United States Department of Agriculture

NRCS

Natural Resources Conservation Service
Field Support Office
1717 N. Lincoln Ave., Suite 104
Pierre, South Dakota 57501-7800

Telephone: (605) 224-2476, extension 5
Fax: (605) 224-6615

October 22, 2009

Mr. Jeff Stewart, Coordinator
Randall Resource Conservation & Development
P. O. Box 247
Lake Andes, SD 57356

Dear Mr. Stewart:

As requested by your office, I have reviewed boring logs that were performed as a preliminary site investigation for the Lake Andes Restoration Project and have the following comments.

All 3 boring logs indicate that clays--CL or CH--are located within the profile and start at the boring depth of 1 foot to 5 feet and extend as deep as 15 feet (see attached logs). Boring number 3 indicated that CH material is located within 5 to 15 feet (bottom limit of boring) of the surface. Generally, this type of material is preferential in the construction of dams and dikes. Borings 2 and 3 indicated a presence of sand within 0 to 3 feet of the surface. This accumulation was more than likely due to grading and separation of materials by past wave action. In consultation with Soil Scientist Darrell VanderBusch, who performed the borings, we feel with proper mixing of this sandy material (which should be a minimal amount) with the underlying clays that an adequate blend of material would be achieved for the utilization of fill on the proposed dike. Organics located at the top of the profile would be removed as they are not desirable for fill material.

Although desirable fill material is present, moisture contents are not clear enough to determine the method of removing and placing this material and whether it will need to be dried in order to obtain optimum moisture for compaction. Based on the boring information, a determination cannot be made on this issue. I believe the soil borings that were performed were intended to determine if clays were present or if sands, gravels, or organic material were so excessive that the material could not be utilized for fill. Due to the fact that suitable clayey material is present, further investigations would be warranted as the project plan/design is developed.

Although the borings provide direct information for each location, it is hard to see (1) how they relate to each other, (2) the identified water tables that were encountered and recorded on the logs, and (3) how the borings relate to a proposed design such as a required depth of the proposed pond, which I am assuming will require some amount of excavation. In order to bring more value to the borings, I would recommend obtaining ground elevations at each boring and the existing water level of the lake, tying all of the data together on a vertical datum. I can perform this task utilizing survey grade GPS.

When a vertical/horizontal datum is established, further evaluation of suitability of soils can be made. At the time of this review, all that can be extracted from the soil borings is that material is present within the boring profile that is consistent with the type of fill required for construction of dam or dike embankments; but it is dependent on the amount of moisture or ground water that may be encountered at the time of construction. As the design of the embankment and associated pond develops along with required depths of excavation and associated fill quantities, then it is recommended that further borings or excavations be performed to confirm the existing soils on site. In order to address the existing moisture content present in the proposed fill material, a sample should be obtained and tested from within the area that has been determined to be excavated. Eventually laboratory testing should be performed to determine the moisture-density relationship of the specific proposed fill material. This will identify a range of moisture in the soil that is required in order to obtain maximum density when it is placed as fill.

In summary, the borings that were performed indicate a substantial amount of clayey material is present in the project area that possibly (dependent on moisture content/water tables) may be utilized for fill material. Further soils investigations should be performed upon the completion of a preliminary layout/design of the project. This will ensure that the actual proposed material that will be excavated for fill placement is suitable for construction or if an alternative borrow site is required.

Please call me at 224-2476, extension 135, if you have any questions.

Dana Edwards

DANA B. EDWARDS, PE, LS
Civil Engineer

Attachments

cc: Chuck Ring, ASTC (FO), NRCS, Pierre FSO

Charles Mix County

Lake Andes Project

U.S. DEPARTMEN AGRICULTURE
Natural Resources Conservation Service

ENG-10

EARTH BORING DOCUMENTATION

Cooperator: Lake Andes Watershed Improvement Project
Practice:
Farm: Tract: Field:
Site Investigator/s: Stewart, Deurmier, VanderBusch
Drilling Location: North side of turn around

County: Charles Mix
Conservation District:
NE 1/4 Sec. 9 T 96 R 65
Hole Elevation:

Date: 11-Aug-09
Hole No: 1
Soil Name:
Sample Taken:

Depth	Unified Soil Class Symbol	Group Name Soil Material
0		
1	ML-CL	silty clay
2	CL	lean clay
	↓ CH	fat clay
3.5		
5	CH	fat clay
	GM	silty gravel
10		
15		
20		
25		

Description of Material

Depth (ft)	Munsell Color	USDA Texture	Unified Classification	Geological Material Oxidized/ Unoxidized	WT:	Permeability Group *	Other: (Consistency, Stratification, Moisture Content, etc.)
0-1	10YR 22	loam	ML-CL	alluvium		II	moist
1-2	10YR 3/2	clay loam	CL	alluvium		III	moist
2-3.5	2.5Y 3/2	clay	CH	alluvium		IV	moist
3.5-5	2.5Y 5/6	clay	CH	alluvium		IV	moist
5-5.5+	2.5Y 6/3	sand & gravel	GM	alluvium	5 foot	I	saturated

Comments:

Alluvium, may have been washed in when vehicle turn around was placed in lake.

Area vegetated with trees and sedges.

Soil borings completed with an auger. Water table is in sand and gravel.

N

Location Map

Unified Symbols & Group Names

GW:	well graded gravel	SW:	well graded sand	CL:	lean clay
GP:	poorly graded gravel	SP:	poorly graded sand	CL-ML:	silty clay
GC:	clayey gravel	SC:	clayey sand	ML:	silt
GM:	silty gravel	SM:	silty sand	CH:	fat clay
				MH:	elastic silt

Table 10D-3**

Soil Group	Median K cm/s	Median K ft/d *
I	7.2x10-4	2.0
I	3.5x10-4	1.0
II	4.8x10-6	0.014
II	1.5x10-6	0.004
III	8.8x10-7	0.0025
III	2.1x10-7	0.0006
IV	4.9x10-7	0.0014
IV	3.5x10-8	0.0001

** "Table 10D-3 summarizes a total of 1,161 tests."

Agricultural Waste Management Field Handbook
Chapter 10

Table 10D-2

Unified Classification vs. Soil Permeability Groups*

Unified Class	Permeability Group: I	II	III	IV	in Permeability Group:	
CH	N	N	S	U		
MH	N	S	U	S	A=	Always
CI	N	S	U	S	N=	Never
ML	N	U	S	N	S=	Sometimes
CL-ML	N	A	N	N	U=	Usually
GC	N	S	U	S		
GM	S	U	S	S		
GW	A	N	N	N		
SM	S	S	S	S		
SC	N	N	U	S		
SW	A	N	N	N		
SP	A	N	N	N		
GP	A	N	N	N		

U.S. DEPARTMEN AGRICULTURE
Natural Resources Conservation Service

ENG-10

EARTH BORING DOCUMENTATION

Cooperator: Lake Andes Watershed Improvement Project
Practice:
Farm: Tract: Field:
Site Investigator/s: Stewart, Deurmier, VanderBusch
Drilling Location: South of road.

County: Charles Mix
Conservation District:
Ne 1/4 Sec. 9 T 96 R 65
Hole Elevation:

Date: 11-Aug-09
Hole No: 2
Soil Name:
Sample Taken:

Depth	Unified Soil Class Symbol	Group Name Soil Material
0		
1	GM	silty gravel
2	GC	clayey gravel
3	SM	silty sand
4	CL	lean clay
4.5	CH	fat clay
5	CL	lean clay
10		
15		
20		
25		

Description of Material

Depth (ft)	Munsell Color	USDA Texture	Unified Classification	Geological Material Oxidized/ Unoxidized	WT:	Permeability Group *	Other: (Consistency,Stratification, Moisture Content, etc.)
0-1	2.5Y6/3	coarse sandy loam	GM	alluvium		I	stratified, wet
1-2	2.5Y 6/3	Sand & Gravel	GC	alluvium	water table	II	stratified, saturated
2-3	2.5Y 6/3	Loamy Coarse sand	SM	alluvium		II	stratifed saturated
3-4	2.5Y4/2	sandy loam	CL	alluvium		II	moist
4-4.5	2.5y 5/3	clay	CH	glacial till		IV	moist
4.5-5.5	2.5Y 6/5	clay loam	CL	glacial till		III	moist

Comments:

Soil boring number 2 is coarse material over glacial till to 5.5 feet. Dug with an auger. Water worked sediments over glacial till.

Water table is in the coarse sediments.

N

Location Map

Unified Symbols & Group Names

GW:	well graded gravel	SW:	well graded sand	CL:	lean clay
GP:	poorly graded gravel	SP:	poorly graded sand	CL-ML:	silty clay
GC:	clayey gravel	SC:	clayey sand	ML:	silt
GM:	silty gravel	SM:	silty sand	CH:	fat clay
				MH:	elastic silt

Table 10D-3**

Soil Group	Median K cm/s	Median K ft/d *
I	7.2x10-4	2.0
I	3.5x10-4	1.0
II	4.8x10-6	0.014
II	1.5x10-6	0.004
III	8.8x10-7	0.0025
III	2.1x10-7	0.0006
IV	4.9x10-7	0.0014
IV	3.5x10-8	0.0001

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Unified Class	Permeability Group: I	II	III	IV	In Permeability Group:	
CH	N	N	S	U		
MH	N	S	U	S	A=	Always
Cl	N	S	U	S	N=	Never
ML	N	U	S	N	S=	Sometimes
CL-ML	N	A	N	N	U=	Usually
GC	N	S	U	S		
GM	S	U	S	S		
GW	A	N	N	N		
SM	S	S	S	S		
SC	N	N	U	S		
SW	A	N	N	N		
SP	A	N	N	N		
GP	A	N	N	N		

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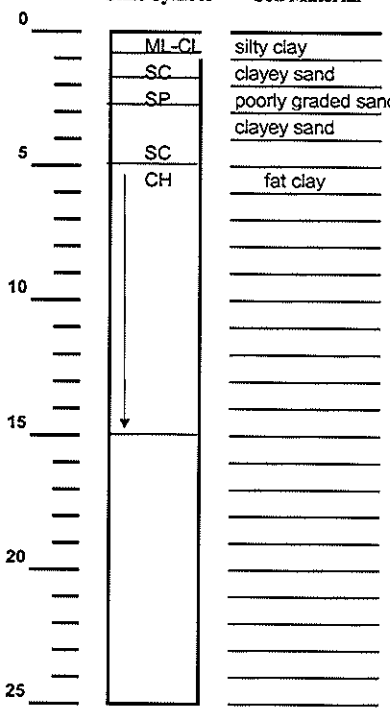
EARTH BORING DOCUMENTATION

Cooperator: Lake Andes Watershed Improvement Project
Practice:
Farm: Tract: Field:
Site Investigator/s: Stewart, Deurmier, VanderBusch
Drilling Location: NE of vehicle turn around, along trail

County: Charles Mix
Conservation District:
NE 1/4 Sec. 9 T 96 R 65
Hole Elevation:

Date: 11-Aug-09
Hole No: 3
Soil Name:
Sample Taken:



Description of Material							
Depth (ft)	Munsell Color	USDA Texture	Unified Classification	Geological Material Oxidized/ Unoxidized	WT:	Permeability Group *	Other: (Consistency,Stratification, Moisture Content, etc.)
0-0.5	10YR 2/1	sandy clay loam	ML_CL	alluvium		II	A horizon material, about 8 percent organic carbon
0.5-1.5	10YR 2/1	sandy clay loam	SC	alluvium	water table	III	A horizon material, about 6 percent organic carbon
1.5-2.5	2.5Y 4/2	loamy coarse sand	SP	alluvium	water table	I	saturated
2.5-5	2.5Y 4/2	sandy clay	SC	alluvium	water table	III	saturated, four inches sandy loam material
5-15	2.5Y5/3	clay	CH	glacial till		IV	moist

Comments:

Auger hole to 15 foot. Glacial till material from 5 to 15 foot.

Water table in coarse material above glacial till.

N

Location Map

Unified Symbols & Group Names

GW:	well graded gravel	SW:	well graded sand	CL:	lean clay
GP:	poorly graded gravel	SP:	poorly graded sand	CL-ML:	silty clay
GC:	clayey gravel	SC:	clayey sand	ML:	silt
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MH	N	S	U	S	A=	Always
CI	N	S	U	S	N=	Never
ML	N	U	S	N	S=	Sometimes
CL-ML	N	A	N	N	U=	Usually
GC	N	S	U	S		
GM	S	U	S	S		
GW	A	N	N	N		
SM	S	S	S	S		
SC	N	N	U	S		
SW	A	N	N	N		
SP	A	N	N	N		
GP	A	N	N	N		