State of South Dakota
BUREAU OF HUMAN RESOURCES AND ADMINISTRATION

Office of the State Engineer
523 East Capitol Ave, Pierre, South Dakota 57501
605.773.3466 / boa.sd.gov/state-engineer

ADDENDUM #01

December 20, 2024

Project: SWFR 0827, NEW SWINE TEACHING AND RESEARCH FACILITY
SOUTH DAKOTA STATE UNIVERSITY
BROOKINGS, SOUTH DAKOTA
OSE# R0325--08X

Design Build Proposals Due: January 9, 2025
4:00 PM CT

Price Proposals Due: January 16, 2025
3:30 PM CT

At: Office of the State Engineer
Joe Foss Building
523 East Capitol Avenue
Pierre, South Dakota 57501-3182

Owner: State of South Dakota, Board of Regents

Scope of this Addendum:

The following becomes a part of the original Project Manual, taking precedence over items that may conflict.

Item No. 1 Change in construction schedule: See attached Design-Build Proposal Form and Schedule of Activities for revised construction dates.

Item No. 2 See attached list of design-build questions with answers.

Item No. 2 See attached geotechnical borings for the existing facility.

STACY WATTERS, P.E.

STACY WATTERS, PE
State Engineer
Office of the State Engineer

DESIGN-BUILD PRICE PROPOSAL FORM

All Price Proposals shall be submitted via the OSE Electronic Bidding Platform, details below:

OSE Electronic Bidding

Submit Bid

Overview

The undersigned, being familiar with the local conditions affecting the work, and with the Contract Documents, including the Invitation to Bid, Instructions to Design-Builder's, Bid Form, Explanation of Alternates, Modification to Bid Form, Bid Bond Form, Performance and Payment Bond, Acknowledgment of Surety, Sample Certification of Surety, Non-Resident Design-Builder Affidavit, Form of Agreement for Construction, General Conditions, Special Conditions, Technical Specifications, Plans and Addenda which govern the purchase of material and labor and the awarding of contracts hereby proposes to do all the work and provide all the material and equipment for the project.

Price Proposal Opening Date:	**January 16, 2025**	
Price Proposal Opening Time:	**3:30 PM CT**	
Date of Project Manual:	**December 5, 2024**	
Substantial Completion Date:	**August 14, 2026**	w/ Liquidated Damages: **$400.00 per calendar day**
Final Completion Date:	**August 28, 2026**	

Total value of material subject to tax: **$0**

Any material furnished by the State for use in this project is subject to Use Tax and Excise Tax.

Link to Price Proposal: https://www.sd.gov/cs?id=sc_cat_item&sys_id=bbf3de62870e9e10a086bae9cebb35ba

ATTENTION DESIGN-BUILDERS!

- ***TECHNICAL DIFFICULTIES:*** *OSE is not responsible for technical difficulties resulting from the electronic bidding platform.*
- ***MODIFY BIDS:*** *It is highly recommended that contractors submit their bid early and modify as needed prior to the bid closing. Please note, bids may be modified as many times as desired prior to the bid opening date/time as well as withdrawn at any point prior to the bid opening.*
- ***SESSION TIMEOUT:*** *The online bidding platform session will timeout if left open for too long, therefore bids need to be submitted in a timely manner as to ensure the information is not lost and other errors do not occur.*

1. GENERAL INFORMATION

a) SCHEDULE OF ACTIVITIES (SUBJECT TO CHANGE) RFP Publication **05 DECEMBER 2024**

Deadline for Submission of Written Inquiries	**31 DECEMBER 2024**
Responses to Offeror Questions	**03 JANUARY 2025**
Qualitative & Management Proposal Submission	**09 JANUARY 2025 @ 3:00 PM CT**
Deadline for Scoring Proposals	**14 JANUARY 2025**
Price Proposal Opening	**16 JANUARY 2025 @ 3:30 PM CT**
Anticipated Award Decision/Contract Negotiation	**24 JANUARY 2025**
Construction Start	**APRIL 2026**
Substantial Completion	**AUGUST 14, 2026**
Final Completion	**AUGUST 28, 2026**

b) The above Construction Start schedule is tentative assuming legislative approval during the 2026 Session and dates are to be finalized when Legislative Authority is granted and notice to proceed is given.

2. SCOPE OF WORK

a) See attached SDSU Swine Education and Research Facility – Owner's Project Requirements. Note: There are no plans and specifications, just diagrams and Owner Requirements. The design build team will produce the plans and specifications. Also, can we refer to this document as a request for proposals or design criteria. This is not a project manual containing all of the information required to construct the project.

b) The Design-Builder shall be responsible for the design, preparation, and acquisition of all required permits, including all legal expenses associated therewith and for any appeals of therefore. Permit applications and related documents shall be prepared and submitted to the appropriate parties.

c) WARRANTIES

i. Design-Builder shall list all major component construction warranties and insurance, including but not limited to:

01. Team Project Insurance or Liability Coverage for Design and Construction and all Warranties.

02. Product Warranties.

03. Ensure existing warranties on the campus are maintained.

3. PROPOSAL REQUIREMENTS AND COMPANY QUALIFICATIONS

a) The offeror is cautioned that it is the offeror's sole responsibility to submit information related to the evaluation categories and that the State of South Dakota is under no obligation to solicit such information if it is not included with the proposal. The offeror's failure to submit such information may cause an adverse impact on the evaluation of the proposal.

b) Offeror's Contacts: Offerors and their agents (including subcontractors, employees, consultants, or anyone else acting on their behalf) must direct all of their questions or comments regarding the

RFP, the evaluation, etc. to the Owner. Offerors and their agents may not contact any state employee other than the Owner of record regarding any of these matters during the solicitation and evaluation process. Inappropriate contacts are grounds for suspension and/or exclusion from specific procurements.

DESIGN-BUILD QUESTIONS AND ANSWERS

1. Excavation
   - Cut and fill calculations for fill needed to leave site done solely by the design builder? This will be required to be done by the design-builder.
   - Soil borings done? Water table levels? Quote to include all water removal in any situation meaning taking risk on all weather? We are in the process of trying to get soil borings done before the price proposal is submitted. Also see attached geotechnical report from the existing facility.
2. Clarify Architect/engineer designed. No stamp needed for bidding? Does this include electrical and plumbing and Civil? – First page of contract after awarded project? Stamp plans will be needed by the A/E and MEP prior to construction, and not for bidding. Price proposals will be based on schematic design.
3. Electrical
   - Service size and generator don't really match? Service size way more than power required? Sized for the possibility of future expansion.

1. Presentation of Proposal
   - Number of envelopes being submitted clarified – 2? Qualitative and Management (no identification) Delivery by mail or in person? The qualitative and management proposals need to be in separate envelopes, but can be sent or delivered in person in one envelope. The OSE secretary will open the envelopes to make sure that there are no names on the proposal and label them A – X.
   - Electronic Price proposal clarified. This will be the total price of the project including design and construction. This number will be inserted into the online bidding platform as a base bid.
2. How to confirm list of all addenda we have received? Any addenda will be noted on the on-line bidding platform and there will be a box to check.
3. Do we need to make a statement on asbestos? The asbestos state is at the front of the project manual and does not need to be noted. It would only need to be discussed if there is asbestos found during construction.
4. 24 gauge roof steel – Yes, 24 gauge is fine
5. Example of value engineering letter? Roof steel? Value Engineering would only be utilized after a firm is selected through the design-build process.
6. Example of Alternates? What we would call options? There are not any alternates on this project.
7. Permits needed =utility and other page 70. City permits? There are no permits required as this is on State property.
8. #1 item design builders miss in the government bidding process. This would be putting the companies name or name of people in the qualitative proposal.
9. Management Proposal – Understand the request and reasoning. Should this include testimonials for each item? This is mainly to describe how the project would be managed from start of design to construction closeout. For the management proposal, you should list all of the members of the design-build team. The State will review and score the qualitative proposals first, then score the management proposals and then combine the two scores.
10. Will the swine watering systems be provided by the "owner" and only plumbed to by the plumber? Or what is the expectation for water supplies? To what extent is the team to provide

water to what fixtures? SDSU would prefer that it be part of the bid. Provide 1 cup waterer in each pen, just like in the existing rooms.

11. Will the manure pump out areas be fitted with a permanent pumping system? Is that furnished by owner? Or is a pumping system brought in only at times of pump out? Is there a power requirement for any pump system? There is a pump out port (4' x 4' ish) that goes into the manure pit on each room. SDSU hires a commercial company to come in, agitate the manure in the pit, and pump it out. So the answer is no permanent pumping system, and a commercial company will come in and pump it out.
12. Do you currently have an automated system operating the fan systems or are they manually operated? The entire ventilation is fully automated and is AP's Expert System. This system is requested in the new rooms.
13. Do we plan on using bulk bins and bag feed in the new barn? Yes, SDSU would like 6 bulk bins for each of the two rooms, same size as are at the current Nutrition Rooms. Also, provide additional storage for bagged feed. Some of the diets have to be bagged, especially for nursery trials so both are needed.
14. We did notice that the existing facility has feed storage with a feed logic feed mix system that is on a rail to move it around the facility. Is the intention to have the structure ready for this system to be put in at a later date? The RFP mentions sizing the joists to supports the feed rail. But again, doesn't mention providing any such feed measuring / or grain storage / distribution systems. The feed delivery system will be included as part of the project. It will be a manual feed system on rails in each room. The building structure will need to be designed to accommodate the additional weight.

Geotechnical Engineering
Environmental Services
Materials Testing

September 15, 2014

SD Bureau of Administration
Office of the State Engineer
Joe Foss Building
523 E Capitol Avenue
Pierre, SD 57501

Attn: Mr. John Ullmann

RE: Report of Geotechnical Exploration and Review
Proposed Swine Teaching & Research Facility
South Dakota State University Campus
2171 Medary Avenue
Brookings, South Dakota
CEC #14-034

Dear Mr. Ullmann,

This report presents the results of a subsurface exploration program and geotechnical engineering review for the proposed swine teaching and research facility to be constructed on the South Dakota State University campus in Brookings, South Dakota. This work was conducted in accordance with the contract between the Office of the State Engineer and Core Engineering & Consulting, Inc. (CEC) dated July 9, 2014. We are submitting three (3) copies of the report to you.

The opinions expressed in this report are based on information provided by you and the data obtained from our subsurface exploration. Should there be any changes as the project develops, we request that we be notified so that these new conditions can be reviewed and, if necessary, we can modify our recommendations

The soil samples remaining after the laboratory testing is completed will be retained for a period of one month, at which time they will be discarded. Please advise us in writing if you wish to have us retain them for a longer period of time.

CEC appreciates the opportunity to provide these services to you. As your project proceeds, we would be interested in providing additional geotechnical and construction materials engineering services. If you have any questions about this report, or if you require additional information, feel free to contact us.

Sincerely,

Core Engineering & Consulting, Inc.

Victoria Job, EIT
Staff Engineer
victoria@coresd.com

REPORT OF GEOTECHNICAL EXPLORATION
AND
ENGINEERING REVIEW

Proposed Swine Teaching & Research Facility

South Dakota State University
2171 Medary Avenue
Brookings, South Dakota

CEC Job No.: 14-034

Report Date: Monday, September 15, 2014

Prepared For: Bureau of Administration
Office of the State Engineer
523 East Capitol Avenue
Pierre, South Dakota

PROJECT SUMMARY

Core Engineering & Consulting, Inc. (CEC) mobilized to the site in Brookings, South Dakota on August 13, 2014 to perform a subsurface exploration program and subsequent engineering review. The purpose of the work performed on this site is to provide you and your project team the necessary subsurface soil information to adequately plan, design and construct the project.

The proposed project, as we understand it, consists of constructing a 16,500 ft² wean-to-finish research barn, a 15,500 ft² teaching & research facility, a 1,700 ft² composting facility, feed bins, gravel-surfaced driveways & loadout areas and a gravel-surfaced parking lot on the site. Both the wean-to-finish research barn and the teaching & research facility are planned to be supported on shallow spread footings bearing approximately 10' below grade to facilitate a manure pit area while the composting facility is planned to be supported on shallow spread footings bearing 5' below grade for frost protection. We estimate the structures will produce loads not exceeding 4 kips/foot at supporting walls and 100 kips at columns while the foundation loads for the storage bins, loaded to capacity, will not exceed 425 kips each. Changes in perimeter site grades are expected to be +2'.

The field exploration consisted of twelve (12) Standard Penetration Test (SPT) borings drilled and sampled to depths of 11' to 16' below existing surface grade each. The borings encountered approximately 1½' to 2' of surficial topsoil overlying mixed layers of fine and coarse grained alluvial soils. All 12 borings encountered glacial till soils underlying the mixed alluvium, extending to the full depth of exploration at each boring location. Groundwater measurements were taken within each of the open boreholes immediately after drilling and up to 1½ days following drilling. Groundwater was encountered within each of the open boreholes at a depth as shallow as 4.1' below existing surface grade. Boring #11 was completed with a standpipe piezometer to facilitate long-term groundwater level monitoring.

The site soils were found to consist primarily of mixed alluvium and glacial deposits in a moist to wet state. The SPT N-values indicated the soils range from very soft to very stiff and very loose to dense. Based on the field and laboratory testing, we make the following recommendations:

- Prior to fill or footing placement, all topsoil and soils containing significant root structure should be removed from the building footprints, roadway areas and any other areas to receive fill
- Excavations for footings and floor slabs should be extended a minimum of 18" below slab bearing elevation to facilitate placement of a compacted granular bedding layer
- Following the mass excavation for the barns and pavement areas, and prior to new fill placement, the exposed subgrade soils should be scarified to a minimum depth of 12", moisture-conditioned to be near the Standard Proctor optimum moisture content, and re-compacted to a minimum of 95% of the Standard Proctor maximum dry density
- Structural fill placed in support of footings and manure pit slabs should consist of clean, coarse granular engineered fill soils with a maximum aggregate size of 2", less than 40% finer than the #4 sieve and less than 5% finer than the #200 sieve
- Following the above soil corrections, the buildings can be constructed using spread-footing type shallow foundations designed using a maximum allowable soil bearing capacity of 2,000 psf; footings for heated buildings should be placed a minimum of 42" below exterior grade for frost protection while footings for unheated building(s) should bear a minimum of 60" below finished grade for frost protection
- Fill placed in support of structures and pavement surfaces should be placed in thin, horizontal lifts, at or near the Standard Proctor optimum moisture content, and should be compacted to a minimum of 95% of the Standard Proctor maximum dry density
- Foundation wall/manure pit backfill should consist of granular fill soils with a maximum aggregate size of 2" containing less than 12% by weight finer than the #200 sieve (clay/silt portion), compacted to a minimum of 95% of the Standard Proctor maximum dry density for walls designed using an at-rest equivalent fluid density of 50 pcf or less; if on-site soils are used as backfill, walls should be designed using an at-rest equivalent fluid density of 90 pcf.

These recommendations are summarized, please read the entire report for additional details.

TABLE OF CONTENTS

TABLE OF CONTENTS

REPORT OF GEOTECHNICAL EXPLORATION AND ENGINEERING REVIEW
PROPOSED SWINE TEACHING & RESEARCH FACILITY
SOUTH DAKOTA STATE UNIVERSITY
BROOKINGS, SOUTH DAKOTA

CEC #14-034

INTRODUCTION

This report presents the results of a subsurface exploration program and geotechnical engineering review for the proposed swine teaching and research facility to be constructed on the South Dakota State University campus in Brookings, South Dakota. To protect you, Core Engineering & Consulting, Inc. (CEC), and the public, we authorize use of the opinions and recommendations in this report only by you and your project team for this specific project. Contact us if other uses are intended.

Prior to releasing plans and specifications for bidding and/or construction, we request the opportunity to review said documents to verify our recommendations have been correctly interpreted. Even though this report is not intended to provide sufficient information to accurately determine quantities and locations of particular materials, we recommend that any potential contractors be advised of the report availability.

BACKGROUND INFORMATION

Previous Site Usage

At the time of our exploration, the site consisted of existing swine and storage barns along with buildings to be demolished as part of the construction. A ground-supported water storage reservoir used as part of the Brookings Municipal Water System is located immediately south of the proposed development. The balance of the site is currently used as horse pasture by the University.

No evidence is available which indicates the site has ever had any other previous use than the current development or other agricultural uses.

Proposed Construction

Based on the information provided, we understand that the anticipated construction will be a 16,500 ft² wean-to-finish research barn, a 15,500 ft² teaching & research facility, a 1,700 ft² composting facility, feed bins, gravel-surfaced driveways & loadout areas and a gravel surfaced

parking lot on the site. The wean-to-finish research barn and the teaching & research facility are each planned to be supported on shallow spread footings bearing approximately 10' below grade to facilitate manure pit areas while the composting facility is planned to be supported on shallow spread footings bearing a minimum of 5' below finished surface grade for frost protection with a slab-on-grade interior floor slab. Changes in perimeter site grades are expected to include approximately 2' of fill with finished floor elevations on each of the buildings approximately 2' above that of the existing swine research barn which is to remain as part of the new facility.

Based on this description, we will assume that footing loads will not exceed 4 kips/foot at supporting walls and 100 kips at columns for each the wean-to-finish research barn and the teaching & research facility. The composting facility is expected to have foundation loads of less than 2 kips/foot at supporting walls with no interior columns. The feed storage bins, loaded to capacity, are not exceed to exceed 425 kips each.

The above project information represents our understanding of the proposed construction. This information is an integral part of our engineering review. It is important that you contact us if there are changes from that described so that we can evaluate whether changes in our recommendations are appropriate.

Authorized Scope of Services

CEC's services for this project were performed in accordance with the contract between the Office of the State Engineer (OSE) and Core Engineering & Consulting, Inc. (CEC) dated July 9, 2014. The authorized scope of services for this project consists of the following:

- Drill twelve (12) Standard Penetration Test (SPT) borings to depths of 15' each within the proposed building footprints
- Drill two (2) SPT borings to depths of 10' each within the proposed compost building footprint
- Drill one (1) SPT boring to a depth of 20' below existing surface grade near the site perimeter to be finished as a standpipe piezometer to evaluate long term groundwater conditions prior to and during construction
- Perform laboratory analyses on select soil samples to aid in classification and engineering review
- Perform a geotechnical engineering analysis based on the above and prepare this report

After final approval of the contract between OSE and CEC, SDSU Physical Plant personnel requested a modification to the scope of services due to their assumed consistency of the site soils. As a result, two of the deeper building borings were omitted and the standpipe piezometer was

installed within one of the borings drilled for the composting facility instead of in an independent borehole near the site perimeter. The change to the contracted scope included 45 less total feet of borehole and 5 less feet of installed piezometer.

The contracted scope of services is intended for geotechnical purposes only and is not intended to explore for the presence or extent of environmental contamination at the site or provide opinions regarding the status of the site relative to "wetland" definitions.

METHODOLOGIES

Field Testing & Observations

The subsurface exploration program consisted of twelve (12) standard penetration test borings. The field testing was performed on August 14th and 15th, 2014.

The approximate soil boring locations are shown on attached Figure 2. Boring locations were determined in the field based on a drawing provided by you. Surface elevations were measured in the field by use of an engineer's level. The top of the water storage reservoir foundation, located immediately south of the site, was used as a benchmark for the project.

Drilling

The standard penetration test borings were drilled using 3¼" I.D. hollow-stem augers. The boreholes were backfilled in compliance with State and local regulations.

Sampling

Split-Spoon Samples (SS)

Soil sampling was performed according to the procedures described by ASTM:D1586. Using this procedure, a two-inch O.D., split-barrel sampler is driven into the soil by a 140-pound weight falling 30 inches. After an initial set of six inches, the number of blows required to drive the sampler an additional 12 inches is known as the penetration resistance, or N-value. The N-value is an index of the relative density of cohesionless soils and the consistency of cohesive soils.

Sampling Limitations

Unless actually observed in a sample, contacts between soil layers are estimated based on the spacing of samples and the action of drilling tools. Cobbles, boulders and other large objects generally cannot be recovered from test borings. They may still be present in the ground even if they are not noted on the boring logs.

Soil Classification

Included are the Subsurface Boring Log sheets, indicating the depth and identification of the various strata, the N-value, the laboratory test data, water level information and pertinent information regarding the method of maintaining and advancing the boreholes. Soil classifications shown on the boring logs are based on the Unified Soil Classification (USC) system. The USC system is described in ASTM:D2487 and D2488. Where laboratory classification tests (i.e. particle size analyses and Atterberg Limits) have been performed, classifications per ASTM:D2487 are possible. We have attached charts illustrating the USC system, the descriptive terminology and the symbols used on the boring logs.

As the samples were obtained in the field, they were visually and manually classified by a field geologist in accordance with ASTM:D2488. Representative portions of all samples were then sealed and returned to the laboratory for further examination and for verification of the field classification. The boring logs also include judgments of the geological depositional origin. This judgment is primarily based on observation of the soil samples, which can be limited. Observations of the surrounding topography, vegetation and development can sometimes aid this judgment.

Water Level Measurements

The ground water measurements are shown at the bottom of the boring logs. The following information appears under "Water Level Measurements" on the logs:

- Date and Time of measurement
- Sampled Depth: lowest depth of soil sampling at the time of measurement
- Casing Depth: depth to bottom of casing or hollow-stem auger at time of measurement
- Cave-in Depth: depth at which measuring tape stops in the borehole
- Water Level: depth in the borehole where free water is encountered
- Drilling Fluid Level: same as Water Level, except the liquid in the borehole is drilling fluid, if used

The true location of the water table at the boring locations may be different than the water levels measured in the boreholes. This is possible because there are several factors that can affect the water level measurements in the borehole. Some of these factors include: permeability of each soil layer in the profile, presence of perched water, amount of time between water level readings, presence of drilling fluid, weather conditions and the use of borehole casing.

Laboratory Testing

Representative samples of the soils encountered were selected for laboratory testing to determine index properties. The tests included the determination of natural moisture content, Atterberg Limits, and particle size distribution.

The test results can be found on the individual test reports and/or the subsurface boring logs located in the Appendix. The following are summaries of the individual test methods. A discussion of the test results is presented later in this report.

Natural Moisture Content (ASTM:D2216)

The natural moisture content was determined for soils recovered from each boring location, at various depths below ground surface. The natural moisture content is determined by drying a representative sample of the soil to a constant weight in an oven at approximately 230°F. By weighing the soil before and after drying the total moisture loss can be compared against the total weight of soil solids to determine the percent moisture content.

Atterberg Limits (ASTM:D4318)

The Atterberg Limits were determined for samples recovered from the boring #2, #5, #7, #8 and #12 locations, below approximate footing depth. The Atterberg Limits are those moisture contents at which a soil changes phases from a solid material to a plastic material (plastic limit) and from a plastic material to a liquid material (liquid limit). The plastic limit is determined by rolling a moist soil sample into a thread until it will no longer hold together at a diameter less than ⅛". The liquid limit is determined by adjusting the moisture content of a soil sample until dropping a brass cup against a solid surface a distance of ½" 25 times causes a standard groove cut through the soil sample to close upon itself. The Atterberg Limits can be used to evaluate the shrink/swell potential of soils and their relative stability under varying moisture conditions.

Particle Size Analyses (ASTM:D422)

The particle size distribution was determined for soils recovered from the boring #1, #4, #6, and #10 locations, below approximate footing depth. The particle size distribution for the coarse fraction (gravel/sand) is determined by mechanical sieve analysis where the soil particles are agitated over a series of sieves and the weight retained on each recorded as a percent of the total. The particle size distribution for the fine fraction (silt/clay) is determined by colloidal analysis where the soil particles are forced into suspension and the rate of sedimentation is monitored by measuring the change in specific gravity of the solution through the use of a calibrated hydrometer. The particle size distribution is plotted on a logarithmic scale as a function of "percent finer by

weight" and "effective particle size".

FINDINGS

Surface Observations

The immediate site drainage is generally in sheet flow from the northeast to the southwest, ultimately into Sixmile Creek which flows from northeast to southwest, passing just south of the proposed building site.

Surface elevations taken at the site indicate 4.4' of relief between the twelve soil boring locations, measuring between 101.4' at the Boring #4 and #8 locations along the east edge of the site and 97.0' at the Boring #12 location near the western edge of the site. The benchmark used for the elevation survey was the top of the water storage tank foundation, located immediately south of the site. The benchmark was assigned an arbitrary elevation of 100.0'.

Subsurface Conditions

Logs of the test borings are included in the Appendix. The logs contain information concerning soil layering, soil classification, geologic description and moisture. Relative density or consistency is also noted, which is based on the standard penetration resistance (N-value). Please note the boring logs only indicate the subsurface conditions at the sampled locations. Variations often occur between and beyond borings.

Site Geology

The primary geologic origin of the soils encountered at this site consists of alluvium, referring to soil transported and deposited by water flow, and glacial till, referring to soils transported and deposited by glacial advance.

The glacial deposits at this site are the result of Illinoisan Age Glaciation. The following description of the geologic depositions in the area comes from the SD Geologic Survey website "http://www.sdgs.usd.edu/geology/pleistocene.html".

> Beginning about 2 million years ago, continental glaciers moved generally southward across North America, covering eastern South Dakota several times. As each ice sheet advanced, it transported large volumes of rock debris frozen into the lower layers of ice. If the ice sheet was very thick and heavy, the glaciers scoured and smoothed off the terrain. In contrast, where the ice was thin, the glaciers overrode obstacles rather than planing them. As the ice melted, sediment called glacial drift was left behind.

The Illinoisan age glacial till consists primarily of a compact, silty, clay-rich matrix with sand- to boulder-sized clasts of glacial origin. The total thickness of the Illinoisan age glacial deposits is as much as 300 ft; however, the thickness of the deposit varies greatly from site to site.

Subsurface Soils

Based on our interpretation of the soil boring results, it is our judgment the generalized soil profile consists of encountered ½' to 2' of topsoil overlying mixed layers of fine and coarse grained alluvial soils which in turn overlie glacial till deposits, encountered to the full depth of exploration at all twelve boring locations. The exception being the Boring #4 & #8 locations which encountered approximately 1½' to 2' of fill soils overlying the topsoil and/or alluvial soils. The following are detailed descriptions of the different soil layers encountered.

Topsoil

The topsoil encountered consists primarily of silty lean clay and sandy lean clay. These soils are considered low strength materials and are considered potentially compressible under the anticipated building loads, primarily due to the continued decomposition of the organic content over time. The topsoil encountered is slow to very slow draining and is judged to be highly frost susceptible though not significantly expansive under varying moisture conditions.

No laboratory testing was performed on the recovered topsoil samples.

Fill

The fill soils encountered at this site were found to consist primarily of clayey sand with gravel and silty lean clay. The fill soils are considered to have unreliable strength properties due to the uncertainty surrounding the conditions under which they were placed and are therefore considered potentially compressible under the anticipated building loads. The fill soils encountered are moderate to slow draining and are judged to be highly frost susceptible, though not significantly expansive under varying moisture conditions.

No laboratory testing was performed on the recovered fill soils.

Fine-Grained Alluvium

The fine-grained alluvial soils encountered consist primarily of silty lean clay, sandy lean clay, and clayey silt. These soils are considered low strength materials and are considered potentially compressible under some of the larger anticipated building loads. The fine-grained alluvium encountered is slow to moderate draining and is judged to be highly frost susceptible though not significantly expansive under varying moisture conditions.

Laboratory tests performed on the recovered samples of the fine-grained alluvial soils include the determination of the natural moisture content and Atterberg Limits.

The results of the laboratory moisture testing indicate the fine-grained alluvial soils occur naturally at moisture contents ranging from 15% to 29%, likely slightly below to well above the Standard Proctor optimum moisture content for these soils.

The results of the Atterberg Limits determinations indicate the fine-grained alluvial soils have Liquid Limits (LL) ranging from 25% to 46%, Plastic Limits (PL) ranging from 9% to 18% and resultant Plasticity Indices (PI) ranging from 7% to 29%. Based on these findings, the soil materials have a USCS classification of silty clay (CL-ML) and lean clay (CL).

Coarse-Grained Alluvium

The coarse-grained alluvial soils encountered consist primarily of clayey sand, silty sand, silty sand with clay and gravel, silty sand with gravel, gravelly/silty sand, and gravelly sand with silt. These soils are considered moderate to high strength materials and are not considered significantly compressible under the anticipated building loads. The coarse-grained alluvium encountered is moderate to fast draining and is judged to be at least moderately frost susceptible though not significantly expansive under varying moisture conditions.

Laboratory tests performed on the recovered coarse-grained alluvium include the determination of the natural moisture content and particle-size distribution.

The results of the natural moisture content tests indicate the coarse-grained alluvial materials occur naturally at moisture contents ranging from 6% to 15%, likely well below to well above the Standard Proctor optimum moisture content for these soil types.

The particle size analyses performed indicate the coarse-grained alluvial soils encountered contain 0% to 38% gravel, 34% to 70% sand, 6% to 36% silt and 3% to 23% clay. These values indicate USCS classifications of gravelly/silty sand (SM), gravelly sand with silt (SP-SM), silty sand with sand and gravel (SM), & silty sand with gravel (SM).

Glacial Till

The glacial till soils encountered at the site consist primarily of silty fat clay, clayey silt, sandy silt, silty sand and gravelly sand with silt. These soils are considered moderate to high strength materials and are not considered significantly compressible under the anticipated building loads. The glacial till soils encountered are considered fast to very slow draining and are judged to be

moderately to highly frost susceptible though not significantly expansive under varying moisture conditions.

Laboratory tests performed on the recovered glacial till soils consist of the determination of the natural moisture content and Atterberg Limits.

The results of the natural moisture content tests indicate the glacial till soils occur naturally at moisture contents ranging from 23% to 34%, likely very near to well above the Standard Proctor optimum moisture content for these soil types.

The Atterberg Limits determinations indicate the glacial till soils encountered have liquid limits (LL) ranging from 18% to 52%, plastic limits (PL) ranging from non-plastic to 14% and resultant plasticity indices (PI) ranging from 0% to 38%. These values indicate the soils have USCS classifications of fat clay (CH) and silt (ML).

Groundwater

The boreholes were probed for the presence of ground water and water level measurements were taken. The measurements are recorded on the boring logs.

Groundwater measurements taken immediately following drilling revealed a measureable ground water surface ranging from 4.7' to 8.6' within the open boreholes and at 1½ days after completion a measureable ground water surface ranging from 4.1' to 8.5' within the open boreholes. A standpipe piezometer was installed within the Boring #11 location, to a total depth of 15' below existing surface grade, to facilitate long-term groundwater monitoring.

The groundwater is expected to affect both the construction and long-term stability of the proposed structures at this site. Potential contractors should be made aware of the groundwater conditions and should be prepared to implement a dewatering program during construction to facilitate fill and concrete placement below the static groundwater elevation.

Note that ground water levels usually fluctuate. Fluctuations occur due to varying seasonal and yearly rainfall and snow melt, as well as other factors.

RECOMMENDATIONS

Approach Discussion

The soils encountered at this site consisted primarily of lean clay alluvium & silty sand with gravel and gravelly/silty sand glacial till soils. The SPT N-values indicated the soils range from very soft to very stiff and very loose to dense. The soils at this site were found to be highly variable, at times somewhat soft/loose, causing us to recommend a decreased bearing pressure to control settlements. Additionally, considerations include minimum embedment depths to limit frost movements and a modest amount of soil correction below footings and floor slabs to provide stability for structural elements bearing below the static groundwater table.

Our foundation design assumptions include a minimum safety factor of 3 with respect to localized shear or base failure of the foundations. We assume the structure will be able to tolerate total settlements/heaves of up to 1" and differential settlements/heaves over a 30' distance of up to ½". If any of these assumptions are viewed as inadequate for the proposed construction please contact us for additional review of our calculations and recommendations.

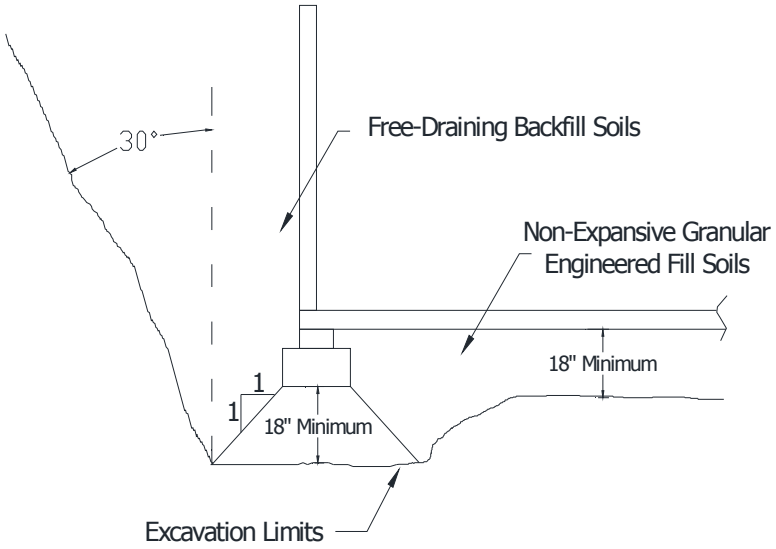
Grading

Excavation

Areas to receive fill, concrete or roadway surfacing should be stripped of all topsoil and/or soils containing significant root structure. Additionally, building excavations should extend 18" (vertical) below footings and floor slabs to facilitate placement of a granular bedding layer. Excavation bottoms should be oversized laterally from the planned outside edges of the foundations/floor slab a distance equal to at least one foot for each vertical foot of compacted fill required at that location (i.e., 1:1 oversize).

The following diagram illustrates the over-excavation required for structural support of the buildings at this site. Please note that the free-draining backfill is not a requirement for the slab-on-grade compost facility.

Diagram 1: Manure Pit Excavation Detail



Excavation Side-Sloping/Retention

If un-retained, the excavation should maintain side slopes in accordance with OSHA Regulations (Standards - 29 CFR) Part 1926, Subpart P, "Excavations." Even with the required OSHA sloping, ground water seepage and/or surface water runoff can induce side slope raveling or running which would require maintenance.

Excavation Observations

On-site observation of excavation bottoms by a geotechnical engineer is highly recommended to evaluate potential changes in soil conditions. The recommendations in this report are based on the subsurface conditions found at our test boring locations. The subsurface can be expected to vary away from and between soil boring locations.

Dewatering

Groundwater will likely enter the excavations from the granular layers encountered throughout the site. The contractor should be prepared to design and implement a dewatering program in the event groundwater becomes a factor in construction. All reasonable efforts should be made to dewater the excavation prior to fill placement. If dewatering of the excavation proves to be impractical we should be contacted for additional recommendations with regard to underwater fill placement. These considerations include specific gradation requirements for the imported fill soils as well as special soil placement and compaction procedures.

Fill/Compaction

Construction Considerations

The site soils encountered are easily softened if allowed to become saturated. Care should be taken to not disturb the in-situ alluvium/glacial till soils at the excavation bottom. If construction is performed during periods of wet weather, protections should be put in place to limit the amount of water allowed to collect in excavations and trenches. Any soils which become disturbed should be moisture conditioned and re-compacted, or removed from the excavation and replaced in the same manner as new fill placement.

Material Types

The on-site soil materials are not likely to be suitable for re-use as structural fill beneath footings & floor slabs or for pit wall backfill; however, these soils can be used for foundation wall backfill at the compost facility and for general site grading provided they are cleaned of any aggregate/rubble larger than 2" nominal diameter. Any excavated topsoil or soils containing significant root structure should be stockpiled and reserved for final landscaping purposes only.

All structural fill soils placed in support of the footings and/or floor slabs should be non-organic, non-expansive, granular engineered fill soils free of deleterious/frozen materials with a maximum aggregate size of 2", less than 40% finer than the #4 sieve and less than 5% finer than the #200 sieve.

Manure pit wall backfill soils should be granular soils with a liquid limit less than 40%, a maximum aggregate size of 2" and less than 12% finer than the #200 sieve to achieve an at-rest lateral earth pressure of 50 pcf equivalent fluid density. If on-site materials are to be used as pit wall backfill, walls should be designed using an at-rest lateral earth pressure of 90 pcf equivalent fluid density.

If imported fill soils are to be used for construction of the project, we recommend submitting a sample of each type of proposed fill material to our laboratory so we can evaluate its suitability for the intended purpose.

Fill Placement

The following are recommendations for placement of the engineered fill and foundation backfill soils:

- Fill required to attain grade for footings and for foundation wall backfill should be uniformly compacted in thin lifts to a minimum of 95% of the Standard Proctor maximum dry density (ASTM:D698) or Relative Minimum/Maximum Density of Cohesionless Soils (ASTM:4253/4254), depending on the applicability of the test method

- All backfill and engineered fill should be moisture conditioned to near optimum moisture content prior to being placed
- Compaction tests should be performed on alternating lifts to ensure the minimum density is maintained
- Utility lines serving the structure should be leak tested prior to covering

Soil Density Testing

Soil density testing should be performed on the new fill placed in order to document that project specifications for compaction have been satisfied. Density tests should be taken at intervals not exceeding 1 set of tests for each 2' of thickness of fill placed with a final set of tests at the finished surface prior to footing/slab placement. Minimum testing frequencies should include at least 1 test per 2,000 ft² of fill soils placed beneath footings/slabs & in parking/drive areas and 1 test per 50 linear feet of foundation/trench backfill.

Footings, Foundations & Retaining Walls

Frost Protection

The structures can be supported on spread footing type shallow foundations placed on the newly compacted engineered fill material. Footings bordering heated building space should be placed a minimum of 42" below exterior grade for frost protection. Footings not bordering heated building space (e.g. compost facility, stoops and/or canopy footings) should be extended a minimum of 60" below exterior grade. Interior footings can be placed a convenient depth below floor slab.

Bearing Pressures

Based on the conditions encountered and the recommendations presented in this report, it is our opinion the footings/foundations can be designed based on a maximum allowable soil bearing pressure of 2,000 psf provided the grading recommendations presented above are adhered to. It is our opinion the recommended design pressure will have a factor of safety of at least 3 against localized shear or base failure. We estimate that total settlements/heave under this loading should not exceed 1" and that differential settlements/heave of conditions depicted by the borings should not exceed ½" over a 30' distance.

Observation & Testing

Observation of reinforcing steel placement and plastic concrete testing by a third-party testing agency is recommended to verify plans and specifications are adhered to and materials delivered to the site will perform adequately during the service life of the structures.

Final Site Grading & Drainage

Perimeter Drainage

Final exterior grades adjacent to the structures should be maintained at 20:1 or steeper. Settlement of backfill and utility line fill can cause depressions adjacent to the structure which could allow ponding of water and subsequent infiltration into the foundation soils. These areas should be monitored after construction and additional fill be placed, as needed, to maintain positive drainage away from the structures.

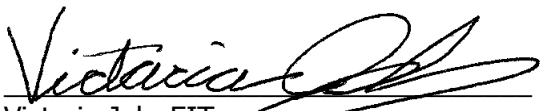
LIMITATIONS

The data derived through this sampling and observation program has been used to develop our opinions about the subsurface conditions at your site. However, because no exploration program can reveal totally what is in the subsurface, conditions between borings and between samples and at other times, may differ from conditions described in this report. The exploration we conducted identified subsurface conditions only at those points where we took samples or observed groundwater conditions. Depending on the sampling methods and sampling frequency, every soil layer may not be observed, and some materials or layers which are present in the ground may not be noted on the boring logs. If conditions encountered during construction differ from those indicated by our borings, it may be necessary to alter our conclusions and recommendations, or to modify construction procedures, and the cost of construction may be affected. The extent and detail of information about the subsurface condition is directly related to the scope of the exploration. It should be understood, therefore, that additional information can be obtained by means of additional exploration. Our services for your project have been conducted to those standards considered normal for services of this type at this time and location. Other than this, no warranty, express or implied, is intended.

AUTHORIZATION

Report Prepared by:

Core Engineering & Consulting, Inc.



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Staff Engineer
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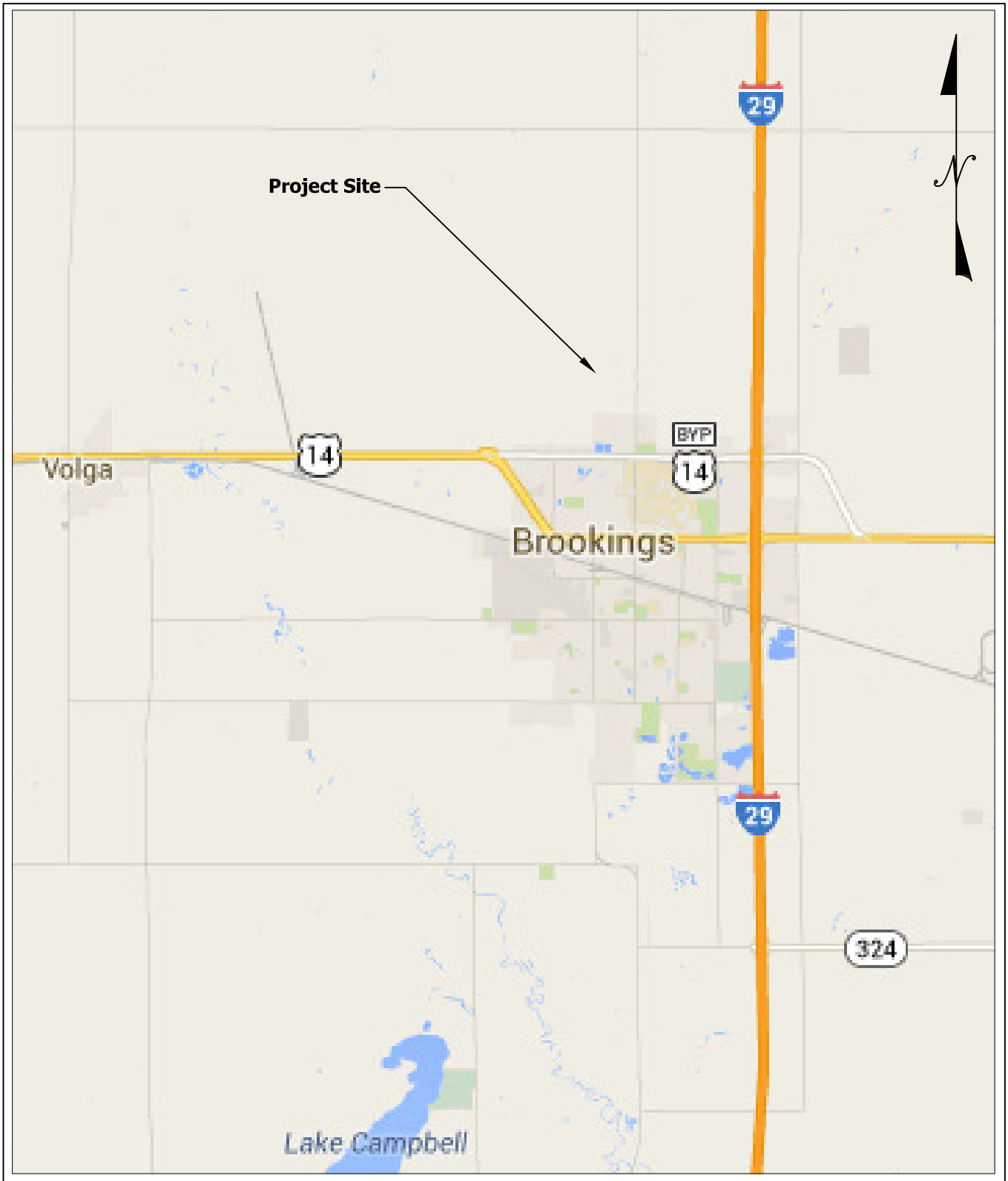
Report Reviewed by:

Core Engineering & Consulting, Inc.

Patrick J. Engels, PE
Geotechnical Engineer
patrick@coresd.com

APPENDIX A

FIGURE 1 – SITE LOCATION MAP
FIGURE 2 – BORING LAYOUT MAP
SOIL BORING LOGS (11)
ATTERBERG LIMITS TEST RESULTS (ASTM:D4318)
PARTICLE SIZE ANALYSIS (ASTM:D422)
BORING LOG NOTES
UNIFIED SOIL CLASSIFICATION SYSTEM



Project: Proposed Swine Teaching & Research Facility
2171 Medary Avenue; Brookings, SD

Core Engineering & Consulting, Inc.
115 West Beebe Avenue
PO Box 456
Chamberlain, SD 57325-1223
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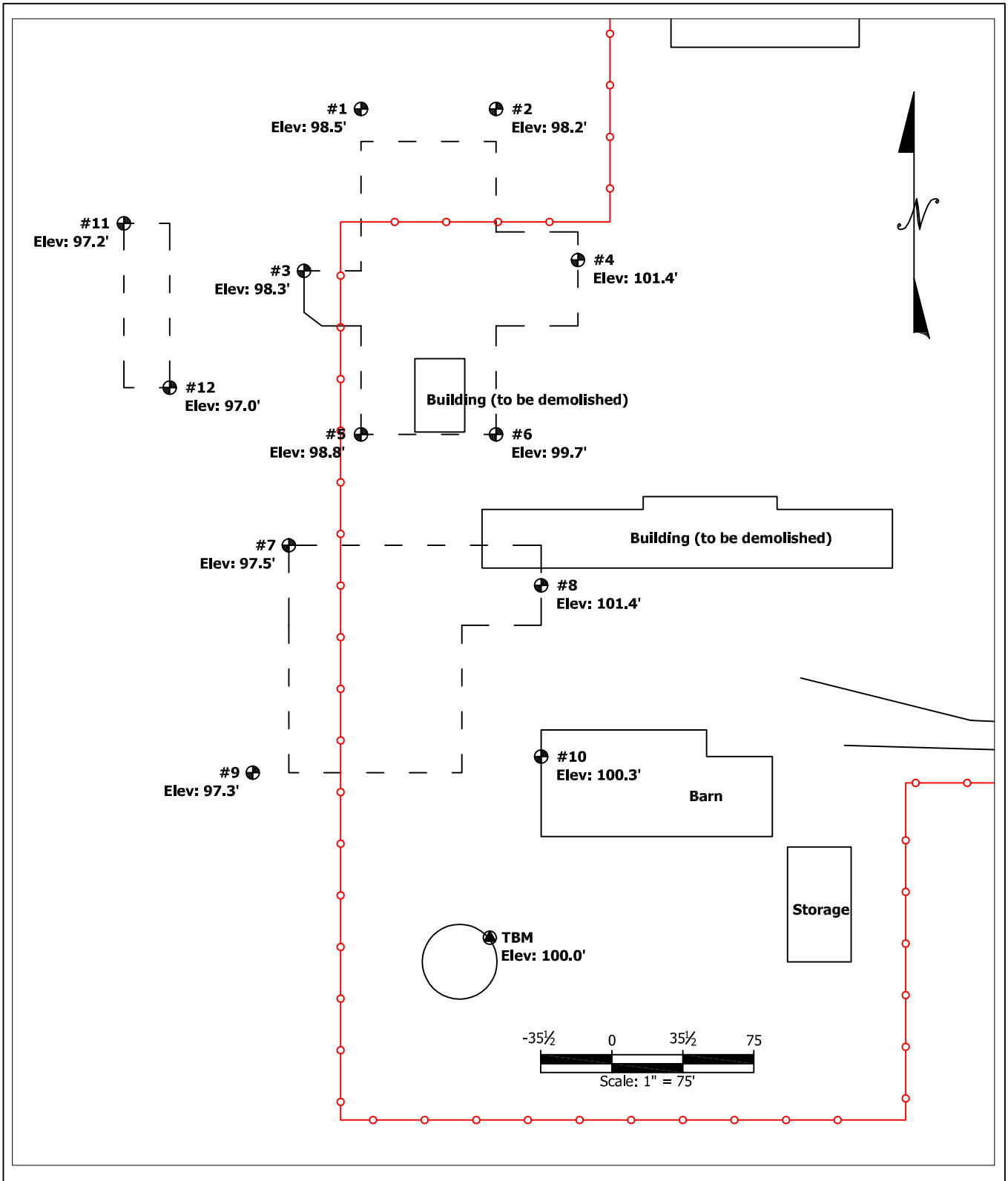
Job No.: 14-034
Drawn By: VDJ
Checked By: PJE
Date: August 27, 2014

Site Location Map

Figure 1



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Boring Layout Map

Figure 2

SUBSURFACE BORING LOG

Visual-Manual Classification Unless Verified by Laboratory Testing

CEC JOB NO: **14-034** LOG OF BORING NO. **1**

PROJECT: **Proposed SDSU Swine Research Facility; 2171 Medary Avenue; Brookings, South Dakota**

SURFACE ELEVATION: 98.5'

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	GW	SAMPLE TYPE	REC. IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	-#200
1 -	TOPSOIL, Silty Lean Clay, trace roots, dark brown, moist, firm (CL)	Topsoil	6	M	SS	13					
2 -	SANDY LEAN CLAY, brown, moist, soft (CL)	Fine Alluvium	3	M	SS	15					
4 -	SILTY LEAN CLAY, a little sand, gray, moist, firm (CL-ML)		5	M ▼	SS	18	24%				
6 -	GRAVELLY/SILTY SAND, a little clay, fine and course grained, wet, dense to medium dense (SM)	Coarse Alluvium	31	W	SS	16	9%				
10 -			12	W	SS	22					
11 -	SILTY FAT CLAY, gray, moist, firm (CH)	Glacial Till	5	M	SS	16	32%				
15 -	CLAYEY SILT, gray, moist, loose (ML)		10	M	SS	17					
16 -	END OF BORING										

DEPTH	DRILLING METHOD
0'-14½'	3¼" I.D. HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
8/14/14	**8:15**	**16.0'**	**N/A**	**8.2'**	**N/A**	**6.2'**
8/15/14	**16:00**	**16.0'**	**"**	**6.2'**	**"**	**4.9'**

BORING COMPLETED: **8/14/2014**

CC: **PE** CA: **RS** Rig: **3**

SUBSURFACE BORING LOG

Visual-Manual Classification Unless Verified by Laboratory Testing

CEC JOB NO: **14-034** LOG OF BORING NO. **2**

PROJECT: **Proposed SDSU Swine Research Facility; 2171 Medary Avenue; Brookings, South Dakota**

SURFACE ELEVATION: 98.2'

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	GW	SAMPLE TYPE	REC. IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	-#200
1 -	TOPSOIL, Silty Lean Clay, trace roots, dark brown, moist, firm (CL)	Topsoil	5	M	SS	10					
2 -											
3 -			3	M	SS	17			25%	18%	
4 -	SILTY LEAN CLAY, a little sand, brown, moist, stiff (CL-ML)	Fine Alluvium									
5 -				▼							
6 -			3	M	SS	18	26%				
7 -											
8 -	GRAVELLY/SILTY SAND, a little clay, fine and course grained, brown, moist to wet, dense to loose (SM)	Coarse Alluvium	31	W	SS	14	10%				
9 -											
10 -			9	W/M	SS	28					
11 -											
12 -	SILTY FAT CLAY, gray and brown, moist, stiff to firm (CH)	Glacial Till									
13 -			7	M	SS	13					
14 -											
15 -	SANDY SILT, gray, moist, medium dense (ML)						26%		18%	NP	
	GRAVELLY SAND WITH SILT, fine and course grained, gray, wet, medium dense (SP-SM)		12	M	SS	12					
16 -	END OF BORING										

DEPTH	DRILLING METHOD
0'-14½'	3¼" I.D. HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
8/14/14	**9:35**	**16.0'**	**N/A**	**7.3'**	**N/A**	**5.0'**
8/15/14	**16:00**	**16.0'**	**"**	**7.2'**	**"**	**4.9'**

BORING COMPLETED: **8/14/2014**

CC: **PE** CA: **RS** Rig: **3**

SUBSURFACE BORING LOG

Visual-Manual Classification Unless Verified by Laboratory Testing

CEC JOB NO: **14-034** LOG OF BORING NO. **3**

PROJECT: **Proposed SDSU Swine Research Facility; 2171 Medary Avenue; Brookings, South Dakota**

SURFACE ELEVATION: 98.3'

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	GW	SAMPLE TYPE	REC. IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	-#200
1 -	TOPSOIL, Silty Lean Clay, trace roots, dark brown, moist, firm (CL)	Topsoil	5	M	SS	14					
2 -											
3 -	SILTY LEAN CLAY, brown, moist, firm (CL-ML)	Fine Alluvium	5	M	SS	16	17%				
4 -											
5 -				▼							
6 -			12	M	SS	16					
7 -											
8 -	GRAVELLY/SILTY SAND, a little clay, fine and coarse grained, brown, moist to wet , medium dense to dense to medium dense (SM)	Coarse Alluvium	45	W	SS	17	6%				
9 -											
10 -			11	W	SS	25					
11 -											
12 -											
13 -			6	M	SS	18	30%				
14 -	SILTY FAT CLAY, gray, moist, firm (CH)	Glacial Till									
15 -			5	M	SS	8					
16 -	END OF BORING										

DEPTH	DRILLING METHOD
0'-14½'	3¼" I.D. HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
8/14/14	**20:55**	**16.0'**	**N/A**	**6.3'**	**N/A**	**5.0'**
8/15/14	**16:05**	**16.0"**	**"**	**6.1'**	**"**	**4.9'**

BORING COMPLETED: **8/14/2014**

CC: **PE** CA: **RS** Rig: **3**

SUBSURFACE BORING LOG

Visual-Manual Classification Unless Verified by Laboratory Testing

CEC JOB NO: **14-034** LOG OF BORING NO. **4**

PROJECT: **Proposed SDSU Swine Research Facility; 2171 Medary Avenue; Brookings, South Dakota**

DEPTH IN FEET	SURFACE ELEVATION: 101.4' MATERIAL DESCRIPTION	GEOLOGY	N	GW	SAMPLE TYPE	REC. IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	-#200
1 -	FILL, mostly Clayey Sand with Gravel, brown, moist, loose (SC)	Fill	8	M	SS	13					
2 -	TOPSOIL, Sandy Lean Clay, dark brown, moist, soft (CL)	Topsoil	3	M	SS	16					
4 -	SILTY SAND, fine grained, brown, moist, very loose (SM)	Coarse Alluvium	4	M	SS	19	8%				
6 -	SILTY LEAN CLAY, brown, moist, soft (CL)	Fine Alluvium									
7 -	CLAYEY SILT, brown, moist, very loose (ML)		2	M ▼	SS	15	25%				
9 -	GRAVELLY SAND WITH SILT, brown, wet, dense to medium dense (SP-SM)	Coarse Alluvium	40	W	SS	18					
12 -			24	W	SS	21					
14 -	SILTY FAT CLAY, gray, moist, firm (CH)	Glacial Till	6	M	SS	17	31%				
16 -	END OF BORING										

DEPTH	DRILLING METHOD
0'-14½'	3¼" I.D. HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
8/15/14	**9:45**	**16.0'**	**N/A**	**9.7'**	**N/A**	**8.6'**
"	**16:10**	**16.0"**	"	**9.5'**	"	**8.5'**

BORING COMPLETED: **8/15/2014**

CC: **PE** CA: **RS** Rig: **3**

SUBSURFACE BORING LOG

Visual-Manual Classification Unless Verified by Laboratory Testing

CEC JOB NO: **14-034** LOG OF BORING NO. **5**

PROJECT: **Proposed SDSU Swine Research Facility; 2171 Medary Avenue; Brookings, South Dakota**

DEPTH IN FEET	SURFACE ELEVATION: 98.8' MATERIAL DESCRIPTION	GEOLOGY	N	GW	SAMPLE TYPE	REC. IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	-#200
1 - 2 -	TOPSOIL, Silty Lean Clay, a little gravel, trace roots, dark brown, moist, firm (CL)	Topsoil	6	M	SS	14					
3 - 4 -	SANDY LEAN CLAY, brown, moist, soft (CL)	Fine Alluvium	3	M	SS	14	15%				
5 - 6 -	SILTY LEAN CLAY, brown, moist, soft (CL-ML)		3	M ▼	SS	16					
7 - 8 - 9 - 10 - 11 -	SILTY SAND WITH CLAY AND GRAVEL, brown, wet, medium dense (SM)	Coarse Alluvium	21	W	SS	14	7%				
			20	W	SS	18					
12 - 13 - 14 -	SILTY FAT CLAY, a little sand, gray, moist, firm (CH)	Glacial Till	8	M	SS	14	34%		52%	14%	
15 - 16 -	CLAYEY SILT, a little sand, gray, wet, loose (ML)		8	W	SS	14					
	END OF BORING										

DEPTH	DRILLING METHOD
0'-14½'	3¼" I.D. HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
8/15/14	**12:05**	**16.0'**	**N/A**	**7.0'**	**N/A**	**5.9'**
"	**16:15**	**16.0'**	"	**6.8'**	"	**5.7'**

BORING COMPLETED: **8/15/2014**

CC: **PE** CA: **RS** Rig: **3**

SUBSURFACE BORING LOG

Visual-Manual Classification Unless Verified by Laboratory Testing

CEC JOB NO: **14-034** LOG OF BORING NO. **6**

PROJECT: **Proposed SDSU Swine Research Facility; 2171 Medary Avenue; Brookings, South Dakota**

DEPTH IN FEET	SURFACE ELEVATION: 99.7' MATERIAL DESCRIPTION	GEOLOGY	N	GW	SAMPLE TYPE	REC. IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	-#200
1 - 2 -	TOPSOIL, Sandy Lean Clay, dark brown, moist, stiff (CL)	Topsoil	9	M	SS	18					
3 - 4 -	SILTY SAND, fine grained, brown, moist, very loose (SM)	Coarse Alluvium	4	M	SS	18	7%				
5 - 6 -	SILTY LEAN CLAY, brown, moist, very soft (CL)	Fine Alluvium	3	M ▼	SS	19					
7 -	CLAYEY SILT, brown, moist, medium dense (ML)						21%				
8 - 9 - 10 - 11 - 12 - 13 -	SILTY SAND WITH CLAY AND GRAVEL, fine and course grained, brown, wet to moist, dense to loose (SM)	Coarse Alluvium	11	M	SS	14					
			37	W	SS	16					
			10	W/M	SS	28	8%				
14 - 15 - 16 -	SILTY FAT CLAY, gray, moist, stiff to firm (CH)	Glacial Till	6	M	SS	25					
	END OF BORING										

DEPTH	DRILLING METHOD
0'-14½'	3¼" I.D. HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
8/15/14	**10:55**	**16.0'**	**N/A**	**8.0'**	**N/A**	**6.6'**
"	**16:10**	**16.0'**	"	**7.8'**	"	**6.6'**

BORING COMPLETED: **8/15/2014**

CC: **PE** CA: **RS** Rig: **3**

SUBSURFACE BORING LOG

Visual-Manual Classification Unless Verified by Laboratory Testing

CEC JOB NO: **14-034** LOG OF BORING NO. **7**

PROJECT: **Proposed SDSU Swine Research Facility; 2171 Medary Avenue; Brookings, South Dakota**

DEPTH IN FEET	SURFACE ELEVATION: 97.5' MATERIAL DESCRIPTION	GEOLOGY	N	GW	SAMPLE TYPE	REC. IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	-#200
1 -	TOPSOIL, Silty Lean Clay, trace roots, dark brown, moist, firm (CL)	Topsoil	6	M	SS	9					
2 -											
3 -	SILTY LEAN CLAY, brown, moist, soft (CL)		2	M	SS	17	19%				
4 -		Fine Alluvium		▼							
5 -	SILTY LEAN CLAY, a little gravel, gray to brown, moist, soft (CL)		4	M	SS	18					
6 -							26%		33%	9%	
7 -	SILTY SAND WITH GRAVEL, fine and course grained, brown, wet to moist, medium dense (SM)	Coarse Alluvium	24	W	SS	17					
8 -											
9 -											
10 -			15	W/M	SS	28					
11 -											
12 -	SILTY FAT CLAY, gray, moist, very stiff (CH)	Glacial Till	16	M	SS	19	32%				
13 -											
14 -											
15 -	SILTY SAND, gray, wet, loose (SM)		8	W	SS	15	23% Bor				
16 -	END OF BORING										

DEPTH	DRILLING METHOD
0'-14½'	3¼" I.D. HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
8/14/14	**19:50**	**16.0'**	**N/A**	**6.6'**	**N/A**	**4.7'**
8/15/14	**15:50**	**16.0'**	**"**	**6.4'**	**"**	**4.6'**

BORING COMPLETED: **8/14/2014**

CC: **PE** CA: **RS** Rig: **3**

SUBSURFACE BORING LOG

Visual-Manual Classification Unless Verified by Laboratory Testing

CEC JOB NO: **14-034** LOG OF BORING NO. **8**

PROJECT: **Proposed SDSU Swine Research Facility; 2171 Medary Avenue; Brookings, South Dakota**

DEPTH IN FEET	SURFACE ELEVATION: 101.4' MATERIAL DESCRIPTION	GEOLOGY	N	GW	SAMPLE TYPE	REC. IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	-#200
	PORTLAND CEMENT CONCRETE (4")										
1 - 2 -	FILL, mostly Silty Lean Clay, brown, moist, soft (CL) (a lense of Topsoil at 2')	Fill	3	M	SS	11	19%				
3 - 4 - 5 - 6 - 7 -	CLAYEY SAND, fine grained, brown, moist, very loose to loose (SC)	Coarse Alluvium	4 6	M M	SS SS	16 18	11%				
8 - 9 -	SILTY LEAN CLAY, slightly organic, dark brown, moist, soft (CL) SILTY LEAN CLAY, brown, moist, soft (CL)	Fine Alluvium	2	M	SS	18	29%		34%	18%	
10 - 11 - 12 - 13 - 14 -	SILTY SAND WITH GRAVEL, fine and course grained, brown, wet, medium dense (SM)	Coarse Alluvium	23 29	W W	SS SS	14 18					
15 - 16 -	SILTY FAT CLAY, a little gravel, gray, moist, very stiff (CH)	Glacial Till	18	M	SS	14	28%				
	END OF BORING										

DEPTH	DRILLING METHOD
0'-14½'	3¼" I.D. HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
8/15/14	**13:25**	**16.0'**	**N/A**	**10.0'**	**N/A**	**8.3'**
"	**16:20**	**16.0'**	"	**9.9'**	"	**8.2'**

BORING COMPLETED: **8/15/2014**

CC: **PE** CA: **RS** Rig: **3**

SUBSURFACE BORING LOG

Visual-Manual Classification Unless Verified by Laboratory Testing

CEC JOB NO: **14-034** LOG OF BORING NO. **9**

PROJECT: **Proposed SDSU Swine Research Facility; 2171 Medary Avenue; Brookings, South Dakota**

SURFACE ELEVATION: 97.3'

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	GW	SAMPLE TYPE	REC. IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	-#200
1 -	TOPSOIL, Silty Lean Clay, dark brown, moist, firm (CL)	Topsoil	7	M	SS	12					
2 -	SILTY LEAN CLAY, gray, moist, soft (CL)	Fine Alluvium	3	M	SS	17					
4 -	SILTY LEAN CLAY, a little gravel, gray, moist, stiff (CL)		11	M	SS	15	27%				
6 -	SILTY SAND WITH GRAVEL, brown, wet, dense to medium dense (SM)	Coarse Alluvium	31	W	SS	15	8%				
10 -	SILTY FAT CLAY, gray, moist, stiff (CH)	Glacial Till	13	W/M	SS	17					
13 -	GRAVELLY SAND WITH SILT, fine and course grained, gray, wet, loose (SP-SM)		10	M	SS	18	30%				
15 -			5	W	SS	18	15%				
16 -	END OF BORING										

DEPTH	DRILLING METHOD
0'-14½'	3¼" I.D. HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
8/14/14	**18:50**	**16.0'**	**N/A**	**6.6'**	**N/A**	**4.9'**
8/15/14	**15:50**	**16.0'**	**"**	**6.1'**	**"**	**4.7'**

BORING COMPLETED: **8/14/2014**

CC: **PE** CA: **RS** Rig: **3**

SUBSURFACE BORING LOG

Visual-Manual Classification Unless Verified by Laboratory Testing

CEC JOB NO: **14-034** LOG OF BORING NO. **10**

PROJECT: **Proposed SDSU Swine Research Facility; 2171 Medary Avenue; Brookings, South Dakota**

SURFACE ELEVATION: 100.3'

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	GW	SAMPLE TYPE	REC. IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	-#200
1 - 2 -	TOPSOIL, Sandy Lean Clay, trace roots, dark brown, moist, very stiff (CL)	Topsoil	27	M	SS	3					
3 - 4 -	SILTY SAND, fine grained, dark brown, moist, loose (SM)	Coarse Alluvium	9	M	SS	17	9%				
5 - 6 -	SILTY LEAN CLAY, brown, moist, soft (CL)	Fine Alluvium	4	M	SS	20					
7 - 8 - 9 - 10 - 11 - 12 -	SILTY SAND WITH GRAVEL, fine and course grained, brown, wet, dense (SM)	Coarse Alluvium	4	M	SS	19					
			42	W	SS	17	8%				
12 - 13 -	SILTY FAT CLAY, a little gravel, gray, moist, hard (CH)	Glacial Till	32	M/W	SS	16					
13 - 14 -	GRAVELLY SAND WITH SILT, fine and course grained, brown, wet, dense (SP-SM)										
15 - 16 -	SILTY FAT CLAY, gray, moist, stiff (CH)		10	M	SS	14	31%				
	END OF BORING										

DEPTH	DRILLING METHOD
0'-14½'	3¼" I.D. HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
8/15/14	**14:45**	**16.0'**	**N/A**	**9.1'**	**N/A**	**7.9'**
"	**16:25**	**16.0'**	"	**9.0'**	"	**7.7'**

BORING COMPLETED: **8/15/2014**

CC: **PE** CA: **RS** Rig: **3**

SUBSURFACE BORING LOG

Visual-Manual Classification Unless Verified by Laboratory Testing

CEC JOB NO: **14-034** LOG OF BORING NO. **11**

PROJECT: **Proposed SDSU Swine Research Facility; 2171 Medary Avenue; Brookings, South Dakota**

DEPTH IN FEET	SURFACE ELEVATION: 97.2' MATERIAL DESCRIPTION	GEOLOGY	N	GW	SAMPLE TYPE	REC. IN.
0-	TOPSOIL, Silty Lean Clay, trace roots, dark brown, moist, firm (CL)	Topsoil	7	M	SS	9
2-	SILTY LEAN CLAY, gray, moist, soft (CL)	Fine Alluvium	3	M	SS	18
5-	GRAVELLY/SILTY SAND, a little clay, fine and course grained, brown, wet, medium dense to dense (SM)	Coarse Alluvium	29	W	SS	16
7-			27	W	SS	18
10-	SILTY FAT CLAY, gray, moist, firm (CH)	Glacial Till	7	M	SS	17
11-	END OF BORING					

Standpipe Piezometer Construction: 2½' Riser; Above Ground Well Cover; Concrete; Cuttings; Bentonite Chips; 10' Solid PVC Pipe; Natural Cave; 5' PVC Screen (0.010 Slot)

DEPTH	DRILLING METHOD
0'-9½'	3¼" I.D. HSA

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
8/14/14	**10:55**	**11.0'**	**N/A**	**14.3'**	**N/A**	**N/A**
8/15/14	**15:34**	**11.0'**	**"**	**5.7'**	**"**	**4.5'**

BORING COMPLETED: **8/14/2014**

CC: **PE** CA: **RS** Rig: **3**

SUBSURFACE BORING LOG

Visual-Manual Classification Unless Verified by Laboratory Testing

CEC JOB NO: **14-034** LOG OF BORING NO. **12**

PROJECT: **Proposed SDSU Swine Research Facility; 2171 Medary Avenue; Brookings, South Dakota**

SURFACE ELEVATION: 97.0'

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	GW	SAMPLE TYPE	REC. IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	-#200
1 -	TOPSOIL, Silty Lean Clay, trace roots, dark brown, moist, firm (CL)	Topsoil	5	M	SS	12					
2 -											
3 -	SILTY LEAN CLAY, gray, moist, soft (CL)	Fine Alluvium	3	M	SS	18	28%		46%	17%	
4 -				▼							
5 -			20	W	SS	12					
6 -											
7 -	GRAVELLY/SILTY SAND, a little clay, fine and course grained, brown, wet, medium dense to dense to loose (SM)	Coarse Alluvium									
8 -			36	W	SS	19	12%				
9 -											
10 -			9	W/M	SS	28					
11 -	CLAYEY SILT, gray, moist, loose (ML)	Glacial Till									
	END OF BORING										

DEPTH	DRILLING METHOD
0'-9½'	3¼" I.D. HSA

WATER LEVEL MEASUREMENTS

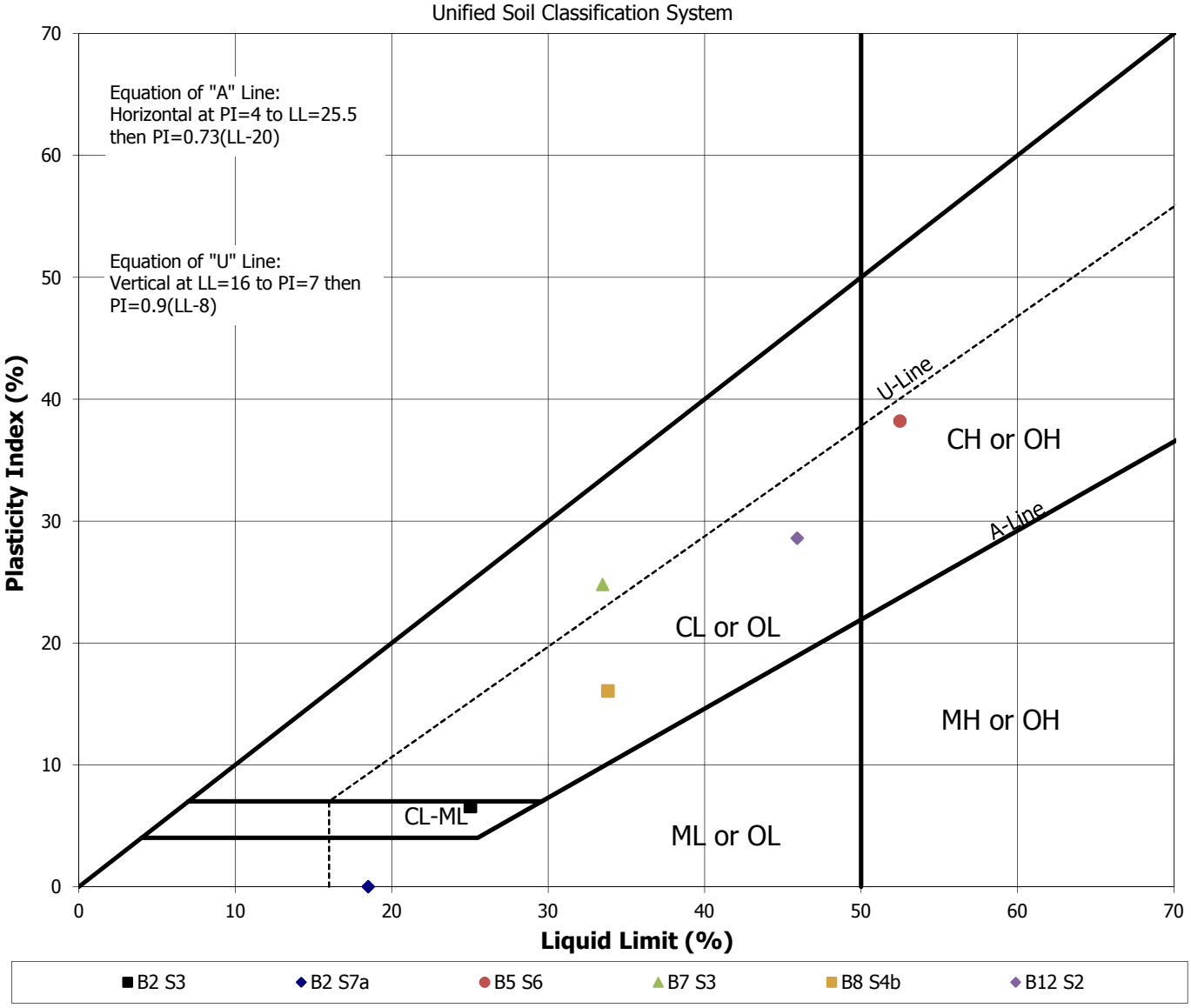
DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
8/14/14	**17:50**	**11.0'**	**N/A**	**5.2'**	**N/A**	**4.7'**
8/15/14	**15:35**	**11.0'**	**"**	**4.9'**	**"**	**4.1'**

BORING COMPLETED: **8/14/2014**

CC: **PE** CA: **RS** Rig: **3**

Soil Classification Chart

Unified Soil Classification System



Test Results

Boring	Sample	Depth	LL (%)	PL (%)	PI (%)	Classification
B2	S3	5' - 5½'	25	18	7	CL-ML
B2	S7a	14½'-15'	18	N/A	N/A	ML
B5	S6	12½' - 13'	52	14	38	CH
B7	S3	5½' - 6'	33	9	25	CL
B8	S4b	8' - 8½'	34	18	16	CL
B12	S2	2½' - 3'	46	17	29	CL

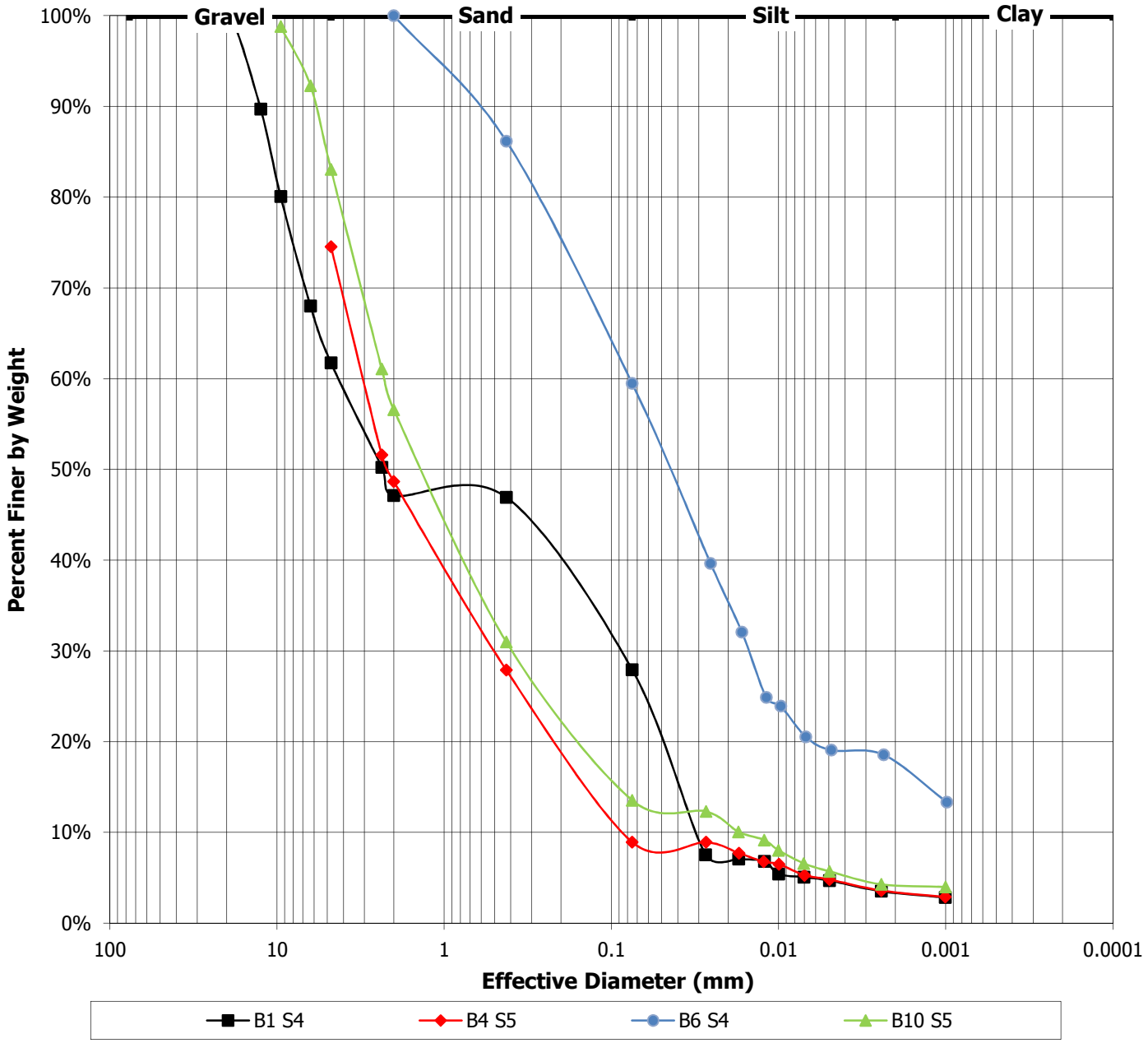
Project Information

Project:	SDSU Swine Teaching & Research Facility	**Job Number:**	14-034
Location:	2171 Medary Avenue; Brookings, SD	**Date:**	8/29/2014

CORE engineering & consulting inc.

ATTERBERG LIMITS TEST RESULTS
(ASTM:D4318)

Grain Size Distribution Curves



Test Results

Boring	Sample	Depth	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Cu	Cc	Classification
B1	S4	7½' - 8'	38.3%	33.8%	24.6%	3.3%	N/A	N/A	SM
B4	S5	10½' - 11'	25.5%	65.6%	5.5%	3.4%	N/A	N/A	SP-SM
B6	S4	7½' - 8'	0.0%	40.5%	42.3%	17.2%	N/A	N/A	SM
B10	S5	10' - 10½'	16.9%	69.5%	9.3%	4.2%	N/A	N/A	SM

Project Information

Project: Proposed SDSU Swine Teaching & Research Facility	**Job No.:** 14-034
Location: 2171 Medary Avenue; Brookings, South Dakota	**Date:** 8/28/2014

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PARTICLE SIZE ANALYSIS
(ASTM:D422)

BORING LOG NOTES

DRILLING AND SAMPLING SYMBOLS

Symbol	Definition
B,H,N:	Size of flush-joint casing
CA:	Crew Assistant (initials)
CAS:	Pipe casing, number indicates nominal diameter in inches
CC:	Crew Chief (initials)
COT:	Clean-out tube
DC:	Drive casing; number indicates diameter in inches
DM:	Drilling mud or bentonite slurry
DS:	Disturbed sample from auger flights
FA:	Solid-stem flight auger; number indicates outside diameter in inches
HA:	Hand auger; number indicates outside diameter
HSA:	Hollow stem auger; number indicates inside diameter in inches
MC:	Column used to describe moisture condition of samples and for the ground water level symbols
N (BPF):	Standard penetration resistance (N-value) in blows per foot (see notes)
NQ:	NQ wireline core barrel
PQ:	PQ wireline core barrel
RD:	Rotary drilling with fluid and roller or drag bit
94mm:	94 millimeter wireline core barrel
thin-walled tube sampling, the recovered length (in inches)	of sample. In rock coring, the length of core recovered (expressed as percent of the total core run). Zero indicates no sample recovered.
REV:	Revert drilling fluid
2L:	California-spoon sampler (steel; 2" inside diameter with 4" long brass liners; 3" outside diameter)
SS:	Standard split-spoon sampler (steel; 1⅜" inside diameter; 2" outside diameter); unless indicated otherwise
SU:	Spin-up sample from hollow stem auger
TW:	Thin-walled tube; number indicates inside diameter in inches
WC:	Core sample of pavement materials cut using a diamond-tipped wet saw
WASH:	Sample of material obtained by screening returning rotary drilling fluid or by which has collected inside the borehole after "falling" through drilling fluid
WH:	Sampler advanced by static weight of drill rod and 140 lb hammer
WR:	Sampler advanced by static weight of drill rod
▼	Water level directly measured in boring
▽	Estimated water level based solely on sample appearance

TEST SYMBOLS

Symbol	Definition
CONS:	One-dimensional consolidation test
DEN:	Dry density, pcf
DST:	Direct shear test
E:	Pressuremeter Modulus, tsf
HYD:	Hydrometer analysis
LL:	Liquid Limit, %
LP:	Pressuremeter Limit Pressure, tsf
OC:	Organic Content, %
PERM:	Coefficient of permeability (K) test; F – Field; L-Laboratory
PL:	Plastic Limit, %
q_p:	Pocket Penetrometer strength, tsf (approximate)
q_c:	Static cone bearing pressure, tsf
q_u:	Unconfined compressive strength, psf
R:	Electrical Resistivity, ohm-cms
RQD:	Rock Quality Designation of Rock Core, in percent (aggregate length of core pieces 4" or more in length as a percent of total core run)
SA:	Sieve analysis
TRX:	Triaxial compression test
VSR:	Vane shear strength, remolded (field), psf
VSU:	Vane shear strength, undisturbed (field), psf
WC:	Water content, as percent of dry weight
%-200:	Percent of material finer than #200 sieve

STANDARD PENETRATION TEST NOTES

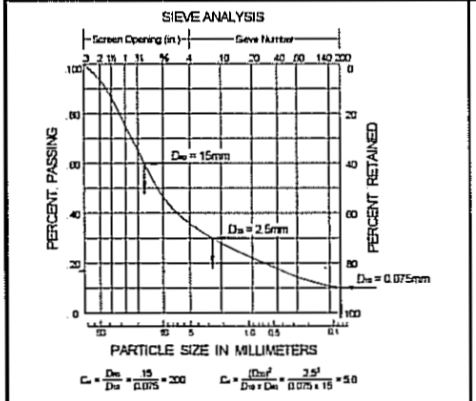
The standard penetration test consists of driving the sampler with a 140 pound hammer and counting the number of blows applied in each of three 6" increments of penetration. If the sampler is driven less than 18" (usually in highly resistant material), permitted in ASTM:D1586, the blows for each complete 6" increment and for each partial increment is on the boring log. For partial increments, the number of blows is shown to the nearest 0.1' below the slash. An "R" in the N-value column indicates refusal of the sampler prior to completing the initial 6" set.

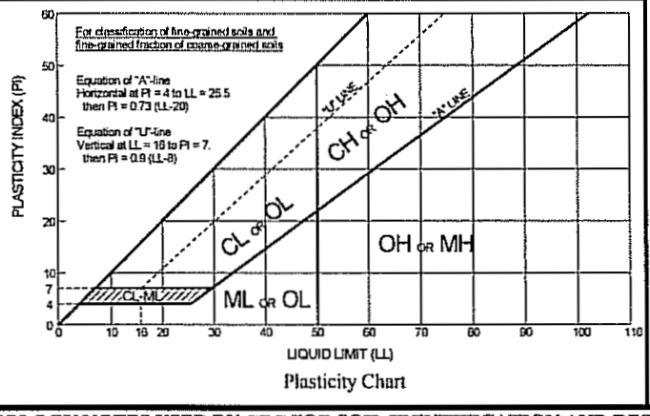
The length of sample recovered, as shown on the "REC" column, may be greater than the distance indicated in the N column. The disparity is because the N-value is recorded below the initial 6" set (unless partial penetration defined in ASTM:D1586 is encountered) whereas the length of sample recovered is for the entire sampler drive (which may even extend more than 18").

UNIFIED SOIL CLASSIFICATION SYSTEM
ASTM Designations: D 2487, D2488

Core Engineering & Consulting, Inc.
115 West Beebe Avenue
PO Box 456
Chamberlain, SD 57325

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Soil Classification: Group Symbol	Soil Classification: Group Name[B]
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	Cu≥4 and 1≤Cc≤3[E]	GW	Well graded gravel[F]
			Cu<4 and/or 1>Cc>3[E]	GP	Poorly graded gravel[F]
		Gravels with Fines more than 12% fines[C]	Fines classify as ML or MH	GM	Silty gravel[F,G,H]
			Fines classify as CL or CH	GC	Clayey gravel[F,G,H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[D]	Cu≥6 and 1≤Cc≤3[E]	SW	Well-graded sand[I]
			Cu<6 or 1>Cc>3[E]	SP	Poorly-graded sand[I]
		Sands with Fines more than 12% fines[D]	Fines classify as ML or MH	SM	Silty sand[G,H,I]
			Fines classify as CL or CH	SC	Clayey sand[G,H,I]
Fine-Grained Soils 50% or more passes the No. 200 sieve (see Plasticity Chart below)	Silts and Clays Liquid limit less than 50	inorganic	PI>7 and plots on or above "A" line[J]	CL	Lean clay[K,L,M]
			PI<4 or plots below "A" line[J]	ML	Silt[K,L,M]
		organic	Liquid limit–oven dried / Liquid limit – not dried <0.75	OL	Organic clay[K,L,M,N] / Organic silt[K,L,M,O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay[K,L,M]
			PI plots below "A" line	MH	Elastic silt[K,L,M]
		organic	Liquid limit–oven dried / Liquid limit – not dried <0.75	OH	Organic clay[K,L,M,P] / Organic silt[K,L,M,Q]
Highly organic soil			Primarily organic matter, dark in color, and organic in odor	PT	Peat[R]





Plasticity Chart

Notes

[A]Based on the material passing the 3-in (75-mm) sieve.

[B]If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C]Gravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay

[D]Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay

[E]$Cu = D_{60}/D_{10}$, $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F]If soil contains ≥15% sand, add "with sand" to group name.

[G]If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H]If fines are organic, add "with organic fines" to group name.

[I]If soil contains ≥15% gravel, add "with gravel" to group name.

[J]If Atterberg limits plot is hatched area, soils is a CL-ML silty clay.

[K]If soil contains 15 to 29% plus No. 200 add "with sand" or "with gravel", whichever is predominant.

[L]If soil contains ≥30% plus No. 200, predominantly sand, add "sandy" to group name.

[M]If soil contains ≥30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N]PI≥4 and plots on or above "A" line.

[O]PI<4 or plots below "A" line.

[P]PI plots on or above "A" line.

[Q]PI plots below "A" line.

[R]Fiber Content description shown below.

ADDITIONAL TERMINOLOGY NOTES USED BY CEC FOR SOIL IDENTIFICATION AND DESCRIPTION

Grain Size

Term	Particle Size
Boulders	Over 12"
Cobbles	3" to 12"
Gravel	#4 sieve to 3"
Sand	#200 to #4 sieve
Fines (silt & clay)	Pass #200 sieve

Gravel Percentages

Term	Percent
A Little Gravel	3% - 14%
With Gravel	15% - 29%
Gravelly	30% - 50%

Consistency of Plastic Soils

Term	N-Value, BPF
Very Soft	less than 2
Soft	2 - 4
Firm	5 - 8
Stiff	9 - 15
Very Stiff	16 - 30
Hard	Greater than 30

Relative Density of Non-Plastic Soils

Term	N-Value, BPF
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	Greater than 50

Moisture/Frost Condition

(MC Column)

D (Dry): Absense of moisture, dusty, dry to touch.

M (Moist): Damp, although free water not visible. Soil may still have a high water content (over "optimum").

W (Wet/ Waterbearing): Free water visible intended to describe non-plastic soils. Waterbearing usually relates to sands and sand with silt.

F (Frozen): Soil frozen

Layering Notes

Laminations: Layers less than ½" thick of differing material or color.

Lenses: Pockets or layers greater than ½" thick of differing material or color.

Fiber Content of Peat

Term	Fiber Content (Visual Estimate)
Fibric Peat:	Greater than 67%
Hemic Peat:	33 – 67%
Sapric Peat:	Less than 33%

Organic/Roots Description (if no lab tests)

Soils are described as *organic*, if soil is not peat and is judged to have sufficient organic fines content to influence the soil properties. *Slightly organic* used for borderline cases.

With roots: Judged to have sufficient quantity of roots to influence the soil properties.

Trace roots: Small roots present, but not judged to be in sufficient quantity to significantly affect soil properties.