water investigations for the City of Huron*. South Dakota Geological Survey Special Report 51, 31 p.
 - Beard, A., and Hinton, D. 1915. *Ground-water study for the Brookings-Greenville River Basin*. South Dakota Geological Survey Special Report 46, 31 p.
 - Hesslein, L. J. 1949. *Water resources of Brookings and Greenville Counties*. South Dakota Geological Survey Water Resources Investigation Report 64-1185, 82 p.
 - Lee, K. Y. 1938. *Geology and hydrology of the Brookings area*. South Dakota Geological Survey Report of Investigations 14, 62 p.
 - 1939. *Geology of the Elliptical and Elliptical*. South Dakota Geological Survey Circular 1, 20 p.
 - 1940. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 2, 20 p.
 - 1941. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 3, 20 p.
 - 1942. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 4, 20 p.
 - 1943. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 5, 20 p.
 - 1944. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 6, 20 p.
 - 1945. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 7, 20 p.
 - 1946. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 8, 20 p.
 - 1947. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 9, 20 p.
 - 1948. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 10, 20 p.
 - 1949. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 11, 20 p.
 - 1950. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 12, 20 p.
 - 1951. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 13, 20 p.
 - 1952. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 14, 20 p.
 - 1953. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 15, 20 p.
 - 1954. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 16, 20 p.
 - 1955. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 17, 20 p.
 - 1956. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 18, 20 p.
 - 1957. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 19, 20 p.
 - 1958. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 20, 20 p.
 - 1959. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 21, 20 p.
 - 1960. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 22, 20 p.
 - 1961. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 23, 20 p.
 - 1962. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 24, 20 p.
 - 1963. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 25, 20 p.
 - 1964. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 26, 20 p.
 - 1965. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 27, 20 p.
 - 1966. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 28, 20 p.
 - 1967. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 29, 20 p.
 - 1968. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 30, 20 p.
 - 1969. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 31, 20 p.
 - 1970. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 32, 20 p.
 - 1971. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 33, 20 p.
 - 1972. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 34, 20 p.
 - 1973. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 35, 20 p.
 - 1974. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 36, 20 p.
 - 1975. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 37, 20 p.
 - 1976. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 38, 20 p.
 - 1977. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 39, 20 p.
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 - 1979. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 41, 20 p.
 - 1980. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 42, 20 p.
 - 1981. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 43, 20 p.
 - 1982. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 44, 20 p.
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 - 1984. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 46, 20 p.
 - 1985. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 47, 20 p.
 - 1986. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 48, 20 p.
 - 1987. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 49, 20 p.
 - 1988. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 50, 20 p.
 - 1989. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 51, 20 p.
 - 1990. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 52, 20 p.
 - 1991. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 53, 20 p.
 - 1992. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 54, 20 p.
 - 1993. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 55, 20 p.
 - 1994. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 56, 20 p.
 - 1995. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 57, 20 p.
 - 1996. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 58, 20 p.
 - 1997. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 59, 20 p.
 - 1998. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 60, 20 p.
 - 1999. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 61, 20 p.
 - 2000. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 62, 20 p.
 - 2001. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 63, 20 p.
 - 2002. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 64, 20 p.
 - 2003. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 65, 20 p.
 - 2004. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 66, 20 p.
 - 2005. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 67, 20 p.
 - 2006. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 68, 20 p.
 - 2007. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 69, 20 p.
 - 2008. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 70, 20 p.
 - 2009. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 71, 20 p.
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 - 2011. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 73, 20 p.
 - 2012. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 74, 20 p.
 - 2013. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 75, 20 p.
 - 2014. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 76, 20 p.
 - 2015. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 77, 20 p.
 - 2016. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 78, 20 p.
 - 2017. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 79, 20 p.
 - 2018. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 80, 20 p.
 - 2019. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 81, 20 p.
 - 2020. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 82, 20 p.
 - 2021. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 83, 20 p.
 - 2022. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 84, 20 p.
 - 2023. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 85, 20 p.
 - 2024. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 86, 20 p.
 - 2025. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 87, 20 p.
 - 2026. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 88, 20 p.
 - 2027. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 89, 20 p.
 - 2028. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 90, 20 p.
 - 2029. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 91, 20 p.
 - 2030. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 92, 20 p.
 - 2031. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 93, 20 p.
 - 2032. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 94, 20 p.
 - 2033. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 95, 20 p.
 - 2034. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 96, 20 p.
 - 2035. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 97, 20 p.
 - 2036. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 98, 20 p.
 - 2037. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 99, 20 p.
 - 2038. *Geology of the Huron and Huron*. South Dakota Geological Survey Circular 100, 20 p.



Brookings County Groundwater Protection Zones



Shallow Aquifer Boundaries

300 ft. accuracy ~~~~~

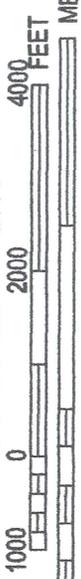
1600 ft. accuracy ~~~~~

Areas Contributing Drainage
to Zone A

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



MAP SCALE 1" = 2000'



NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0325C

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

PANEL 325 OF 700
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
BROOKINGS COUNTY 460253 0325 C

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



MAP NUMBER
46011C0325C
EFFECTIVE DATE
JULY 16, 2008

Federal Emergency Management Agency

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