STATE OF KANSAS
CONSTRUCTION PROJECT NO. A-015174

ADDENDUM NO. 2
November 13, 2024

ISSUED BY:

Department of Administration
Office of Facilities and Property Management
Design, Construction & Compliance
700 SW Harrison St., Suite 1200
Topeka, Kansas 66603-3929

ISSUED FOR ARCHITECT/ENGINEER

Sabatini Architects Inc.
401 Elm Street, Suite B
Lawrence, Kansas 66044
Contact: Dan Sabatini
Phone Number: 785-331-3399
E-Mail: dsabatini@sabatiniarchitects.com

NOTICE ALL BIDDERS FOR THE:

Department of Wildlife and Parks
Kanopolis Visitor Center
New Construction
Marquette, Kansas

You are instructed to read and to note the following described changes, corrections, clarifications, omissions, deletions, additions, approvals and statements pertinent to the Contract Bid and Construction Documents. All official answers or positions of the State of Kansas will be presented in writing, by means of Addendum.

The Addendum No. 2 is a part of the Contract Bid and Construction Documents and shall govern in the performance of the Work.

Article 2-1; Document C - Form of Bid: (Attachment)
A. Use the attached revised Document C – Form of Bid when submitting your bid.

Article 2-2; Pre-Bid Meeting Notes & Sign-In Sheet: (Attachments)
A. See attached for pre-bid meeting notes and sign-in sheet.

Article 2-3; Table of Contents: (Attachment)
A. Replace existing Table of Contents.

Article 2-4; Division 1 General Requirements: (Attachments)
A. Replace existing Unit Prices Section 01 2200
B. Replace existing Alternates Section 01 2300

Article 2-5; Division 31 Earthwork: (Attachment)
A. Add Preliminary Geotechnical Report.

Article 2-6; Drawings Changes:
A. Sheet G001: Remove Alternate No. 4. Add Deduct Alternate No. 8 Strand Vertical Siding and Batten. Reference Article 2-6 Item B.
B. Sheet A100: Note 14 – Retaining wall guardrails to be aluminum. Refer to aluminum guardrail specifications on sheet G005.
C. Sheet T202: All equipment and associated cabling listed in the “Video Surveillance Hardware Schedule” and the “Access Control Hardware Schedule” shall be provided by State Approved Vendor AllTech. Associated conduit pathways shall be provided and installed by Contractor. Contractor shall contact AllTech for price to be included in bid. AllTech point of contact: Scott Wheat 785-267-0316 (Extension 103), swheat@alltechks.com.
D. Sheet T202: Video Surveillance Hardware Schedule – C2 camera shall be a bullet camera in lieu of a dome camera.
E. Sheet T202: Access Control Hardware Schedule – Access Control Panel (ACP) model number shall be UA-APP-PRO-7 with Lifesafety 8-door power supply cabinet and Mercury control boards. The card reader shall be an HID Signo multiclass reader. Avigilon access control licensing shall be provided per door.

Article 2-7; Sheet G005 (Material Specifications):

A. Stone Veneer Products (Limestone):
   1. Clarification: Veneer Stone to be 70% Dover Shell with 30% Blue Dover Shell mix, split face.
   2. Approved Substitution: Veneer Stone 70% Silverdale / 30% Eagle Creek, final percentage mix and layout subject to approved sample and mockup.
   3. Approved providers/quarries:
      a) Silverdale Quality Stone, 30994 141st Rd | Arkansas City, KS 67005, 620-442-5750
      b) US Stone1880 Kimball Ave. Suite 120 B, Manhattan, Kansas 66502 (913) 529-4154

B. Strand Vertical Siding and Batten (Alternate)
   1. Approved Alternate Material: LP SmartSide Strand Substrate Vertical Siding for Board & Batten Applications.
   2. Location: Where fiber-cement board and batten and trim are indicated.
   3. Texture/Finish: Smooth Texture (no-cedar texture), pre-primed
   4. Panel Type: 4’ x 10’ flat panels (no groove)
   5. Battens Type: 440 Series 0.675” x 5.5” Smooth Texture
   6. Batten Length: minimum 8 feet before a joint. Maximize batten length to minimize joints.
   7. Joint: Scarf Joint, scarf to slope away from building to drain.
   8. Cut Edges or Ends: Prime exposed surfaces
   9. Horizontal Panel Joints: sloped metal Z-flashing.
   10. Fasteners: Per the manufacturer’s guidance and technical notes.
   11. Installation: Install per the manufacturer’s guidance and technical notes and code.

Article 2-8; Sheet A500 (Door Schedule):

A. Door Hardware Schedule: Approved manufacturer and material subject to compliance with the drawings and specifications:
   1. Stabley Access Technologies, Magic Force Operator, Heavy Duty Series

Article 2-9; Sheet A500 (Door Schedule):

A. Interior Wood Doors: Approved manufacturer subject to compliance with the drawings and specifications:
   1. Strek-O Doors, 518 Birch Street, Abbotsford, WI 54405, Ph: 715-223-2376, Fax: 715-223-2377, www.strekodoors.com.

B. Hollow Metal Doors and Frames: Approved manufacturer subject to compliance with the drawings and specifications:
   1. Deansteel Manufacturing Co, Inc., 931 S. Flores Street, San Antonio, TX 78204, 800.825.8271.

Article 2-10; Sheet LP101 (Lightning Protection):

A. Manufacturers: Approved manufacturer and materials subject to compliance with the drawings and specifications:
   1. Preferred Lightning Protection, 2100 East 1st Street, Maryville, MO 64468.

Article 2-11; Questions and Clarifications:

A. Sheet C402: No yard hydrant is required.

B. Sheet A100: Note 4: Semi-Recessed Fire Extinguisher Cabinet basis of design: J.L. Industries or equal. Ambassador Series, Vertical duo panel with frame, semi-recessed with 2.5” rolled edge trim. Cabinet to be steel with white powder coat finish. Lettering on Cabinet to be vertical black lettering “FIRE EXTINGUISHER” and tempered clear glass lite with pull handle mounted to comply with ADA guidelines. Fire Extinguisher basis of design: J.L. Industries or equal. Multipurpose UL rated ABC dry chemical fire extinguisher for Business occupancy. NFPA compliant and FM Global labeled. Install in FE cabinets.

C. Sheet A500: General Finish Notes: FRP panel manufacturer basis of design: Marlite FRP or equal. Refer to Finish Schedule General Notes for panel location, color and texture.

D. Sheet C300: Note 9 should be Alternate No. 3 in lieu of Alternate No. 4.

E. Sheet S001: Timber truss specifications are on sheet. Structural performance shall comply with notes on sheet and any other applicable notes and details throughout the construction documents.

F. Sheet S001: Connectors for the timber trusses shall be fabricated with ¼” min steel plate and ¾” min diameter steel bolts. Exposed connectors/fasteners to be painted black, satin finish.

G. Sheet S001: Timber trusses to be fabricated from Douglas Fir, stain finish.

H. Sheet S601: Timber truss web profiles should be provided as shown on drawings. Contractor to provide appropriately sized truss members to meet slenderness ratio requirements to overcome uplift. Column to Timber Truss connection to be exposed. Truss Designer to provide connection that meets load requirements.

I. Sheet ME001: Ductwork Insulation - 1 ½" insulation shall meet the equivalent specifications of 1.5 lb density listed for 1" insulation.

*** RECEIPT OF THIS ADDENDUM IS TO BE ACKNOWLEDGED ON THE FORM OF BID - DOCUMENT C*** DESIGN, CONSTRUCTION & COMPLIANCE

DOCUMENT C - FORM OF BID - REVISED

PART 1 - GENERAL

SUBMITTED BY:

_____

NAME OF COMPANY (*Please print or type*)

ATTACH CERTIFIED OR CASHIER'S CHECK HERE
IF FURNISHED IN LIEU OF A BID BOND

SUBMITTED TO:

Todd Herman, Director
Procurement and Contracts
Department of Administration
900 S.W. Jackson Street, Suite 451S
Topeka, Kansas 66612

SUBMITTED FOR:

Department Of Wildlife and Parks
Kanopolis Visitor Center
New Construction
Bldg No.: 71000-27677
Marquette, Kansas
A-015174

Sir:

In response to your Notice to Bidders and in compliance with the Instructions to Bidders, the undersigned herewith submits his offer to provide all labor, materials, equipment, tools of trades and labor, accessories, appliances, warranties and guarantees and to pay all royalties, fees, permits, licenses, applicable taxes insurances, haulage, storage, superintendency, overhead and profit necessary to complete the following construction work:

BASE BID (LUMP SUM):

For the referenced project and in accordance with the Construction Contract Documents as prepared by the Project Architect/Engineer for a total lump sum price of:

_____

_____DOLLARS ($_____).

ALTERNATE BIDS AND UNIT PRICES:

The undersigned offers for the Owner's consideration and use the following prices for specific alternate bids and unit prices. These prices include all costs to the Owner, including those for labor, materials, equipment, tools of trades and labor, appliances, accessories, warranties, guarantees, royalties, fees, permits, licenses, applicable taxes, insurances, haulage, storage, superintendency, overhead and profit. Alternates are to be added to the above quoted base bid price as noted and may be a negative number.

Bidders are advised that the Owner **is not restricted** to selecting Alternates in numerical order as listed below. The sole intent of this provision is to allow the agency maximum flexibility to incorporate enhancements into the project.

Any change in the alternate and unit price listing will cause a new Form of Bid to be issued.

ALTERNATE NO. 1	Carpet Flooring	ADD ($_____)
ALTERNATE NO. 2	Stone Wainscot	ADD ($_____)
ALTERNATE NO. 3	6" Asphalt Paving Per KDOT Specifications	ADD ($_____)
~~ALTERNATE NO. 4~~	~~Exterior Paving~~	NOT USED

ALTERNATE NO. 5	Metal Roofing	ADD ($_____)
ALTERNATE NO. 6	Basement Perimeter Wall	ADD ($_____)
ALTERNATE NO. 7	Lightning Protection	ADD ($_____)
ALTERNATE NO. 8	Strand Vert. Siding & Batten	ADD ($_____)
UNIT PRICE NO. 1	Unit Cost of Cut Soil - per CY (1,175 CY base)	ADD/DEDUCT ($_____)
UNIT PRICE NO. 2	Unit Cost of Fill Soil – per CY (975 CY base)	ADD/DEDUCT ($_____)
~~UNIT PRICE NO. 3~~	~~Unit Cost of Haul Off Excess Soil - per CY (6,065 CY base)~~	NOT USED
~~UNIT PRICE NO. 4~~	~~Unit Cost of Rock Removal – per CY (500 CY base)~~	NOT USED
UNIT PRICE NO. 5	Unit Cost of Imported Soil – per CY (150 CY base)	ADD/DEDUCT ($_____)

MAJOR SUBCONTRACTORS:

The undersigned hereinafter identifies as part of this bid the major subcontractors he proposes to use in the performance of work under the contract. If the bidder will perform the work of a subcontractor with his own forces, he must so indicate by writing his company name in the space where the subcontractor would have been listed.
If the choice of major subcontractors is dependent upon the combinations of alternates the owner elects to include as a part of the work, a separate sheet shall be attached to the Form of Bid designating the different combinations of such major subcontractors. No change or substitution may be made in the listed subcontractors without the prior approval of the Secretary of Administration. In order to obtain this approval a written request shall be made to the Director of the Office of Facilities and Property Management.

MECHANICAL CONSTRUCTION (List one (1) only)

_____
Name

_____
Address

ELECTRICAL CONSTRUCTION (List one (1) only)

_____
Name

_____
Address

TIME OF COMPLETION:

The undersigned agrees to have the work of the project to a point of final completion, including all punch list items, ready for the Project Architect/Engineer's final inspection and the Owner's and Office of Facilities and Property Management's acceptance, in **240** Calendar days (or less) following issuance of the written Notice to Proceed.

ADDENDA:

The undersigned acknowledges receipt of the following Addenda:

#1(_____) #2(_____) #3(_____) #4(_____) #5(_____) #None(_____)

STATE TAX:

The undersigned attests this Bidder is not in arrears in taxes due the State of Kansas.

This project has been determined by the Kansas Department of Revenue to be subject to Kansas sales tax. The cost of said Tax must be **INCLUDED IN** all Bid and Contract prices. Sales tax includes all applicable state, county and city sales taxes. (Refer to the Supplemental General Conditions, Document E, for instructions on paying the tax.)

FEDERAL TAX:

The undersigned has included in all quoted prices the cost of federal excise tax on all items of construction and equipment subject to said tax.

AGREEMENTS:

The undersigned agrees to the following terms and conditions:

1. An incomplete bid or other information not requested which is written on or attached to this Form of Bid, may be cause for rejection of the bid.

2. For a bid to be considered responsive, every blank must be filled in. Failure to do so may result in the disqualification of the bid.

3. A bid may be considered incomplete and non-responsive that does not indicate a price for any alternate bid or unit price described and identified on the Form of Bid. A typed or printed "no bid" entered in the space provided for an alternate bid or unit price may lead to the bid being considered non-responsive and be grounds for rejection of the bid. A typed or printed "no charge" entered in the space provided for an alternate bid or unit price will be considered a valid bid, as will the figure "0.00."

4. He has read the Notice to Bidders and the Instructions to Bidders carefully.

5. The accompanying bid security (bond) (certified check) (cashier's check) in the amount of:

   _____

   _____ DOLLARS ($_____).

   is payable without condition to the State of Kansas, the sum of which it is agreed will be forfeited as liquidated damages for the delay and extra expense caused the owner if the undersigned fails to execute the Contract and to furnish the bonds and insurances required by the Construction Contract Documents.

6. The Director, Procurement and Contracts reserves the right to reject any or all bids and to waive all technicalities should such action be deemed to be in the best interest of the State of Kansas.

7. The Owner reserves the right to accept or reject any or all alternate bids and unit prices.

8. Subject to the provisions of K.S.A.75-6901 et seq. this bid may not be withdrawn for a period of thirty (30) calendar days following the receipt, opening and public reading thereof.

9. Failure to acknowledge receipt of any addendum issued may be cause for a bid rejection.

10. **Prior to the complete execution of a construction contract this project may be canceled at any time by the State. Neither the State of Kansas nor any of its agencies, employees or agents shall be responsible for any bid preparation costs, or any costs or charges of any type, should all bids be rejected or the project canceled for any reason prior to the complete execution of a construction contract.**

CERTIFICATION REGARDING IMMIGRATION REFORM & CONTROL

All Contractors are expected to comply with the Immigration and Reform Control Act of 1986 (IRCA), as may be amended from time to time. This Act, with certain limitations, requires the verification of the employment status of all individuals who were hired on or after November 6, 1986, by the Contractor as well as any subcontractor or sub-subcontractor. The usual method of verification is through the Employment Verification (I-9) Form. With the submission of this bid, the Contractor hereby certifies without exception that Contractor has complied with all federal and state laws relating to immigration and reform. Any misrepresentation in this regard or any employment of persons not authorized to work in the United States constitutes a material breach and, at the State's option, may subject the contract to termination and any applicable damages.

Contractor certifies that, should it be awarded a contract by the State, Contractor will comply with all applicable federal and state laws, standards, orders and regulations affecting a person's participation and eligibility in any program or activity undertaken by the Contractor pursuant to this contract. Contractor further certifies that it will remain in compliance throughout the term of the contract.

At the State's request, Contractor is expected to produce to the State any documentation or other such evidence to verify Contractor's compliance with any provision, duty, certification, or the like under the contract.

Contractor agrees to include this Certification in contracts between itself and any subcontractors in connection with the services performed under this contract.

By signing this Form of Bid, the Contractor agrees to follow the Immigration and Reform Control Act of 1986 and any and all amendments to the Act.

DECLARATIONS:

The undersigned hereby declares he has carefully examined the Drawings and Specifications, has visited the actual location of the work, has satisfied himself as to all conditions and understands that, in signing this Form of Bid, he waives all right to plead any misunderstanding regarding same and agrees to be bound by the provisions of said Drawings and Specifications and all statements made therein.

The undersigned proposes to enter into Contract and to furnish and pay for the specified bonds and other required documents within fifteen (15) working days after award of the contract.

The undersigned certifies that he does not have any substantial conflict of interest sufficient to influence the bidding process on this bid. A conflict of substantial interest is one which a reasonable person would think would compromise the open competitive bid process.

All bidders and major sub-contractors listed on the bid form shall **not** be in arrears in taxes due the state of Kansas.

1. All bidders and major sub-contractors listed on the Form of Bid must submit with their bid, current **Certificate of Tax Clearance** obtained from the Kansas Department of Revenue. Bidders and listed major sub-contractors can obtain the Certificate of Tax Clearance through the following website: http://www.ksrevenue.org/taxclearance.html .

2. Do not send Certificate of Tax Clearance in with Fax Modifications or as a Fax Modification. If not submitted with original bid all bidders and major sub-contractors will have 48 hours after bid openings to submit Certificate of Tax Clearance.

The undersigned attests this Bidder is not in arrears in taxes due the State of Kansas, has attached Kansas Department of Revenue Certificate of Tax Clearance for the Bidder and all major sub-contractors listed on the Form of Bid, and has attached signed State of Kansas - Tax Clearance Status forms from all listed major sub-contractors.

SIGNATURE AND SEAL:

DATED THIS _____DAY OF _____, 20____ .

_____
LEGAL NAME OF PERSON, FIRM OR CORPORATION

_____
FEDERAL EMPLOYEE IDENTIFICATION NUMBER

_____
MAILING ADDRESS for the above

_____
CITY, STATE and ZIP CODE

_____/_____
TELEPHONE NUMBER FAX NUMBER

_____/_____
CELL PHONE NUMBER E-MAIL ADDRESS

_____
CONTACT PERSON FOR TAX ISSUES

If the bid is submitted
by a Corporation, affix seal here

_____/_____
BY (SIGNATURE) TITLE

BIDDER'S CONTRACTING IDENTIFICATION NUMBER:

To help facilitate the awarding of the Contract and subsequent payment(s) processes, the bidder gives the FEIN (Federal Employers Identification Number) or the SSN (Social Security Number) planned for use when making application for partial or full work compensation. (Use space provided above.)

END OF DOCUMENT

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DIVISION 23 – HEATING, VENTILATING, AND AIR CONDITIONING
Specifications on Drawings

DIVISION 25
NOT USED

DIVISION 26 – ELECTRICAL
Specifications on Drawings

DIVISION 27 – COMMUNICATIONS
Specifications on Drawings

DIVISION 28 – ELECTRONIC SAFETY AND SECURITY
Specifications on Drawings

DIVISION 29 AND DIVISION 30
NOT USED

DIVISION 31 – EARTHWORK
Geotechnical Engineering Report, Terracon, April 8, 2024
Specifications on Drawings

DIVISION 32 – EXTERIOR IMPROVEMENTS
Specifications on Drawings

DIVISION 33 THROUGH 49
NOT USED

END OF TABLE OF CONTENTS

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL (Not Used)

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. UNIT PRICE NO. 1: Unit Cost of Cut soil per Cubic Yard of Cut exceeding a balance of ~~9,765.44 Cu. Yd. of cut~~. 1,175 Cu. Yd. of cut.

B. UNIT PRICE NO. 2: Unit Cost of Fill Soil per Cubic Yard of Fill exceeding a balance of ~~3,701.02 Cu. Yd. of fill~~. 975 Cu. Yd. of fill.

~~C. UNIT PRICE NO. 3: Unit Cost of Imported Soil in excess of 150Cu. Yd. (relocated to an area in the park determined by Owner)~~ NOT USED

~~D. UNIT PRICE NO. 4: Unit Cost of Rock Removal in excess of 500 Cu. Yd.~~ NOT USED

E. UNIT PRICE NO. 5: Unit Cost of Imported per Cubic Yard (150 Cu. Yd. base)

END OF SECTION 012200

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A schedule of alternates is included at the end of this Section.

PART 2 - EXECUTION

2.1 SCHEDULE OF ALTERNATES

A. ADD Alternate No. 1: Carpet Flooring.

The cost to add materials and labor for all carpet and walk off carpet installation per the drawings and specifications above the Base Bid to provide labor, materials, fees, and taxes.

B. ADD Alternate No. 2: Stone Wainscot

The cost to add materials and labor for installing stone wainscot at perimeter walls of office area in lieu board and batten siding. (Columns and entry vestibule stone wainscot are base bid.) Base bid is board and batten concrete fiber board extended to the base of office walls where indicated as stone per the drawings above the Base Bid to provide all work including labor, materials, fees, and taxes.

C. Add Alternate No. 3: 6" Asphalt Paving Per KDOT Specifications

The cost to add material and labor to install asphalt paving instead of gravel surface. See civil drawings for location, specifications and details.

~~D. Add Alternate No. 4: Exterior Paving~~ NOT USED

~~The cost to add material and labor to install all exterior paving as described on the documents. Including base layers and reinforcing.~~

E. Add Alternate No. 5: Metal Roofing

The cost to Install metal roofing in lieu of asphalt shingles above the Base Bid shingles to provide all work including labor, materials, fees, and taxes.

F. Add Alternate No.6: Basement Perimeter Wall

The cost to add 2 x 4 wall around the perimeter of the concrete foundation (north/east/south) wall above the Base Bid to provide all work including labor, materials, fees, and taxes.

G. Add Alternate No. 7: Lightning Protection

The cost to add lightning protection to the building. Refer to sheet LP101 for lightning protection details and specifications above the Base Bid to provide all work including labor, materials, fees, and taxes.

H. Deduct Alternate No. 8: Strand Vertical Siding and Batten

The cost deducts for material and labor to install Strand Vertical siding and battens instead of fiber cement board and batten to provide all work, including labor, materials, fees and taxes.

END OF SECTION 012300

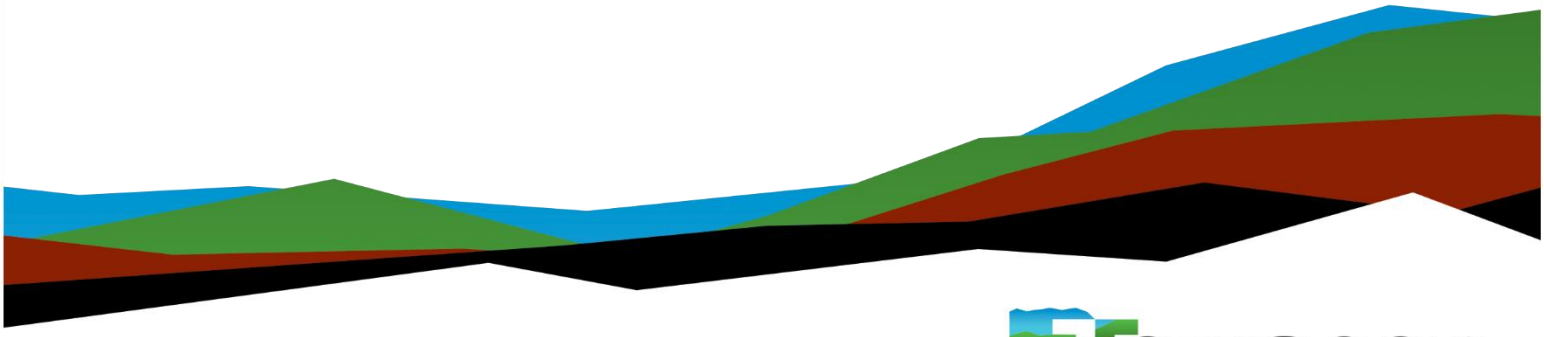
KDWP Visitor's Center

Geotechnical Engineering Report

April 8, 2024 | Terracon Project No. C6245003.R1

Prepared for:

Schwab Eaton
Manhattan, Kansas



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1120 Hostetler Drive
Manhattan, KS 66502
(785) 539-9099
Terracon.com

April 8, 2024

Schwab Eaton
5410 Ledge Stone Drive
Manhattan, Kansas 66503

Attn: Mr. Jared Brooks, P.E.
P: (785) 539-4687
E: jbrooks@schwab-eaton.com

Re: Geotechnical Engineering Report
KDWP Visitor's Center
Near Horsethief Rd. and Buzzard Bay Rd.
Kanopolis, Kansas
Terracon Project No. C6245003.R1

Dear Mr. Brooks:

We have completed a subsurface exploration and geotechnical engineering evaluation for the referenced project in general accordance with Terracon Proposal No. PC6245003.R1 dated February 8, 2024. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations, floor slabs, and pavements for the project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,

Terracon

Michael A. Snapp, P.E.
Geotechnical Engineer
Kansas PE: 27005

Jamie M. Klein, P.E.
Senior Engineer
Kansas PE: 22112

Table of Contents

Attachments

Note: This report was originally delivered in a web-based format. **Blue Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the Terracon logo will bring you back to this page. For more interactive features, please view your project online at **client.terracon.com**.

Refer to each individual Attachment for a listing of contents.

Introduction

This report presents the results of our subsurface exploration and Geotechnical Engineering services performed for the proposed new building to be located west of the Kansas Department of Wildlife and Parks Facility near the intersection of Horsethief Road and Buzzard Bay Road at Kanopolis Lake near Kanopolis, Kansas. The purpose of these services was to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil and rock conditions
- Groundwater conditions
- IBC seismic site class
- Site preparation and earthwork
- Foundations
- Floor slabs
- Pavements

Drawings showing the site and boring locations are shown on the attached **Site Location** and **Exploration Plan**. The results of the laboratory testing performed on soil samples obtained from the site during our field exploration are included on the boring logs in **Exploration Results**.

Project Description

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Information Provided	Our understanding of the project is from email correspondence with the Client and provided Site Overlay (PDF and .jpg file) and the site location provided in Google Earth.
Project Description	The project will include the construction of a new building with a walk-out basement to the west. The building will have a plan area of approximately 3,200 square feet and will include associated paved parking and apron areas south of the building. In addition, we understand a lateral field is planned west of the new building.

Item	Description
Proposed Structure	We anticipate the building will be wood-framed and likely supported by shallow foundations.
Finished Floor Elevation (FFE)	Main level: 1,530 feet Basement level: 1,520 feet
Maximum Loads	Anticipated structural loads were not provided. We have assumed the following maximum loads based on our experience with similar projects. ▪ Columns: 125 kips ▪ Walls: 3 kips per linear foot (klf) ▪ Slabs: 125 pounds per square foot (psf)
Grading/Slopes	Based on grading plans, cuts of up to 8 feet will be required to achieve the basement FFE. We understand that final slopes would have a maximum height of 10 feet and inclination of 3H:1V (Horizontal: Vertical).
Below-Grade Structures	We understand a walk-out basement is planned.
Free-Standing Retaining Walls	We understand up to 10-foot-tall retaining walls will be required for the walk-out basement.
Pavements	No information regarding anticipated vehicle types, axle loads, or traffic volumes was provided. We anticipate the pavements will be utilized primarily by passenger vehicles (cars, pickup trucks, SUV's) with occasional 2-axle delivery trucks and 3-axle trash collection trucks.

Terracon should be notified if any of the above information is inconsistent with the planned construction, especially the grading limits, as modifications to our recommendations may be necessary.

Site Conditions

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Project Location	The project is located at the existing Kanopolis Public Lands office located near the intersection of Horsethief Road and Buzzard Road in Kanopolis Lake State Park, which is about 9 miles southeast of Kanopolis, Kansas. Latitude/Longitude: 38.6455, -97.9879 (approximate) See **Site Location**
Existing Improvements	The general area of the project is improved with the existing Kanopolis Public Lands office and associated parking and drive lanes. The immediate project site is currently an undeveloped area.
Current Ground Cover	Short grass, lightly to moderately vegetated
Existing Topography	The site slopes down from east to west with ground surface elevations ranging from about 1,530 feet to 1,520 feet across the project site.

Geotechnical Characterization

We have developed a general characterization of the subsurface conditions based on the subsurface exploration, laboratory data, geologic setting, and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical evaluation. Conditions observed at each boring location are indicated on the individual logs. The individual logs and GeoModel are in the **Exploration Results** section of this report.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the individual boring logs and GeoModel.

Model Layer	Layer Name	General Description
1	**Surface**	Topsoil
2	**Possible Fill Materials**	Lean to Fat and Lean Clays, varying amounts of sand
3	**Cohesive Soils**	Lean to Fat Clays, varying amounts of sand, medium stiff to stiff
4	**Cohesionless Soils**	Sands, fine to coarse grained, varying amounts of silt and clays, very loose to medium dense
5	**Bedrock**	Shale, completely weathered

The borings were observed during drilling and shortly after completion of drilling for the presence and level of water. Groundwater was observed at a depth of 17 feet while drilling in Boring B-3. Groundwater was not encountered in the other borings at these times. However, this does not necessarily mean stable groundwater level was observed in Boring B-3, or that the remaining borings terminated above groundwater. A longer period of time may be required for groundwater to develop and stabilize in a borehole. Longer term observations in piezometers or observation wells, sealed from the influence of surface water, are often required to define groundwater levels.

Groundwater levels may fluctuate due to seasonal variations in the amount of rainfall, runoff, and other factors not evident at the time the borings were performed. "Perched" water could occur above lower permeability soil layers and/or near the soil/bedrock interface, and "trapped" water could be present within existing fill materials. Therefore, groundwater conditions at other times may be different than the conditions encountered in our exploratory borings. The potential for water level fluctuations and perched water should be considered when developing design and construction plans and specifications for the project.

Seismic Site Class

The seismic design requirements for buildings and other structures are based on Seismic Design Category. The Site Class is required to determine the Seismic Design Category for a structure. The Site Class is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7 and the International Building Code (IBC). Based on the geotechnical characterization of the site, **Seismic Site Class C** can be considered for design of the project. The subsurface exploration at this site extended to a maximum depth of 20 feet. The site properties below the maximum boring depth were estimated based on our experience and knowledge of geologic conditions of the general area. Upon request, we could perform deeper borings or geophysical testing to confirm the conditions below the current maximum boring depth.

Geotechnical Overview

Based on the results of the subsurface exploration, laboratory tests, and our analyses, it is our opinion the proposed building can be supported on spread footings bearing on native soil or newly placed compacted engineered fill that extends to suitable native soils. Additional considerations are provided below.

Cohesionless Soils and Soft Subgrade potential

Due to the somewhat low strength clay soils and cohesionless soils, the need for some surficial compaction with hand-held dynamic compaction equipment should be anticipated prior to placing structural fill, steel, and/or concrete. Should surficial compaction not be adequate, construction of a working surface consisting of either crushed stone or a lean concrete mud mat may be necessary prior to the placement of reinforcing steel and construction of foundations.

Possible Existing Fill

Possible fill materials were encountered at 4 of the 5 boring locations to depths ranging from approximately 2 to 7 feet. These materials were composed of lean to fat and lean clays with varying amounts of sand and exhibited low sample recovery, relatively low strength and variable moisture content as summarized below.

Item	Range
Sample Recovery (%)	33 – 100
Moisture Content (%)	8 – 27
SPT N-Value (bpf)	4 – 5

Foundations, floor slabs and pavements supported on/above undocumented fill may not perform predictably and could experience larger-than-tolerable movements (settlement and/or heave) resulting in cracking, uneven floors, sticking doors, and other damage. However, based upon the finished floor elevation of the basement, we anticipate the majority of these materials will be removed. To limit the potential for these conditions for pavement areas, we recommend subsurface conditions be evaluated during construction, and any existing fill be removed at least 1 foot below the final pavement subgrade elevation.

Once planned cuts have been made, the subgrade should be further evaluated by Terracon as described in the **Earthwork** section of this report. After evaluation and removal of any unsuitable soils, the over-excavation should be backfilled as recommended in the **Earthwork** section of this report. Based on the recovered soil samples it may be feasible to reuse the possible fill as new engineered fill below the recommended LVC zone; however, significant moisture conditioning could be required.

Existing fill should be anticipated in unexplored areas of the site, possibly to greater extents. The depth and composition of the existing fill materials can vary greatly over relatively small lateral and vertical distances. Caution should be exercised when using the depth and composition of the fill observed at the discrete boring locations for estimating purposes. Therefore, a contingency budget could be considered to provide for additional earthwork items such as moisture conditioning subgrade soils, and repairing

soft subgrade soils, uncontrolled existing fill remediation, and unsuitable foundation bearing soils.

Swell Potential

Moderately expansive clay soils were encountered at the site. These materials have the potential to shrink and swell with seasonal fluctuations in the soil moisture content. We recommend the floor slabs be supported on at least 18 inches of low volume change (LVC) material. In areas that are currently above or less than 2 feet below the planned bottom of floor slab level, native fat clay soils should be undercut to accommodate placement of LVC material. In areas where more than 2 feet of fill will be placed below the bottom-of-floor-slab level, at least the upper 18 inches of new engineered fill should consist of LVC material. Details regarding the LVC zone are provided in **Earthwork** and **Floor Slabs**.

This report provides recommendations to help mitigate the effects of soil shrinkage and expansion. However, even if these procedures are followed, some movement and at least minor cracking in the structure could still occur. The severity of cracking and other cosmetic damage such as uneven floor slabs on grade could increase if any modification of the site results in excessive wetting or drying of the expansive soils. Eliminating the risk of movement and cosmetic distress may not be feasible, but it may be possible to further reduce the risk of movement if significantly more expensive measures are used during construction. We would be pleased to discuss other construction alternatives with you upon request.

General

The recommendations contained in this report are based upon the results of field and laboratory testing (presented in the **Exploration Results**), engineering analyses, and our current understanding of the proposed project. The **General Comments** section provides an understanding of the report limitations.

Earthwork

Site preparation, excavation, subgrade preparation, and placement of engineered fill should follow the recommendations presented in this section. The recommendations presented for design and construction of earth-supported elements including foundations, slabs, and pavements are contingent upon the recommendations outlined in this section being followed. We recommend earthwork on this project be observed and evaluated by Terracon. The evaluation of earthwork should include observation and testing of subgrade preparation, engineered fill, foundation bearing soils, and other geotechnical conditions exposed during the construction of the project.

Site Preparation

Vegetation, topsoil, and any loose, soft, or otherwise unsuitable soils present within the proposed construction areas should be stripped. Based on information obtained at the boring locations, stripping depths on the order of 6 inches should be anticipated to remove the root zone materials. However, greater stripping depths may be required in areas not explored by the borings. Organic soils removed during site preparation should not be used as fill beneath the proposed new building and pavement areas.

As noted in **Geotechnical Overview**, the borings encountered possible fill materials which were variable in consistency and moisture to depths ranging from 2 to 7 feet below the existing grades. Support of foundations, floor slabs and pavements on or above the variable possible fill soils without remediation is not recommended. However, we would anticipate most of these materials in the building footprint will be removed to accommodate the planned basement. We recommend evaluation and removal of existing fill 1 foot below final pavement subgrade elevations.

After cuts have been completed for the planned construction, the subgrade should be further evaluated by Terracon using hand equipment, test pits, field density tests, and/or possibly obtaining additional samples for further laboratory testing. If unsuitable materials are encountered at this time, these materials should be removed and replaced with controlled engineered fill. There is inherent risk for the owner that compressible or unsuitable material, within or buried in fill materials, will not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the fill materials.

After completing these operations, the exposed soils should be proofrolled. A Terracon representative should observe the proofrolling. Proofrolling can be accomplished using a loaded tandem-axle dump truck with a gross weight of at least 20 tons, or similarly loaded equipment. Areas that display excessive deflection (pumping) or rutting during proofroll operations should be improved by scarification/compaction or by removal and replacement with engineered fill.

Although no evidence of fill or underground facilities (such as septic tanks, cesspools, basements, and utilities) was observed during the exploration and site reconnaissance, such features could be encountered during construction. If unexpected fills or underground facilities are encountered, such features should be removed, and the excavation thoroughly cleaned prior to backfill placement and/or construction.

Excavation

We anticipate that excavations for the proposed construction can be accomplished with conventional earthmoving equipment. The bottom of excavations should be thoroughly cleaned of loose soils and disturbed materials prior to backfill placement and/or construction.

Based on the results of our exploration, it appears that cohesionless soils (sand) may be encountered during construction. Continued confinement is required for cohesionless soils (native or when used as engineered fill) to remain in a dense state. Therefore, caution should be used where existing or new improvements (foundations, sidewalks, pavements, existing utilities, etc.) are supported over cohesionless soils that have been placed as fill and new adjacent excavations are performed as undermining could quickly occur. In addition, temporary trench excavations that encounter cohesionless materials typically require flatter cut slopes than trench excavations within cohesive soils. Further, any water present within the cohesionless soils, perched or from surface drainage, would significantly complicate excavation and backfilling efforts and additional dewatering techniques may be required.

Subgrade Stabilization

Due to the presence of soils with high moisture content and relatively low strength, some means of subgrade stabilization may be required to facilitate construction, especially if wet soils are encountered during site preparation or if the subgrade becomes saturated by precipitation during site preparation/earthwork operations.

In general (weather permitting), scarifying, drying, and compacting the exposed subgrades is expected to be the most economical means of improving these soils prior to placing new fill. However, this option is typically less effective where soft/wet soils are more than about one foot thick. Alternatives for subgrade stabilization could include undercutting unsuitable soils (wet, low strength, and/or disturbed), incorporating crushed limestone aggregate (typically on the order of 12 to 30 inches thick) to improve subgrade stability, and/or the incorporation of a chemical additive such as portland cement or Class C fly ash. The need for stabilization, and the most appropriate type of stabilization, will be dependent upon soil, groundwater, and weather conditions at the time of construction. The proposed grading plan, the construction schedule, and construction methods will also affect the selection of stabilization method. Terracon should be retained during construction to help provide recommendations as needed.

Fill Material Types

Fill required to achieve design grades should be classified as engineered fill. Engineered fill could be further classified as structural fill and general fill. Structural fill is material used below, or within 10 feet of structures, pavements or constructed slopes. General fill is material used to achieve grade outside of these areas.

Reuse of On-Site Soil: Excavated on-site native soil may be selectively reused as engineered fill. Based on our subsurface characterization it appears the existing native soils are suitable for reuse as engineered fill below the recommended LVC zone. Material property requirements for on-site soil for use as general fill and engineered fill are noted in the table below:

Fill Type [1]	USCS Classification	Acceptable Location for Placement
Possible Existing fill and native lean and lean to fat clays	CL or CL/CH [2]	Pavement areas and at depths greater than 18 inches below building finished grade Existing fill should be observed, tested and approved by Terracon. Moisture conditioning of existing fill should be anticipated. Organics, rock/rubble fragments larger than 3 inches, debris, or other unsuitable materials should be removed prior to re-use of the existing fill in engineered fill sections.
Native lean clays (LL<45 and 5<PI<23)	CL	All locations and elevations, except where baserock or free-draining materials are required

Imported Fill Materials: Imported fill materials should meet the following material property requirements. Regardless of its source, engineered fill should consist of approved materials that are free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade.

Fill Type [1]	USCS Classification	Acceptable Location for Placement
Native fat clays and/or lean to fat clays (LL≥45 and/or PI≥23)	CH, CL/CH [2]	Pavement areas and at depths greater than 18 inches below building finished grade

Fill Type [1]	USCS Classification	Acceptable Location for Placement
Low volume change (LVC) material [3]	GM [4] or CL (LL<45 and 5<PI<23)	All locations and elevations, except where baserock or free-draining materials are required
Free draining granular [5]	GW, GP, SW, SP	All locations free-draining material is required

1. Engineered fill should consist of approved materials that are free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade.
2. By our definition, cohesive soils with a liquid limit of 46 to 49 and/or plastic index of 22 or greater are classified as lean to fat clay (with the borderline symbol CL/CH) to alert of the expansive potential of moderate plasticity clay soils (see ASTM D2487, Section 1.1, Note 1).
3. If LVC material meeting the above criteria cannot be readily obtained, an LVC soil may be developed by chemically modifying the onsite clay soils. Additional recommendations can be provided upon request if consideration is given to this method of construction.
4. KDOT Type AB-3 or an approved alternate gradation of crushed limestone aggregate
5. Granular materials with less than 5 percent fines (material passing the #200 sieve), such as ASTM C33 Size No. 57 aggregate or an approved alternate gradation.

Fill Placement and Compaction Requirements

Structural and general fill should meet the following compaction requirements.

Item	Structural Fill	General Fill
Maximum Lift Thickness	9 inches or less in loose thickness when heavy, self-propelled compaction equipment is used 4 to 6 inches in loose thickness when hand-guided equipment (i.e., a jumping jack or plate compactor) is used	Same as structural fill
Minimum Compaction Requirements [1,2,3]	95% of max. for cohesive soils	92% of max.

Item	Structural Fill	General Fill
Water Content Range [1]	Low plasticity cohesive (LL<45): -2% to +2% of optimum High plasticity cohesive (LL≥45): 0 to +4% of optimum Granular: -3% to +3% of optimum	As required to achieve min. compaction requirements [4]

1. Maximum density and optimum water content as determined by the standard Proctor test (ASTM D 698).
2. High plasticity cohesive fill should not be compacted to more than 100% of standard Proctor maximum dry density.
3. If the granular material is a coarse sand or gravel, or of a uniform size, or has a low fines content, compaction comparison to relative density may be more appropriate. In this case, granular materials should be compacted to at least 70% relative density (ASTM D 4253 and D 4254). Materials not amenable to density testing should be placed and compacted to a stable condition observed by the Geotechnical Engineer or representative.
4. Typically -3% to +3% of optimum

Utility Trench Backfill

Any soft or unsuitable materials encountered at the bottom of utility trench excavations should be removed and replaced with structural fill or bedding material in accordance with project and utility owner's specifications. This recommendation is particularly applicable to utility work requiring grade control and/or in areas where subsequent grade raising could cause settlement in the subgrade supporting the utility. Trench excavation should not be conducted below a downward 1:1 projection from existing foundations without engineering review of shoring requirements and geotechnical observation during construction.

Trench backfill should be mechanically placed and compacted as discussed earlier in this report. Compaction of initial lifts should be accomplished with hand-operated tampers or other lightweight compactors. Where trenches are placed beneath slabs or footings, the backfill should satisfy the material requirements of engineered fill discussed in this report. Flooding or jetting for placement and compaction of backfill is not recommended without further evaluation.

Utility trenches are a common source of water infiltration and migration. Utility trenches that penetrate beneath the building should be effectively sealed to restrict water intrusion and flow through the trenches, which could migrate below the building. Each trench should be provided with an effective trench plug that extends at least 5 feet from the face of the building exterior. The plug material should consist of cementitious flowable fill or low permeability clay. The trench plug material should be placed to

surround the utility line. If clay is used to construct the trench plug, the clay should be placed and compacted in accordance with the water content and compaction recommendations for structural fill provided in this report.

Grading and Drainage

The site should be graded to provide effective drainage away from the building during and after construction, and these conditions should be maintained throughout the life of the structure. Accumulation of water adjacent to the structure could contribute to significant moisture increases in the subgrade soils and subsequent softening/settlement or expansion/heave, which could result in soil movements greater than those discussed in this report. Greater movements can result in unacceptable differential floor slab and/or foundation movements, cracked slabs and walls, and roof leaks.

Trees or other vegetation whose root systems have the ability to remove excessive moisture from the subgrade and foundation soils should not be planted next to the structure. Trees and shrubbery should be kept away from the exterior edges of the foundation element a distance at least equal to 1.5 times their expected mature height.

After building construction and landscaping have been completed, final grades should be verified to document effective drainage has been achieved. Grades around the structure should also be periodically inspected and adjusted, as necessary, as part of the structure's maintenance program. Where paving or flatwork abuts the structure, a maintenance program should be established to effectively seal and maintain joints and prevent surface water infiltration.

Earthwork Construction Considerations

Care should be taken to avoid disturbance of prepared subgrades. Unstable subgrade conditions can develop during general construction operations, particularly if the soils are wetted and/or subjected to repetitive construction traffic. If unstable subgrade conditions develop, stabilization measures will need to be employed. Construction traffic over the completed subgrade should be avoided to the extent practical. If the subgrade becomes frozen, desiccated, saturated, or disturbed, the affected materials should be removed or these materials should be scarified, moisture conditioned, and compacted prior to floor slab construction.

Based on conditions encountered in the borings, significant seepage is generally not expected in excavations for this project (e.g., for foundation construction and utility installation). If seepage is encountered in excavations during construction, the contractor is responsible for designing, implementing, and maintaining appropriate dewatering methods to control seepage and facilitate construction. In our experience, dewatering of excavations in clay soils can typically be accomplished using sump pits

and pumps. If seepage occurs where sand seams or sand layers are encountered in excavations, a more extensive dewatering system may be required.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, and in accordance with any applicable local, state, and federal safety regulations. The contractor should be aware that slope height, slope inclination, and excavation depth should in no instance exceed those specified by these safety regulations. Flatter slopes than those dictated by these regulations may be required depending upon the soil conditions encountered and other external factors. These regulations are strictly enforced and if they are not followed, the owner, contractor, and/or earthwork and utility subcontractor could be liable and subject to substantial penalties. Under no circumstances should the information provided in this report be interpreted to mean that Terracon is responsible for construction site safety or the contractor's activities. Construction site safety is the sole responsibility of the contractor who shall also be solely responsible for the means, methods, and sequencing of the construction operations.

Construction Observation and Testing

The earthwork efforts should be observed by the Geotechnical Engineer (or others under their direction). Observation should include documentation of adequate removal of surficial materials (vegetation, topsoil, and pavements), evaluation and remediation of existing fill materials, as well as proofrolling and mitigation of unsuitable areas delineated by the proofroll.

Each lift of compacted fill should be tested, evaluated, and reworked, as necessary, as recommended by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content at a frequency of at least one test for every 2,500 square feet of compacted fill in the building areas and 5,000 square feet in pavement areas. Where not specified by local ordinance, one density and water content test should be performed for every 100 linear feet of compacted utility trench backfill and a minimum of one test performed for every 12 vertical inches of compacted backfill.

In areas of foundation excavations, the bearing subgrade should be evaluated by the Geotechnical Engineer. If unanticipated conditions are observed, the Geotechnical Engineer should prescribe mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

Shallow Foundations

If the site has been prepared in accordance with the recommendations in **Earthwork**, the following design parameters are applicable for shallow foundations.

Shallow Foundation Design Parameters

Item	Description
Suitable Bearing Material [1]	Suitable native soils or engineered fill extending to suitable native materials
Maximum Net Allowable Bearing Pressure [2, 3]	1,500 psf
Minimum Foundation Dimensions	Per IBC 1809.7
Minimum Embedment Below Finished Grade [4]	3 feet
Estimated Total Settlement from Structural Loads [5]	Less than 1 inch
Estimated Differential Settlement [5, 6]	About 1/2 to 2/3 of total settlement
Ultimate Passive Pressure [7]	260 pcf, equivalent fluid density
Ultimate Coefficient of Sliding Friction	0.30

1. Unsuitable or soft soils should be overexcavated and replaced per the recommendations presented in **Earthwork**.
2. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Values assume exterior grades are no steeper than 20% within 10 feet of structure.
3. Values provided are for maximum loads noted in **Project Description**. Additional geotechnical consultation will be necessary if higher loads are anticipated.
4. Embedment necessary to minimize the effects of frost and/or seasonal water content variations
5. Foundation settlement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the footings, the thickness of compacted fill, and the quality of the earthwork operations. Additional foundation movements could occur if foundation soils are wetted or dried.
6. Differential settlements are noted for equivalent-loaded foundations and bearing elevation as measured over a span of 50 feet.

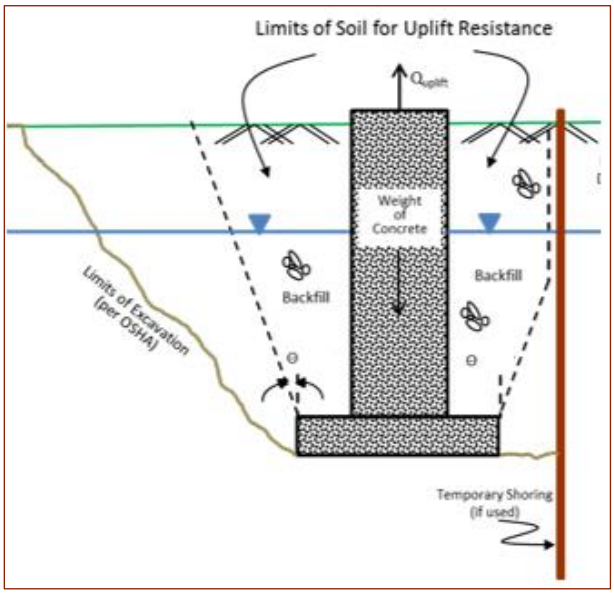
Item	Description

7. Use of the passive earth pressure requires the sides of the excavation for the spread footing foundation to be nearly vertical and the concrete placed neat against these vertical faces or that the footing forms be removed and compacted engineered fill be placed against the vertical footing face. Passive resistance in the upper 3 feet of the soil profile should be neglected. Some movement of the footing will be required to mobilize resistance from passive pressure.

Shallow Foundation Overturning and Uplift Loads

Foundations with significant overturning moments (such as canopy foundations) should be proportioned to maintain resultant eccentricity within the center third of the foundation when subject to overturning loads (e.g., eccentricity < b/6, where b is the foundation width). This requirement will maintain the foundation in compression against the soil bearing surface.

Uplift resistance of spread footings can be developed from the effective weight of the footing and the overlying soils. As illustrated on the subsequent figure, the effective weight of the soil prism defined by diagonal planes extending up from the top of the perimeter of the foundation to the ground surface at an angle, θ, of 20 degrees from the vertical can be included in uplift resistance. The maximum allowable uplift capacity should be taken as a sum of the effective weight of soil plus the dead weight of the foundation, divided by an appropriate factor of safety. A maximum total unit weight of 100 pcf should be used for the backfill. This unit weight should be reduced to 40 pcf for portions of the backfill or natural soils below the groundwater elevation.

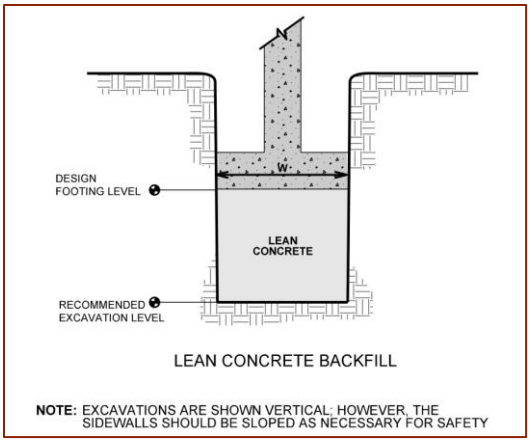


Shallow Foundation Construction Considerations

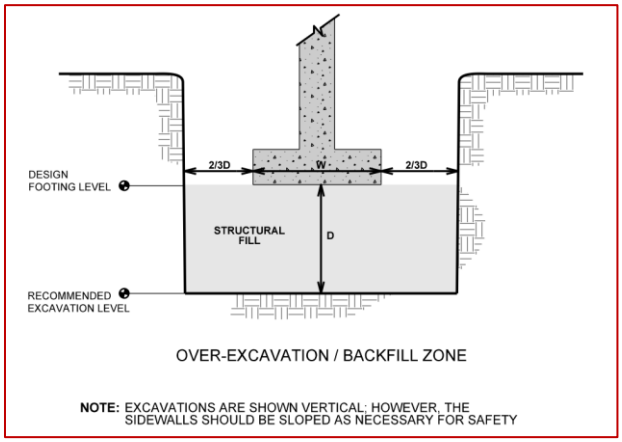
The base of all foundation excavations should be free of water and loose soil prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. If the soils at the bearing level become excessively dry, disturbed, saturated, or frozen, the affected soil should be removed prior to placing concrete. If the excavations must remain open overnight or for an extended period of time, placement of a lean concrete mud-mat over the bearing soils should be considered.

Sandy soils exposed at the surface of footing excavations may require surficial compaction with hand-held dynamic compaction equipment prior to placing structural fill, steel, and/or concrete. Should surficial compaction not be adequate, construction of a working surface consisting of either crushed stone or a lean concrete mud mat may be required prior to the placement of reinforcing steel and construction of foundations.

The bearing materials at the base of each footing excavation should be evaluated by a representative of the Geotechnical Engineer. If unsuitable bearing materials are observed, the excavation should be extended deeper to suitable soils. The footings could bear directly on suitable soils at the lower level or on lean concrete backfill as shown on the following figure.



The footings could also bear on properly compacted structural fill extending down to suitable soils as shown in the following figure. Overexcavation for structural fill placement below footings should extend laterally beyond all edges of the footings at least 8 inches per foot of overexcavation depth below footing elevation. The overexcavation should then be backfilled up to the footing base elevation with well graded granular material (e.g., KDOT AB-3) aggregate or an approved alternate gradation) placed and compacted as recommended in **Earthwork**.



Floor Slabs

Grade supported floor slabs appear feasible for the proposed building. Possible fill materials were encountered at the site to depths of 2 to 7 feet below existing grade. As previously described, existing fill (if present) should be further evaluated by Terracon.

Due to the presence of moderate to high plasticity clay soils, we recommend the upper 18 inches of materials below the floor slab area consist of low volume change materials as described in **Earthwork**.

Design parameters for floor slabs assume the requirements in **Earthwork** have been followed. Specific attention should be given to positive drainage away from the structure and positive drainage of the aggregate base beneath the floor slab.

Floor Slab Design Parameters

Item	Description
Floor Slab Support[1]	At least 18 inches of low volume change (LVC) material
Granular Leveling Course Layer Thickness [2, 3]	4 inches (minimum)
Estimated Modulus of Subgrade Reaction [4]	125 pounds per square inch per inch (psi/in) for point loads

1. Floor slabs should be structurally independent of building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation.
2. Well graded crushed sone (e.g., KDOT AB-3) or open-graded crushed stone (e.g., ASTM C33, Size No. 57 aggregate) can be used as the leveling course.
3. These granular materials can be considered part of the LVC zone.

Item	Description

4. Modulus of subgrade reaction is an estimated value based upon our experience with the subgrade condition, the requirements noted in **Earthwork**, and the floor slab support as noted in this table. It is provided for point loads. For large area loads the modulus of subgrade reaction would be lower.

The use of a vapor retarder should be considered beneath concrete slabs on grade covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, when the project includes humidity-controlled areas, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

Joints should be placed in slabs at regular intervals as recommended by ACI to help control the locations of cracks. Joints or any cracks that develop in the floor slab should be sealed with a waterproof, non-extruding compressible compound.

If floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing, or other means.

Settlement of floor slabs supported on existing fill materials cannot be accurately predicted but could be larger than normal and result in some cracking. Mitigation measures, as noted in **Earthwork**, are critical to the performance of floor slabs. In addition to the mitigation measures, the floor slab can be stiffened by adding steel reinforcement, grade beams and/or post-tensioned elements.

Floor Slab Construction Considerations

The subgrade should be maintained within the moisture content range recommended for engineered fill until the floor slab is constructed. If the subgrade becomes desiccated prior to construction of the floor slab, the affected material should be removed or the materials should be scarified, moistened, and compacted. Upon completion of grading operations in the building area, care should be taken to maintain the subgrade within the moisture content and density ranges recommended for engineered fill prior to construction of the building floor slab.

On most project sites, the site grading is generally accomplished early in the construction phase. However, as construction proceeds, the subgrade may be disturbed due to utility excavations, construction traffic, desiccation, rainfall etc. As a result, the floor slab subgrade soils may not be suitable for placement of the granular course

and/or concrete at the time of building construction, and corrective action may be required.

The Geotechnical Engineer should observe the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel, and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

Pavements

Pavement Subgrade Preparation

Pavement subgrades are expected to consist of on-site native clay soils, new engineered fill consisting of similar materials, or existing fill that is further evaluated by Terracon during construction. The pavement subgrades should be evaluated and proofrolled as recommended in **Earthwork**. If soft or otherwise unsuitable areas are observed, additional over-excavation and replacement will be needed.

Grading and paving are commonly performed by separate contractors and there is often a time lapse between the end of grading operations and the commencement of paving. Subgrades prepared early in the construction process may become disturbed by construction traffic. Non-uniform subgrades often result in poor pavement performance and local failures relatively soon after pavements are constructed. Depending on the paving equipment used by the contractor, measures may be required to improve subgrade strength to greater depths for support of heavily loaded concrete/asphalt trucks.

We recommend the moisture content and density of the subgrade be evaluated and the pavement subgrades be proofrolled (using a loaded tandem-axle dump truck with a minimum gross weight of 20 tons or similarly loaded rubber-tire equipment) within two days prior to commencement of actual paving operations. Areas not in compliance with the required ranges of moisture or density should be scarified, moisture conditioned, and compacted. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by removing and replacing the materials with properly compacted fills. The subgrade should be in its finished form at the time of the final review.

Pavement Section Thicknesses

Pavement thickness depends upon many factors including but not limited to:

- applied wheel/axle loads and number of repetitions
- subgrade and pavement material characteristics
- climate conditions
- site and pavement drainage

Specific information regarding anticipated vehicle types, axle loads and traffic volumes was not provided at the time of this report. The "Parking Lots" pavement section considers 4-tire, 2-axle personal vehicle traffic only (cars, vans, pickups and SUVs). The "Drives" pavement section considers personal vehicle traffic and a maximum of ten delivery trucks/trash collection trucks per week. Our recommendations for ACC pavement over aggregate base, and portland cement concrete (PCC) pavement sections are outlined in the following table.

Minimum Pavement Section Thicknesses

Pavement Type	Parking Lots	Drives
ACC [1] Over Aggregate Base	2 inches ACC surface 2 inches ACC base 6 inches aggregate base (KDOT AB-3 or similar)	2 inches ACC surface 4 inches ACC base 6 inches aggregate base (KDOT AB-3 or similar)
PCC [2,3]	5 inches PCC 4 inches aggregate base (KDOT AB-3 or similar)	6 inches PCC 4 inches aggregate base (KDOT AB-3 or similar)

1. The pavement thicknesses provided herein are based on all asphaltic concrete surface and base course materials conforming to KDOT Specifications, Section 602 Hot Mix Asphalt (HMA) Construction. Lower quality/cost commercial mixes could also be considered, but a reduced service life should be expected.
2. Minimum 4,000 psi at 28 days and 5 to 7 percent air entrained
3. For trash container pads, we recommend a PCC pavement section be used consisting of 7 inches (minimum) of PCC over 4 inches (minimum) of aggregate base (KDOT AB-3 or similar) on a compacted soil subgrade. The trash container pad should be large enough to support the container and the tipping axle of the collection truck.

PCC pavements will perform better than ACC in areas where short radius turning and braking are expected (i.e., entrance/exit aprons) due to better resistance to rutting and shoving. In addition, PCC pavement will perform better in areas subject to heavy static loads.

Construction traffic on the pavements was not considered in developing our opinions of minimum pavement thickness. If the pavements will be subject to construction equipment/vehicles, the pavement sections should be revised to consider the additional loading.

Pavements and subgrades will be subject to freeze-thaw cycles and seasonal fluctuations in moisture content. Pavement thickness design methods are intended to provide adequate thickness of structural materials over a particular subgrade such that wheel loads are reduced to a level that the subgrade can support. The subgrade support parameters for pavement thickness design do not account for shrink/swell movements of a subgrade constructed of expansive clay soils. Therefore, the pavement may be adequate from a structural standpoint, yet still experience cracking and deformation due to shrink/swell related movement of the subgrade.

The pavement sections provided above consider that the subgrade soils will not experience significant changes in moisture content. Paved areas should be sloped to provide rapid drainage of surface water and to drain water away from the pavement edges. Pavements should be designed so water does not accumulate on or adjacent to the pavement, since this could saturate and soften the subgrade soils and subsequently accelerate pavement deterioration.

Post-construction performance of pavements supported on existing fill materials cannot be accurately predicted but could be larger than normal and result in some cracking. Mitigation measures, as noted in **Earthwork**, are critical to the performance of pavements. In addition to the mitigation measures, aggregate base and/or pavement thicknesses could be increased to further reduce risks associated with existing fill.

Pavement Maintenance

The pavement sections represent minimum recommended thicknesses, and periodic maintenance and repairs should be anticipated. Preventive maintenance should be planned and provided for through an on-going pavement management program. Maintenance activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment. Pavement care consists of both localized (e.g., crack sealing, joint sealing, and patching) and global maintenance (e.g., surface sealing). Additional engineering consultation is recommended to determine the type and extent of a cost-effective program. Even with periodic maintenance, some movements and related cracking may still occur, and repairs may be required.

Pavement performance is affected by the pavement's surroundings. In addition to providing preventive maintenance, the civil engineer should consider the following recommendations in the design and layout of pavements:

- Final grade adjacent to paved areas should slope down from the edges at a minimum 2%.
- Subgrade and pavement surfaces should have a minimum 2% slope to promote proper surface drainage.
- Install pavement drainage systems surrounding areas anticipated for frequent wetting.
- Install joint sealant and seal cracks immediately.
- Seal all landscaped areas in or adjacent to pavements to reduce moisture migration to subgrade soils.
- Place compacted, low permeability backfill against the exterior side of curb and gutter.
- Place curb, gutter, and/or sidewalk directly on clay subgrade soils rather than on unbound granular base course materials.

General Comments

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Support of floor slabs and pavements above existing fill is discussed in this report. Even with the construction observation/testing recommended in this report, the owner must accept the risk that unsuitable materials within or buried by the fill will not be discovered. This may result in larger than normal settlement and damage to slabs and pavements supported above existing fill, requiring additional maintenance. This risk cannot be eliminated without removing the existing fill from below the building and pavement areas, but it can be reduced by thorough observation and testing as discussed herein.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, cost estimating, excavation support, and dewatering requirements/design are the responsibility of others. Construction and site development have the potential to affect adjacent properties. Such impacts can include damages due to vibration, modification of groundwater/surface water flow during construction, foundation movement due to undermining or subsidence from excavation, as well as noise or air quality concerns. Evaluation of these items on nearby properties are commonly associated with contractor means and methods and are not addressed in this report. The owner and contractor should consider a preconstruction/precondition survey of surrounding development. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

Attachments

Exploration and Testing Procedures

Field Exploration

Number of Borings	Approximate Boring Depth (feet)	Location
4	20	Planned building corners
1	5	Planned lateral field

Boring Layout and Elevations: Terracon personnel provided the boring layout using handheld GPS equipment (estimated horizontal accuracy of about ±10 feet) and referencing existing site features. Approximate ground surface elevations at each boring were obtained by interpolation from the provided topographic site plan. If more precise elevations or boring layout are desired, we recommend the borings be surveyed.

Subsurface Exploration Procedures: We advanced the borings with a track-mounted rotary drill rig using continuous flight solid stem augers. Two samples were obtained in the upper 5 feet of each boring and at intervals of 5 feet thereafter. In the thin-walled tube sampling procedure, a thin-walled, seamless steel tube with a sharp cutting edge was pushed hydraulically into the soil to obtain a relatively undisturbed sample. In the split-barrel sampling procedure, a standard 2-inch outer diameter split-barrel sampling spoon was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at the test depths.

We also observed the boreholes while drilling and at the completion of drilling for the presence of groundwater. The groundwater levels are shown on the attached boring logs and GeoModel.

The sampling depths, penetration distances, and other sampling information was recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a geotechnical engineer. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials observed during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

For safety purposes, all borings were backfilled with auger cuttings after their completion. Because backfill material often settles below the surface after a period, we recommend boreholes be checked periodically and backfilled, if necessary.

Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests. The laboratory testing program included the following tests on selected samples:

- Moisture Content
- Dry Unit Weight
- Unconfined Compression
- Atterberg Limits

The laboratory testing program included examination of soil samples by an engineer or geologist. Based on the results of our field and laboratory programs, we described and classified the soil samples in accordance with the Unified Soil Classification System.

Rock classification was conducted using locally accepted practices for engineering purposes and was based on drilling characteristics and observation of disturbed samples and auger cuttings; rock core samples and/or petrographic analysis may reveal other rock types. Boring log rock classification was determined using the attached Rock Classification Notes.

Site Location and Exploration Plans

Contents:

Site Location Plan
Exploration Plan

Note: All attachments are one page unless noted above.

Site Location

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES MAP PROVIDED BY MICROSOFT BING MAPS

Exploration Plan

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

Exploration and Laboratory Results

Contents:

Note: All attachments are one page unless noted above.

KDWP Visitor's Center
Near Horsethief Rd. and Buzzard Bay Rd. | Kanopolis, KS
Terracon Project No. C6245003

Terracon
1120 Hostetler Dr
Manhattan, KS

Boring Log No. B-1

Location: See Exploration Plan

Latitude: 38.6451° Longitude: -97.9883°

Model Layer	Graphic Log	Depth (Ft.)	Elevation.: 1522 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Recovery (In.)	Field Test Results	SAMPLE NUMBER	HP (psf)	Unconfined Compressive Strength (psf)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI
1		0.5	**6 INCHES TOPSOIL** 1521.5											
2			**LEAN TO FAT CLAY (CL/CH)**, trace sand, olive brown to brown, medium stiff, (possible fill)				6	2-1-3 N=4	1	9000 (HP)		27.0		
		3.0	1519											
3			**LEAN TO FAT CLAY (CL/CH)**, trace sand, olive brown, medium stiff	5			21		2	2500 (HP)	1600	22.0	91	
		9.0	1513											
4			**POORLY GRADED SAND (SP)**, fine to medium grained, brown, loose	10			12	2-2-3 N=5	3			5.5		
		14.5	with shale and clay 1507.5				16	2-5-13 N=18	4			17.2		
5			**SHALE**, gray, completely weathered	15										
		20.0	1502				14	10-14-30 N=44	5	9000+ (HP)		13.8		
			Boring Terminated at 20 Feet	20										

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed

Drill Rig
Geoprobe

Hammer Type
Automatic

Driller
AS

Logged by
MRK

Boring Started
03-25-2024

Boring Completed
03-25-2024

Notes

Advancement Method
Solid stem auger

Abandonment Method
Boring backfilled with Auger Cuttings and/or Bentonite

KDWP Visitor's Center
Near Horsethief Rd. and Buzzard Bay Rd. | Kanopolis, KS
Terracon Project No. C6245003

Terracon
1120 Hostetler Dr
Manhattan, KS

Boring Log No. B-2

Location: See Exploration Plan

Latitude: 38.6452° Longitude: -97.9881°

Depth (Ft.) Elevation.: 1527.5 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Recovery (In.)	Field Test Results	SAMPLE NUMBER	HP (psf)	Unconfined Compressive Strength (psf)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI
1		0.5 **6 INCHES TOPSOIL** 1527										
2		**LEAN CLAY (CL)**, trace sand, red brown to brown, medium stiff, (possible fill) 3.0 1524.5			8	1-2-3 N=5	1	7000 (HP)		17.0		40-15-25
3		**LEAN TO FAT CLAY (CL/CH)**, trace sand, olive brown, medium stiff 7.0 1520.5			22		2	6500 (HP)	4150	9.7	99	
4		**WELL GRADED SAND (SW)**, fine to coarse grained, red brown, loose to medium dense 19.0 1508.5			12	2-3-3 N=6	3			1.5		
					16	5-7-10 N=17	4			8.2		
5		**SHALE**, gray, completely weathered 20.0 1507.5			14	9-15-14 N=29	5			7.4		
		Boring Terminated at 20 Feet										

Depth (Ft.): 5, 10, 15, 20

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed

Notes

Advancement Method
Solid stem auger

Abandonment Method
Boring backfilled with Auger Cuttings and/or Bentonite

Drill Rig
Geoprobe

Hammer Type
Automatic

Driller
AS

Logged by
MRK

Boring Started
03-25-2024

Boring Completed
03-25-2024

KDWP Visitor's Center
Near Horsethief Rd. and Buzzard Bay Rd. | Kanopolis, KS
Terracon Project No. C6245003

Terracon
1120 Hostetler Dr
Manhattan, KS

Boring Log No. B-3

Location: See Exploration Plan

Latitude: 38.6450° Longitude: -97.9883°

Depth (Ft.) Elevation.: 1523.5 (Ft.)

Model Layer	Graphic Log	Depth (Ft.)	Water Level Observations	Sample Type	Recovery (In.)	Field Test Results	SAMPLE NUMBER	HP (psf)	Unconfined Compressive Strength (psf)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI
1		0.5 **6 INCHES TOPSOIL** 1523										
2		**LEAN TO FAT CLAY (CL/CH)**, trace sand, olive brown to brown, medium stiff, (possible fill)										
					10	2-2-2 N=4	1	8000 (HP)		7.9		
					24		2					
		7.0 1516.5										
4		**WELL GRADED SAND (SW)**, fine to coarse grained, brown to gray brown, loose										
					11	2-1-2 N=3	3			3.2		
		with clay seams			14	2-4-2 N=6	4			8.5		
		17.0 1506.5	▽									
5		**SHALE**, gray, completely weathered										
					16	10-19-27 N=46	5	9000+ (HP)		14.7		
		20.0 1503.5										
		Boring Terminated at 20 Feet										

Depth (Ft.): 5, 10, 15, 20

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
▽ 17 feet while drilling
17 feet at completion

Drill Rig
Geoprobe

Hammer Type
Automatic

Driller
AS

Logged by
MRK

Boring Started
03-25-2024

Boring Completed
03-25-2024

Notes

Advancement Method
Solid stem auger

Abandonment Method
Boring backfilled with Auger Cuttings and/or Bentonite

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Near Horsethief Rd. and Buzzard Bay Rd. | Kanopolis, KS
Terracon Project No. C6245003

Terracon
1120 Hostetler Dr
Manhattan, KS

Boring Log No. B-4

Location: See Exploration Plan

Latitude: 38.6451° Longitude: -97.9880°

Model Layer	Graphic Log	Depth (Ft.)	Elevation.: 1528 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Recovery (In.)	Field Test Results	SAMPLE NUMBER	HP (psf)	Unconfined Compressive Strength (psf)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI
1		0.5	**6 INCHES TOPSOIL** 1527.5											
3			**LEAN CLAY (CL)**, trace organics, red brown, stiff				14		1	4500 (HP)	3100	22.5	104	
							9	2-2-6 N=8	2	6000 (HP)		19.1		
		7.0	1521	5										
4			**SILTY SAND (SM)**, fine grained, brown, loose				10	3-2-3 N=5	3			3.7		
		12.0	1516	10										
			POORLY GRADED SAND (SP), fine to medium grained, brown, medium dense				14	3-5-6 N=11	4			7.0		
		19.5	1508.5	15										
5		20.0	**SHALE**, gray, completely weathered 1508				16	8-9-22 N=31	5			10.1		
			Boring Terminated at 20 Feet	20										

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed

Drill Rig
Geoprobe

Hammer Type
Automatic

Driller
AS

Logged by
MRK

Boring Started
03-25-2024

Boring Completed
03-25-2024

Notes

Advancement Method
Solid stem auger

Abandonment Method
Boring backfilled with Auger Cuttings and/or Bentonite

KDWP Visitor's Center
Near Horsethief Rd. and Buzzard Bay Rd. | Kanopolis, KS
Terracon Project No. C6245003

Terracon
1120 Hostetler Dr
Manhattan, KS

Boring Log No. B-5

Model Layer	Graphic Log	Location: See Exploration Plan Latitude: 38.6450° Longitude: -97.9885° Depth (Ft.) / Elevation.: 1518.5 (Ft.)	Depth (Ft.)	Water Level Observations	Sample Type	Recovery (In.)	Field Test Results	SAMPLE NUMBER	HP (psf)	Unconfined Compressive Strength (psf)	Water Content (%)	Dry Unit Weight (pcf)	Atterberg Limits LL-PL-PI
1		0.5 **6 INCHES TOPSOIL** 1518											
2		**LEAN TO FAT CLAY (CL/CH)**, trace sand, brown gray, very soft, (possible fill) 2.0 1516.5											
4		**POORLY GRADED SAND (SP)**, fine to medium grained, brown, very loose				10	1-2-1 N=3	1			12.7		
						14	1-1-2 N=3	2			5.3		
		5.0 1513.5	5										
		Boring Terminated at 5 Feet											

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Water Level Observations
No free water observed

Drill Rig
Geoprobe

Hammer Type
Automatic

Driller
AS

Logged by
MRK

Boring Started
03-25-2024

Boring Completed
03-25-2024

Notes

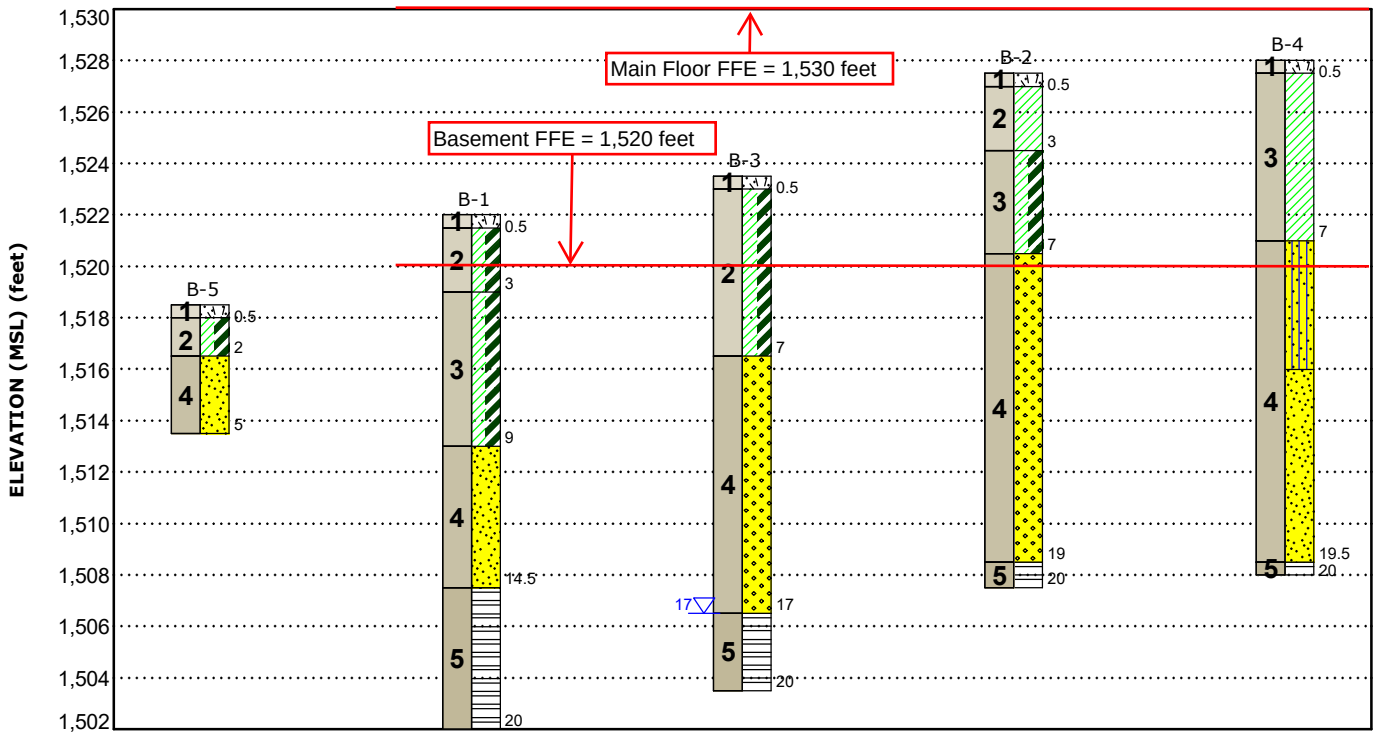
Advancement Method
Solid stem auger

Abandonment Method
Boring backfilled with Auger Cuttings and/or Bentonite

KDWP Visitor's Center
Near Horsethief Rd. and Buzzard Bay Rd. | Kanopolis, KS
Terracon Project No. C6245003

Terracon
1120 Hostetler Dr
Manhattan, KS

GeoModel



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	Surface	Topsoil
2	Possible Fill Materials	Lean to Fat and Lean Clays, varying amounts of sand.
3	Cohesive Soils	Lean to Fat Clays, varying amounts of sand, medium stiff to stiff.
4	Cohesionless Soils	Sands, fine to coarse grained, varying amounts of silt and clays, very loose to medium dense.
5	Bedrock	Shale, completely weathered.

Legend

- Topsoil
- Lean Clay/Fat Clay
- Poorly-graded Sand
- Shale
- Lean Clay
- Well-graded Sand
- Silty Sand

▽ First Water Observation

Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time.
Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project.
Numbers adjacent to soil column indicate depth below ground surface.

Project Name: **KDWP Visitor's Center**
Project Location: **Kanopolis Lake, Kansas**
Terracon Project No.: **C6245003**
Date Test Performed: **3/26/2024**

FIELD PERCOLATION TESTS

TEST LOCATION	TIME MEASURED	INCREMENT		CALCULATED FALL PERCOLATION RATE	AVERAGE PERCOLATION RATE
		TIME	FALL PER TIME INTERVAL		
		(MINUTES)	(INCHES)	(MINTUES/INCH)	(MINTUES/INCH)
Percolation Test	11:42:00 AM	17.00	1.50	11.33	**10.07**
	12:02:00 PM	20.00	2.25	8.89	
	12:17:00 PM	15.00	1.50	10.00	

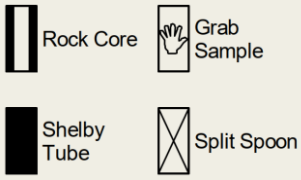
Supporting Information

Contents:

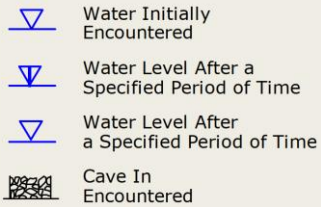
Note: All attachments are one page unless noted above.

General Notes

Sampling



Water Level



Field Tests

N	Standard Penetration Test Resistance (Blows/Ft.)
(HP)	Hand Penetrometer
(T)	Torvane
(DCP)	Dynamic Cone Penetrometer
UC	Unconfined Compressive Strength

Descriptive Soil Classification

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

Location and Elevation Notes

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

Strength Terms

Relative Density of Coarse-Grained Soils (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		**Consistency of Fine-Grained Soils** (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Relative Density	**Standard Penetration or N-Value (Blows/Ft.)**	**Consistency**	**Unconfined Compressive Strength Qu (psf)**	**Standard Penetration or N-Value (Blows/Ft.)**
Very Loose	0 – 3	Very Soft	less than 500	0 – 1
Loose	4 – 9	Soft	500 – 1000	2 – 4
Medium Dense	10 – 29	Medium Stiff	1000 – 2000	4 – 8
Dense	30 – 50	Stiff	2000 – 4000	8 – 15
Very Dense	> 50	Very Stiff	4000 – 8000	15 – 30
		Hard	> 8,000	> 30

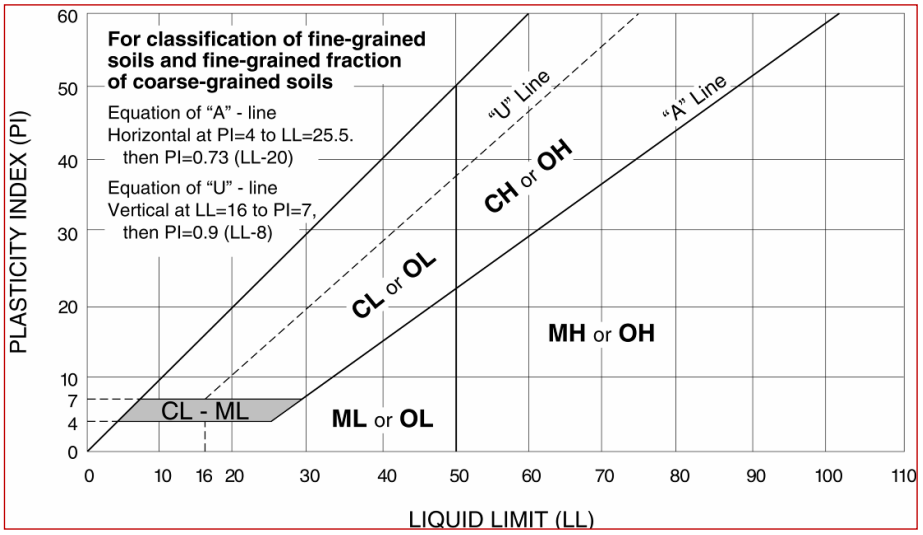
Relevance of Exploration and Laboratory Test Results

Exploration/field results and/or laboratory test data contained within this document are intended for application to the project as described in this document. Use of such exploration/field results and/or laboratory test data should not be used independently of this document.

Unified Soil Classification System

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]				Soil Classification	
				Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 4 sieve	**Gravels:** More than 50% of 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 [Cc<1 or Cc>3.0] [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 and/or [Cc<1 or Cc>3.0] [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	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots above "A" line [J]	CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]	ML	Silt [K, L, M]
		Organic:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	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:	$\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$	OH	Organic clay [K, L, M, P]
					Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-inch (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 in shaded area, soil 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.



Rock Classification Notes

WEATHERING	
Term	**Description**
Fresh	Mineral crystals appear bright; show no discoloration. Features show little or now staining on surfaces. Discoloration does not extend into intact rock.
Slightly weathered	Rock generally fresh except along fractures. Some fractures stained and discoloration may extend <0.5 inches into rock.
Moderately weathered	Significant portions of rock are dull and discolored. Rock may be significantly weaker than in fresh state near fractures. Soil zones of limited extent may occur along some fractures.
Highly weathered	Rock dull and discolored throughout. Majority of rock mass is significantly weaker and has decomposed and/or disintegrated; isolated zones of stronger rock and/or soil may occur throughout.
Completely weathered	All rock material is decomposed and/or disintegrated to soil. The rock mass or fabric is still evident and largely intact. Isolated zones of stronger rock may occur locally.

STRENGTH OR HARDNESS		
Description	**Field Identification**	**Uniaxial Compressive Strength, psi**
Extremely strong	Can only be chipped with geological hammer. Rock rings on hammer blows. Cannot be scratched with a sharp pick. Hand specimens require several hard hammer blows to break.	>36,000
Very strong	Several blows of a geological hammer to fracture. Cannot be scratched with a 20d common steel nail. Can be scratched with a geologist's pick only with difficulty.	15,000-36,000
Strong	More than one blow of a geological hammer needed to fracture. Can be scratched with a 20d nail or geologist's pick. Gouges or grooves to ¼ inch deep can be excavated by a hard blow of a geologist's pick. Hand specimens can be detached by a moderate blow.	7,500-15,000
Medium strong	One blow of geological hammer needed to fracture. Can be distinctly scratched with 20d nail. Can be grooved or gouged 1/16 in. deep by firm pressure with a geologist's pick point. Can be fractured with single firm blow of geological hammer. Can be excavated in small chips (about 1-in. maximum size) by hard blows of the point of a geologist's pick;	3,500-7,500
Weak	Shallow indent by firm blow with geological hammer point. Can be gouged or grooved readily with geologist's pick point. Can be excavated in pieces several inches in size by moderate blows of a pick point. Small thin pieces can be broken by finger pressure.	700-3,500
Very weak	Crumbles under firm blow with geological hammer point. Can be excavated readily with the point of a geologist's pick. Pieces 1-in. or more in thickness can be broken with finger pressure. Can be scratched readily by fingernail.	150-700

DISCONTINUITY DESCRIPTION			
Fracture Spacing (Joints, Faults, Other Fractures)		**Bedding Spacing (May Include Foliation or Banding)**	
Description	**Spacing**	**Description**	**Spacing**
Intensely fractured	< 2.5 inches	**Laminated**	< ½-inch
Highly fractured	2.5 – 8 inches	**Very thin**	½ – 2 inches
Moderately fractured	8 inches to 2 feet	**Thin**	2 inches – 1 foot
Slightly fractured	2 to 6.5 feet	**Medium**	1 – 3 feet
Very slightly fractured	> 6.5 feet	**Thick**	3 – 10 feet
		Massive	> 10 feet

ROCK QUALITY DESIGNATION (RQD) [1]	
Description	**RQD Value (%)**
Very Poor	0 - 25
Poor	25 – 50
Fair	50 – 75
Good	75 – 90
Excellent	90 - 100

1. The combined length of all sound and intact core segments equal to or greater than 4 inches in length, expressed as a percentage of the total core run length.