2964 Sidco Drive, Nashville, TN 37204
+1 615-348-4025

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Addendum No. 1

Date	May 21, 2025
To	Bidders
From	James G. Golias II, PE
Subject	City of Crossville 2024 SPEC Building (PO 16174)
Project Number	Verdantas No. 232137 / Agency Tracking No. 330001-00425

Receipt of this addendum must be acknowledged and noted in accordance with the Contract Documents and Specifications. Failure of any bidder to receive any such addendum or interpretation shall not relieve such bidder from any obligation under his/her bid as submitted. All addenda so issued shall become part of the contract documents.

1. Pre-Bid Meeting Minutes
2. Pre-Bid Sign-In Sheet
3. The Bid Opening Date is being moved to June 6, 2025 @ 2:00PM. The following documents have been updated and included to reflect this change:
    a. Project Information
    b. Advertisements For Bids
    c. Information for Bidders
4. October 2017 site plans prepared by Tare, Inc.
5. Geotechnical Exploration reports dated March 6, 2017 and April 11, 2022.

END OF ADDENDUM NO. 1

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Pre-Bid Meeting Summary

Date	May 13, 2025
To	Bidders
From	James G. Golias II, PE
Subject	City of Crossville 2024 SPEC Building (PO 16174)
Project Number	Verdantas No. 232137 / Agency Tracking No. 330001-00425

This is for the pre-bid meeting that was held at the City of Crossville City Hall in Room 424 at 392 North Main Street, Crossville, TN 38555 on Tuesday, May 13, 2025 at 1:00 PM Central Time.

1. Introduction of attendees
2. Sign in sheet
   - All participants were requested to sign name and contact information on sign-in sheet.
3. Project Area
   - The project is for the construction of a 100,000 SF Pre-Engineered Metal Building (PEMB), inclusive of the site work (as shown on the drawings) at 700 Interchange Drive, Crossville, TN 38555
4. Previous Site Preparation Activities
   - Initial site grading and installation of a stormwater detention basin was previously performed based upon the October 2017 site plans prepared by Tare, Inc. These drawings are available upon request. These drawings show the approximate location where over excavation was performed to remove rock for building foundations.
   - Geotechnical Exploration reports dated March 6, 2017 and April 11, 2022 are available for viewing.
5. Project Funding
   - The City of Crossville has received Site Development Grant (SDG) funds for this project. As such the Upper Cumberland Development District (UCDD) will be providing assistance with to comply with SDG bidding requirements as referenced by the Tennessee Department of Economic and Community Development (TNECD).
6. Availability of Documents and Addenda
   - Documents may be ordered by registering and paying for the documents online at https://bids.verdantas.com Please contact planroom@verdantas.com or call 440-530-2351 if you encounter any problems registering or paying for the documents.
7. Bid Submittals
   - Separate sealed bids for the City of Crossville 2024 Spec Building (PO 16174) will be received by the City of Crossville at the office of 392 North Main Street, Crossville, TN 38555 until 2:00 PM CST on May 30, 2025, and then at said office publicly opened and read aloud.
8. Proper bid submittal requirements

- Each bid must be submitted in a sealed envelope bearing on the outside the name of the bidder, his/her address, the name of the project for which the bid is submitted and all other information required by State law. If forwarded by mail, the sealed envelope containing the bid must be enclosed in another envelope addressed as specified in the bid form.
- Each bidder must deposit with his bid, security in the amount, form and subject to the conditions provided in the Information for Bidders.
- The Payment and Performance Bonds are not required at the time of bidding.
- Attention of bidders is particularly called to the requirements as to conditions of employment to be observed and minimum wage rates to be paid under the contract.
- No bidder may withdraw his bid within 60 days after the actual date of the opening thereof.

9. Addenda and Interpretations
   - No interpretation of the meaning of the plans, specifications or other pre-bid documents will be made to any bidder orally. Every request for such interpretation should be in writing addressed to James Golias at jgolias@verdantas.com and to be given consideration must be received at least five days prior to the date fixed for the opening of bids. (i.e. **Saturday May 24, 2025**). Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the specifications which, if issued, will be provided via emailed to all prospective bidders registered at the Verdantas website and posted on the Verdantas website, not later than three days prior to the date fixed for the opening of bids. (i.e. **Monday May 26, 2025**) Failure of any bidder to receive any such addendum or interpretation shall not relieve such bidder from any obligation under his/her bid as submitted. All addenda so issued shall become part of the contract documents.
10. Contract Time
    - Bidder must agree to commence work on or before a date to be specified in a written "Notice to Proceed" of the Owner and to fully complete the project within 365 consecutive calendar days thereafter. Bidder must agree also to pay as liquidated damages, the sum of $600.00 for each consecutive calendar day thereafter as hereinafter provided in the Supplemental General Conditions.
11. Questions (During or After the Meeting)
    - *Is grading part of this contract or will the City perform this scope of work?*
      - **Yes, grading on Sheets C3.2 and C3.3 are included with the project. The grading shown on Sheet C3.1 is a future grading plan with the site will be fully developed.**
    - *Is the gravel for the building future slab part of this scope or to be done by the Grading contractor?*
      - **Yes**
    - *Is compacted crushed aggregate outside the dock doors on the west side of the building by GC or grading Contractor.*
      - **The work shall be included with the submitted bid.**
    - *Are utilities to the building as shown on C2.2 included with the bid?*

- **Yes**

- *Is there a specified Insulation thickness or R-Value for the PEMB walls and roof?*
  - **Refer to the Envelope Compliance Certificate on Sheet A0.0. It is my understanding that on previous projects, the PEMB supplier works directly with an insulation supplier who is aware of the best way to achieve the required insulation values.**
- *If you have exact R-values for roof and walls will be most helpful.*
  - **Roof: R-19 and R-11 Liner System - thermal spacer blocks required.**
  - **Wall: R-13 plus R-13 continuous insulation**
- *Plans show in the specs a 2" insulation, another place on the drawings says to design it that the entire building can be conditioned. Clarification on thickness / type would be great*
  - **This note can be disregarded and follow the R-values indicated above.**
- *S0.1 PEMB Building Design note 11 specifies a minimum collateral load of 12 PSF. A1.0 Metal building notes require the design to incorporate the design loadings for a future sprinkler system.*
  - *Provide clarification that the minimum collateral load including future fire sprinklers system is 12 PSF.*
    - **12 PSF includes sprinkler loading.**
  - *Confirm no additional line loads are required.*
    - **No additional line loads are anticipated at this time.**
- *A1.1 General Floor Plan Notes say, "design for the possibility of a future sprinkler system to be installed." How many pounds per square foot (psf)? 2, 3, 4, 5?*
  - **This information shall be determined by the PEMB supplier's structural engineer.**
- *Clarify the intent for the future dock door location scope. Contractor assumes that the intent is to install all 'future' framed openings complete with structural support for vertical lift doors. All 'future' openings to be infilled with removable framing, panels, insulation, and trims for future selective removal.*
  - **Correct**
- *Confirm desired paint finish type for metal roof. Options are 2 coat Silicone Polyester, 3 coat Kynar, or Galvalume.*
  - **Galvalume**
- *Confirm desired paint finish type for metal walls. Options are 2 coat Silicone Polyester, 3 coat Kynar, or Galvalume.*
  - **Kynar**
- *Clarify anticipated hardware types and keying requirements for exterior personnel doors.*

    - **Panic hardware that can all be keyed the same, which shall be keyed on the outside, turn latch on the inside with door levers on both sides. Overhead doors shall have an interior lock, but do not have to be keyed.**

- *Specs call for aluminum foil facing for vapor barrier. Will WMP-VPR Plus (white metalized reinforced vapor barrier) work?*
  - **This note can be disregarded and follow the R-values indicated above.**
- *Could you confirm that the piers are 2' 6" thick?*
  - **Top of footing is 3'-0", Top of pier is 0'-6" making the concrete piers 3'-6".**
- *Is the contractor responsible for the design of the PEMB building?*
  - **Yes**
- *Are Davis Bacon wage rates required?*
  - **No. However certified payrolls will be required.**
- *Do Buy American requirements apply to this project?*
  - **No**
- *Is the metal roof Sheet A1.3 references "Screw Down Roof by PEMB Supplier" and Sheet S0.2 references "Standing-Seam Metal Roof Panels". Please provide clarification.*
  - **Minimum 24-gauge thick Standing-Seam Roof Panels**
- *Can a panel profile and gauge be provided for the wall panels?*
  - **Minimum 26-gauge thick PBR Panel**
- *Can colored metal panels or flashing be used in lieu of painting the exterior building stripes?*
  - **Yes**
- *Is excavation considered Unclassified?*
  - **Yes**
- *Is there a construction contingency, alternates and/or unit prices for additional items such as rock excavation?*
  - **There is a $250,000 construction contingency. No alternates are included and this is a lump sum bid. No additional compensation will be provided for rock excavation.**
- Please confirm the number of interior columns needed.
  - **60 (i.e. 15 x 4) internal columns, not including any perimeter columns, are currently anticipated. However, less internal columns are acceptable.**

PRE-BID MEETING SIGN-IN SHEET

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PROJECT NAME: City of Crossville 2024 SPEC Building (PO 16174)
JOB NUMBER: Verdantas Project No. 232137 / Agency Tracking No: 33001-00425
Date: May 13, 2025 1:00 PM CST

NAME	COMPANY	ADDRESS	CITY, STATE	ZIP	PHONE#	EMAIL ADDRESS
James Golias	Verdantas, LLC	2964 Sidco Drive	Nashville, TN	37204	615-349-4025	jgolias@verdantas.com
Phillip Stiles	Evans-Ailey	4163 Blueberry Road	Powell, TN	37849	(865)498-0132 (865)680-9663	phillip@eac-inc.net
Scott Fruehauf	Lee Alcock Construction	684 N. Jefferson st	Shelbyville, TN	37160	931 307-1440	R.Lamb@Leealcock.com
Shawn Banzhoff	Cherry Creek Electric	PO Box 2985	Cookeville TN	38503	931 400 6543	estimating@cherrycreekelec.com
Bucky Burke	BLB Construction LLC	735 Highland Lane	Crossville, TN	38555	931-570-1941	bucky burke@blbconstruction llc.com
Seth Corley	Carter Group	400 E. Main St.	Chattanooga, TN	30750	334-744-0153	seth.corley@cartergroupllc.com
Alaz Looper	ETC Construction	6153 Plateau rd	Crossville TN	38571	931-265-2925	Alaz.looper@outlook.com
Don Cole	City	392 N. Main St	" "	38555	931-456-2014	don.cole@crossvilletn.gov
Ben McLean	UCDD	1104 Englandale Dr.	Cookeville	38506	931-881-7758	bmclean@ucdd.org
Greg Atkins	ETC	6153 Plateau Rd	Crossville	38571	931-265-4520	greg@etcerectors.com
GEORGE Hamilton III	J. PAUL SMITH CONSTRUCTION	40 TANNER ROAD	CROSSVILLE	38571	931-335-6000	GEORGE@GHCONSTRUCTION.com

PRE-BID MEETING SIGN-IN SHEET

verdantas

PROJECT NAME: City of Crossville 2024 SPEC Building (PO 16174)
JOB NUMBER: Verdantas Project No. 232137 / Agency Tracking No: 33001-00425
Date: May 13, 2025 1:00 PM CST

NAME	COMPANY	ADDRESS	CITY, STATE	ZIP	PHONE#	EMAIL ADDRESS
David Bulba	Bulba Builders LLC	793 Keith Valley Rd	Cleveland TN	37323	423 716 4590	Bulbabuilders@Gmail.com

PROJECT INFORMATION

PROJECT:	**CITY OF CROSSVILLE 2024 SPEC BUILDING (PO 16174)**
OWNER:	**CITY OF CROSSVILLE** **392 NORTH MAIN STREET** **CROSSVILLE, TENNESSEE 38555** **CONTACT: TIM BEGLEY** **TELEPHONE: 931-456-2014** **EMAIL:TIM.BEGLEY@CROSSVILLETN.GOV**
CIVIL:	**VERDANTAS, LLC** **2964 SIDCO DRIVE** **NASHVILLE, TENNESSEE 37204** **CONTACT: JAMES G. GOLIAS II** **TELEPHONE: 615-349-4025** **EMAIL: JGOLIAS@VERDANTAS.COM**
ARCHITECT:	**TB ARCHITECTURE, PLLC** **211 SCOTLAND PLACE** **NASHVILLE, TN 37205** **TOMMY BROWN** **TELPHONE: 615-513-3135** **EMAIL: TOMMY@TBARCHITECTUREPLLC.COM**
STRUCTURAL:	**VERDANTAS, LLC** **1001 LAKESIDE AVENUE EAST, SUITE 1005,** **CLEVELAND, OH 44114** **BRAD FRONEK** **TELPHONE: 216-430-8506** **EMAIL: BRAD.FRONEK@VERDANTAS.COM**
MECHANICAL & PLUMBING:	**OLERT ENGINEERING, INC.** **605C BERRY ROAD, NASHVILLE, TN 37204** **JESS GARDNER** **TELEPHONE: 615-944-1296** **EMAIL: JESS@OLERTENGINEERING.COM**
ELECTRICAL:	**IDESIGN SERVICES, INC.** **703 BERRY ROAD, NASHVILLE, TN 37204** **WENDELL BARNETT** **TELEPHONE: 615-298-5557** **EMAIL: WBARNETT@IDESIGNSERVICES.COM**
PROJECT #:	**232137 (PO 16717)**

BID OPENING DATE:	**FRIDAY, JUNE 6, 2025 @ 2:00 PM**
ADVERTISING DATE:	**FRIDAY, MAY 2, 2025**
PRE-BID MEETING DATE:	**TUESDAY, MAY 13, 2025 @ 1:00 PM (NON-MANDATORY)**
COMMENCEMENT DATE:	**TBD**
COMPLETION DATE:	**365 CALENDAR DAYS**

ADVERTISEMENT FOR BIDS

Project No. **232137 (PO 16174)**

The City of Crossville (Owner)

Separate sealed bids for the **City of Crossville 2024 Spec Building (PO 16174)** will be received by the City of Crossville at the office of **392 North Main Street, Crossville, TN 38555 until 2:00 PM CST on June 6, 2025**, and then at said office publicly opened and read aloud.

A **Non-Mandatory pre-bid meeting** will be held in Room **424 at 392 North Main Street, Crossville, TN 38555 on Tuesday, May 13, 2025 at 1:00 PM CST** to discuss the plans and specifications and then visit the site.

The Information for Bidders, Form of Bid, Form of Contract, Plans, Specifications, and Forms of Bid Bond, Performance and Payment Bond, and other contract documents may be examined at the following:

Crossville City Hall, 392 North Main Street, Crossville, TN 38555

Other Plan Rooms (TBD)

Bids must be in accordance with drawings and specifications and on forms available from Verdantas, LLC at a non-refundable cost of One Hundred Twenty-Five Dollars ($125.00) for mailed hard copies and $45.00 for electronic files. Documents may be ordered by registering and paying for the documents online at https://bids.verdantas.com Please contact planroom@verdantas.com or call 440-530-2351 if you encounter any problems registering or paying for the documents.

The bid specifications, drawings, plan holders list, addenda, and other bid information (but not the bid forms) may be viewed and/or downloaded for free via the internet at https://bids.verdantas.com The bidder shall be responsible to check for Addenda and obtain same from the web site. The owner reserves the right to waive any informalities or to reject any or all bids.

Each bidder must deposit with his bid, security in the amount, form and subject to the conditions provided in the Information for Bidders.

Attention of bidders is particularly called to the requirements as to conditions of employment to be observed and minimum wage rates to be paid under the contract.

No bidder may withdraw his bid within 60 days after the actual date of the opening thereof.

RJ Crawford (Mayor) (Date) April 28, 2025

INFORMATION FOR BIDDERS

1. Receipt and Opening of Bids:

   The **City of Crossville** (herein called the "Owner"), invites bids on the form attached hereto, all blanks of which must be appropriately filled in. Bids will be received by the Owner at the office of **392 North Main Street, Crossville, TN 38555 until 2:00 PM CST on June 6, 2025**, and then at said office publicly opened and read aloud. The envelopes containing the bids must be sealed,

   Addressed to **The City of Crossville** and designated as bid for the **City of Crossville 2024 Spec Building (PO 16174)**.

   The Owner may consider informal any bid not prepared and submitted in accordance with the provisions hereof and may waive any informalities or reject any and all bids. Any bid may be withdrawn prior to the above scheduled time for the opening of bids or authorized postponement thereof. Any bid received after the time and date specified shall not be considered. No bidder may withdraw a bid within 60 days after the actual date of the opening thereof.

2. Preparation of Bid: Each bid must be submitted on the prescribed form. All blank spaces for bid prices must be filled in, in ink or typewritten, in both words and figures.

   Each bid must be submitted in a sealed envelope bearing on the outside the name of the bidder, his/her address, the name of the project for which the bid is submitted and all other information required by State law. If forwarded by mail, the sealed envelope containing the bid must be enclosed in another envelope addressed as specified in the bid form.

3. Subcontracts: The bidder is specifically advised that any person, for, or other party to whom it is proposed to award a subcontract under this contract must be acceptable to the owner after verification by the State of the current eligibility status.

4. Telegraphic Modification: Any bidder may modify his/her bid by telegraphic communication at any time prior to the scheduled closing time for receipt of bids provided such telegraphic communication is received by the Owner prior to the closing time, and, provided further, the Owner is satisfied that a written confirmation of the telegraphic modification over the signature of the bidder was mailed prior to the closing time. The telegraphic communication should not reveal the bid price but should provide the addition or subtraction or other modification so that the final pieces or terms will not be known by the Owner until the sealed bid is opened. If written confirmation is not received within two days from the closing time, no consideration will be given to the telegraphic modification.

5. Method of Bidding: The Owner invites Lump Sum bids for the following:
City of Crossville 2024 Spec Building (PO 16174)

6. Qualification of Bidder: The Owner may make such investigations as s/he deems necessary to determine the ability of the bidder to perform the work, and the bidder shall furnish to the Owner all such information and data for this purpose as the Owner may request. The Owner reserves the right to reject any bid if the evidence submitted by, or investigation of, such bidder fails to satisfy the owner that such bidder is properly qualified to carry out the obligations of the contract and to complete the work contemplated therein. Conditional bids will not be accepted.

7. Bid Security: Each bid must be accompanied by cash, certified check of the bidder, or a bid bond prepared on the form of bid bond attached thereto, duly executed by the bidder as principal and having as surety thereon a surety company approved by the Owner, in the amount of 5% of the bid. Such cash, checks or bid bonds will be returned to all except the three lowest bidders within three days after the opening of bids, and the remaining cash, checks or bid bonds will be returned promptly after the Owner and the accepted bidder have executed the contract, or, if no award has been made within 60 days after the date of the opening of bids, upon demand of the bidder at any time thereafter, so long as s/he has not been notified of the acceptance of his/her bid.

8. Liquidated Damages for Failure to Enter into Contract: The successful bidder, upon his/her failure or refusal to execute and deliver the contract and bonds required within 10 days after s/he has received notice of the acceptance of his/her bid, shall forfeit to the Owner, as liquidated damages for such failure or refusal, the security deposited with his/her bid.

9. Time of Completion and Liquidated Damages: Bidder must agree to commence work on or before a date to be specified in a written “Notice to Proceed” of the Owner and to fully complete the project within **365** consecutive calendar days thereafter. Bidder must agree also to pay as liquidated damages, the sum of **$600.00** for each consecutive calendar day thereafter as hereinafter provided in the Supplemental General Conditions.

10. Condition of Work: Each bidder must inform him/herself fully of the conditions relating to the construction of the project and the employment of labor thereof. Failure to do so will not relieve a successful bidder of his/her obligation to furnish all material and labor necessary to carry out the provisions of his/her contract. Insofar as possible, the contractor, in carrying out the work, must employ such methods as will not cause any interruption of or interference with the work of any other contractor.

11. Addenda and Interpretations: No interpretation of the meaning of the plans, specifications or other pre-bid documents will be made to any bidder orally. Every request for such interpretation should be in writing addressed to

James Golias at jgolias@verdantas.com and to be given consideration must be received at least five days prior to the date fixed for the opening of bids. Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the specifications which, if issued, will be mailed by certified mail with return receipt requested to all prospective bidders (at the respective addresses furnished for such purposes), not later than three days prior to the date fixed for the opening of bids. Failure of any bidder to receive any such addendum or interpretation shall not relieve such bidder from any obligation under his/her bid as submitted. All addenda so issued shall become part of the contract documents.

12. Security for Faithful Performance: Simultaneously with his/her delivery of the executed contract, the Contractor shall furnish a surety bond or bonds as security for faithful performance of this contract and for the payment of all persons performing labor on the project under this contract and furnishing materials in connection with this contract, as specified in the General Conditions included herein. The surety on such bond or bonds shall be a duly authorized surety company satisfactory to the Owner.

13. Power of Attorney: Attorneys-in-fact who sign bid bonds or contract bonds must file with each bond a certified and effectively dated copy of their power of attorney.

14. Notice of Special Conditions: Attention is particularly called to those parts of the contract documents and specifications which deal with the following:

    a. Inspection and testing of materials.
    b. Insurance requirements.
    c. Wage rates.
    d. States allowances.

15. Laws and Regulations: The bidder's attention is directed to the fact that all applicable State laws, municipal ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the contract throughout, and they will be deemed to be included in the contract the same as though herein written out in full.

16. Method of Award – Lowest Responsible Bidder: If at the time this contract is to be awarded, the lowest base bid submitted by a responsible bidder does not exceed the amount of funds then estimated by the Owner as available to finance the contract, the contract will be awarded on the base bid only. If such bid exceeds such amount, the Owner may reject all bids or may award the contract on the base bid combined with such deductible alternates applied in numerical order in which they are listed in the Form of Bid, as produces a net amount which is within the available funds.

17. Obligation of Bidder: At the time of the opening of bids each bidder will be presumed to have inspected the site and to have read and to be thoroughly familiar with the plans and contract documents (including all addenda). The failure or omission of any bidder to examine any form, instrument or document shall in no way relieve any bidder from any obligation in respect of his/her bid.

18. Safety Standards and Accident Prevention: With respect to all work performed under this contract, the contractor shall:

    a. Comply with the safety standards provisions of applicable laws, building and construction codes and the "Manual of Accident Prevention in Construction" published by the Associated General Contractors of America, the requirements of the Occupational Safety and Health Act of 1970 (Public Law 91-596), and the requirements of Title 29 of the Code of Federal regulations, Section 1518 as published in the "Federal Register", Volume 36, No. 75, Saturday, April 17, 1971.

    b. Exercise every precaution at all times for the prevention of accidents and the protection of persons (including employees) and property.

    c. Maintain at his/her office or other well-known place at the job site, all articles necessary for giving first aid to the injured and shall make standing arrangements for the immediate removal to a hospital or a doctor's care of persons (including employees), who may be injured on the job site. In no case shall employees be permitted to work at a job site before the employer has made a standing arrangement for the removal of injured persons to a hospital or a doctor's care.

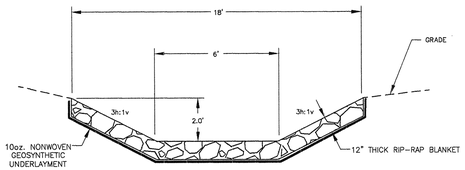
19. Drug-Free Workplace

    Under the provisions of Tennessee Code Annotate §50-9-113 enacted by the General Assembly effective 2001, a) employers with five (5) or more employees who contract with either the state or a local government to provide construction services are required to submit an affidavit stating that they have a drug free workplace program that complies with Title 50, Chapter 9, in effect at the time of submission of a bid at least to the extent required of governmental entities. The statute imposes other requirements on the contractor, but the grantee's responsibility is specifically limited in section (b) of the state as follows:

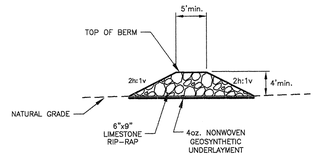
    > (b) A written affidavit by the principal officer of a covered employer provided to a local government at the time such bid or contract is submitted stating that the employer is in compliance with this section shall absolve the local government of all further responsibility under this section and any liability arising from the employer's compliance or failure of compliance with the provisions of this section.

20. Pre-Bid Meeting

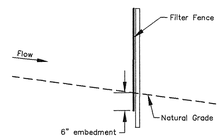
A **Non-Mandatory pre-bid meeting** will be held in **Room 424 at 392 North Main Street, Crossville, TN 38555 on Tuesday, May 13, 2025 at 1:00 PM CST** to discuss the plans and specifications and then visit the site.



RIP-RAP SWALE DETAIL
NOT TO SCALE



RIP-RAP FILTER BERM DETAILS
NOT TO SCALE



FILTER FENCE
TYPICAL INSTALLATION DETAIL
NOT TO SCALE

Scale: 1"=50'

NOTES

1. PRIOR TO CONSTRUCTION START-UP SEDIMENT CONTROL DEVICES SHALL BE INSTALLED TO CONTROL SURFACE RUN-OFF. SEDIMENT CONTROL DEVICES SHALL INCLUDE, BUT NOT LIMITED TO FILTER FABRIC FENCING, STAKED HAY BALES, ROCK CHECK DAMS AND VEGETATIVE WINDROWS. SEDIMENT CONTROL PLANS SHALL BE APPROVED BY THE ENGINEER. STATE AND LOCAL EROSION CONTROL REGULATIONS APPLY.
2. TOPSOIL SHALL BE STRIPPED AND STOCKPILED FOR REDISTRIBUTION OVER THE PROJECT AREA AS REQUIRED. ALL DISTURBED AREAS SHALL BE FERTILIZED, SEEDED, AND MULCHED WITH AN APPROVED REVEGETATIVE MIXTURE EXCEPT FOR PARKING AREAS, BUILDING PADS AND ROADS.
3. SUITABLE BACKFILL MATERIAL SHALL BE PLACED TO ACHIEVE A 100% STANDARD PROCTOR COMPACTION UNDER BUILDING PADS AND 98% STANDARD PROCTOR UNDER PARKING AND LAWN AREAS. COMPACTION TESTS SHALL BE PERFORMED AT REGULAR INTERVALS DURING THE FILL CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COMPACTION TESTING. PROOF ROLLING MAY BE UTILIZED FOR INTERMEDIATE TESTING UNDER THE DIRECTION AND SUPERVISION OF THE ENGINEER.
4. THE GRADES SHOWN REPRESENT THE DESIGN INTENT. ALL AREAS WITHIN THE PROJECT AREA SHALL BE GRADED TO ACHIEVE POSITIVE DRAINAGE. NO PONDING OR STANDING WATER WILL BE PERMITTED.
5. ALL DRAINAGE PIPING SHALL BE REINFORCED CONCRETE PIPE AND SHALL INCLUDE PRECAST HEADWALLS AND ENDWALLS.
6. ALL PROPOSED DRAINAGE DITCHES AND SPLASH PADS ARE TO BE CONSTRUCTED WITH 6"X12" LIMESTONE RIP-RAP WITH A 10 OZ. NONWOVEN GEOSYNTHETIC UNDERLAYMENT.
7. EXISTING CONTOURS SHOWN 2' INTERVAL. PROPOSED FINISHED GRADE CONTOURS SHOWN AT 2' INTERVALS.
8. LOCATIONS OF ALL UTILITIES AND UNDERGROUND STRUCTURES SHOWN ARE APPROXIMATE AND THOSE SHOWN ARE NOT NECESSARILY ALL OF THE EXISTING STRUCTURES. THE FOLLOWING LOCAL UTILITIES SHALL BE CONTACTED PRIOR TO CONSTRUCTION:

TENNESSEE ONE CALL	811
CITY OF CROSSVILLE (water)	484-5113
FRONTIER (telephone)	1-800-351-1111
VOLUNTEER ELECTRIC	484-3527
MIDDLE TENNESSEE NATURAL GAS	484-2067
CITY OF CROSSVILLE (sewer)	484-5113

9. TARE, INC. SHALL NOT BE RESPONSIBLE FOR CONSTRUCTION MEANS, METHODS, TECHNIQUES OR PROCEDURES UTILIZED BY THE CONTRACTOR, NOR FOR THE SAFETY OF THE PUBLIC OR CONTRACTOR'S EMPLOYEES, OR FOR THE FAILURE OF THE CONTRACTOR TO CARRY OUT THE WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.
10. GRADES SHOWN ARE PROJECT FINISHED GRADES. PARKING AREAS AND AND BUILDING PAD SHALL BE GRAVELED TO PREVENT EROSION.
11. STORM SEWER AREA DRAIN INLET STRUCTURES ARE TO BE PROTECTED FROM ERODING MATERIAL WITH HAY BALES OR APPROVED EROSION CONTROL AS DIRECTED BY THE ENGINEER.
12. EXISTING UTILITY RELOCATION IF REQUIRED SHALL BE COORDINATED WITH THE UTILITY PROVIDER, ENGINEER AND THE OWNER PRIOR TO RELOCATION.

BENCH MARK DATA:

BM NO.1 — BENCH MARK NO.1
PK NAIL & WASHER
ELEV. 1795.45'
N=610337.39
E=2249365.91

BM NO.2 — BENCH MARK NO.2
PK NAIL & WASHER
ELEV. 1776.43'
N=610747.20
E=2248812.88

LEGEND

- PROPERTY LINE
- 1800 EXISTING CONTOUR (2' interval)
- 1796 FINISHED CONTOUR (2' interval)
- ss LOW PRESSURE SANITARY SEWER (existing)
- w WATER LINE (existing)
- FIRE HYDRANT (existing)
- g GAS LINE (existing)
- e UNDERGROUND ELECTRIC LINE (existing)
- LIGHT POLE (existing)
- ELECTRIC POWER BOX (existing)
- WATERSHED PEAK
- DRAINAGE FLOW
- FILTER FENCE

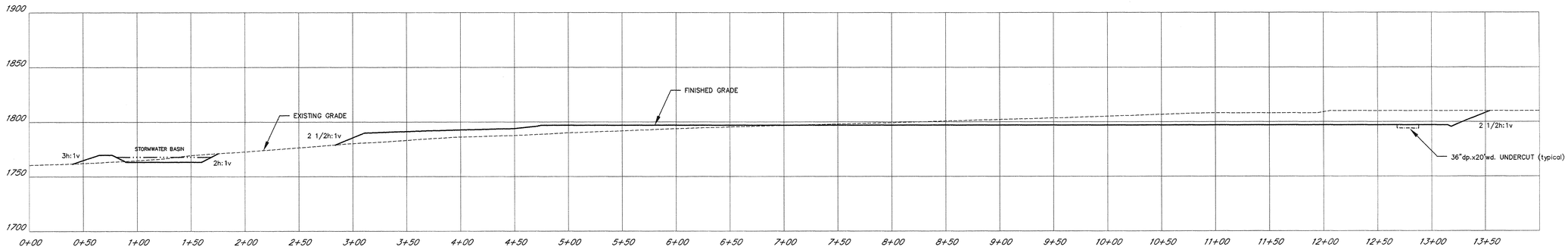
SITE GRADING PLAN
STORM WATER POLLUTION PREVENTION PLAN
for
CITY OF CROSSVILLE
INTERCHANGE BUSINESS PARK

Interchange Drive
Crossville, Tennessee

L.C. MILLER
REGISTERED
AGRICULTURE
ENGINEER
No. 9491
STATE OF TENNESSEE

TARE, INC.
Terre-Aqua Resource Engineering, Inc.
Crossville, Tennessee

PREP. October, 2017



SECTION A–A

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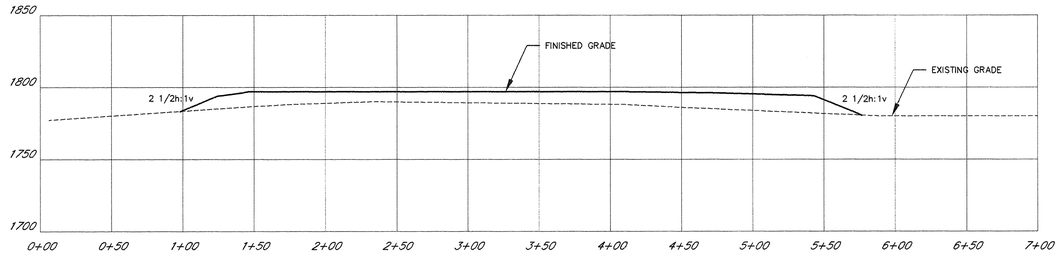
HORIZ. 1" = 50'



SECTION B–B

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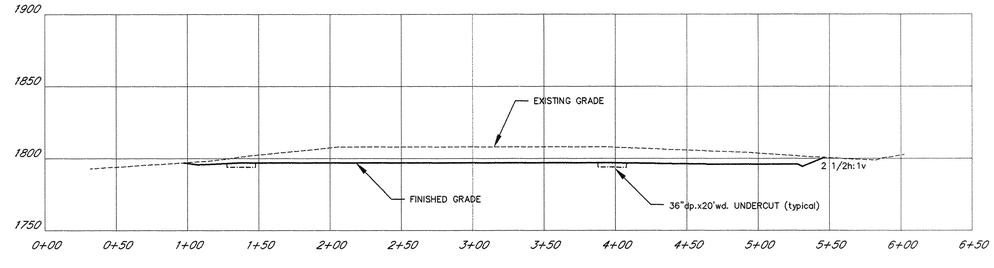

SECTION C–C

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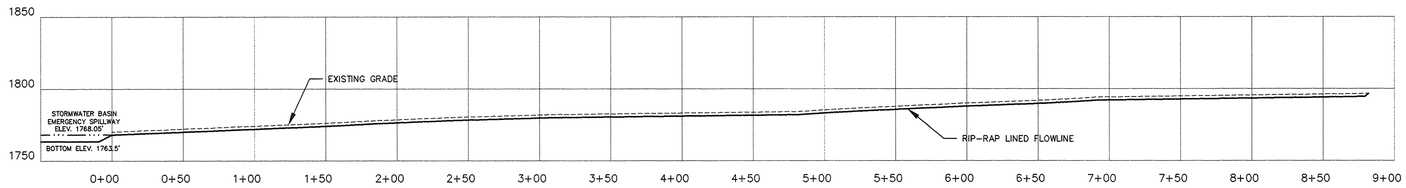

SWALE NO.1 PROFILE

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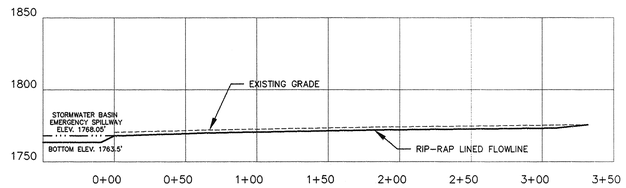
HORIZ. 1" = 50'



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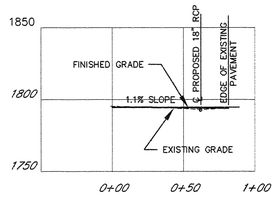

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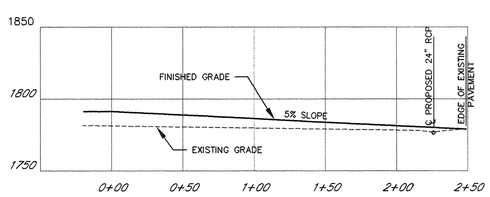


ACCESS NO.2 PROFILE

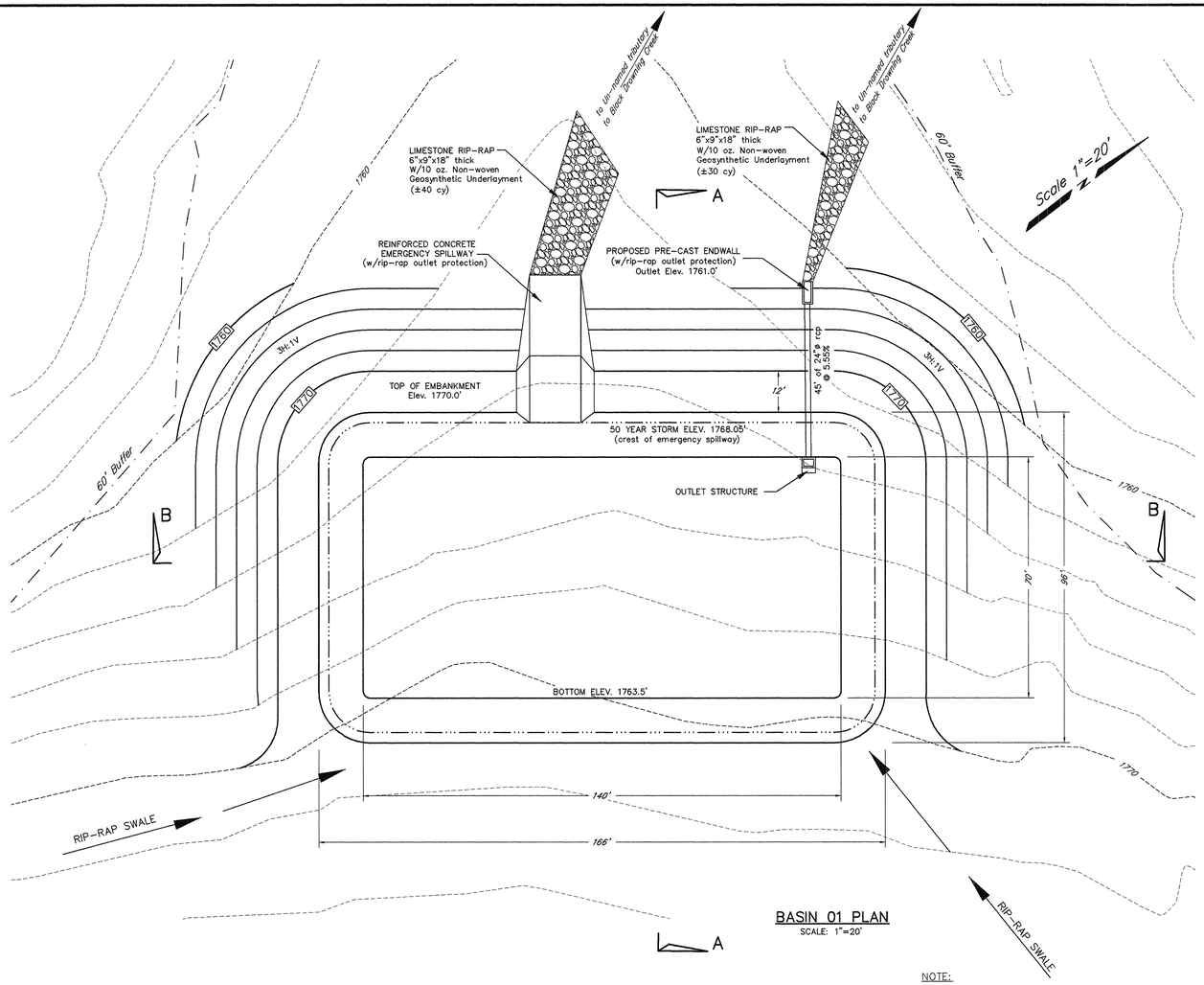
SCALE: VERT. 1" = 50'
HORIZ. 1" = 50'

SECTIONS & PROFILES
for
CITY OF CROSSVILLE
INTERCHANGE BUSINESS PARK

Interchange Drive
Crossville, Tennessee

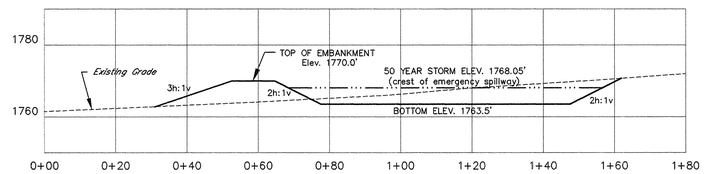
TARE, INC.
Terre-Aqua Resource Engineering, Inc.
Crossville, Tennessee

PREP. October, 2017



BASIN 01 PLAN
SCALE: 1"=20'

NOTE:
FIELD VERIFY ELEVATIONS ADJUST AS REQUIRED TO FIT FIELD CONDITIONS.



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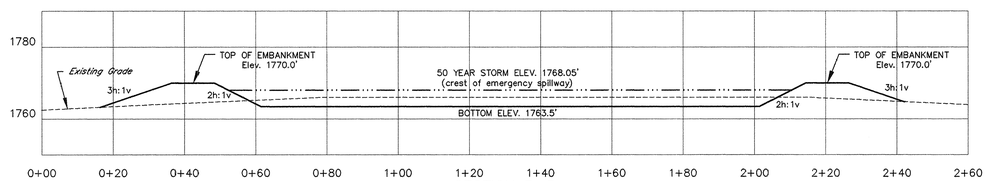

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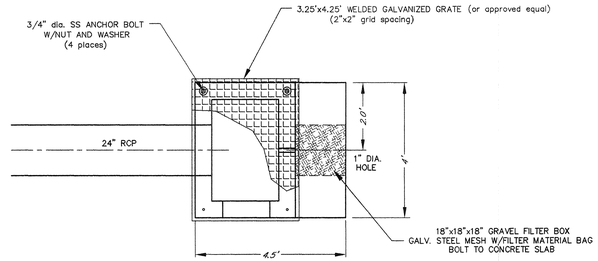
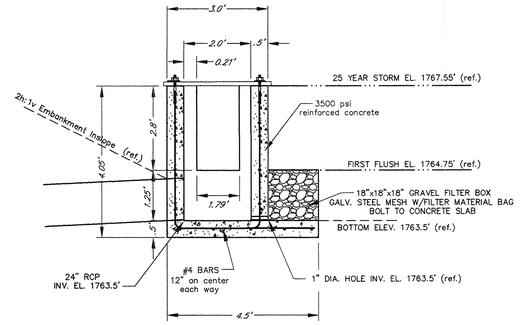
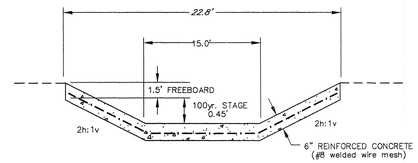


PLAN VIEW
NOT TO SCALE



OUTLET STRUCTURE SECTION
NOT TO SCALE

NOTE:
FIELD VERIFY ELEVATIONS ADJUST AS REQUIRED TO FIT FIELD CONDITIONS.



EMERGENCY SPILLWAY SECTION
NOT TO SCALE

STORMWATER BASIN DETAILS
STORM WATER POLLUTION PREVENTION PLAN
for
CITY OF CROSSVILLE
INTERCHANGE BUSINESS PARK
Interchange Drive
Crossville, Tennessee

TARE, INC.
Terre-Aqua Resource Engineering, Inc.
Crossville, Tennessee

PREP. October, 2017

GEOServices, LLC-Geotechnical and Materials Engineers

March 6, 2017

TARE Inc.
P.O. Box 846
Crossville, Tennessee 38557

ATTENTION: Mr. Darrell M. Hall
dhalltare@frontier.com

Subject: **REPORT OF GEOTECHNICAL EXPLORATION**
Interchange Drive Facility Expansion
Crossville, Tennessee
GEOServices Project No. 21-17138

Dear Mr. Hall:

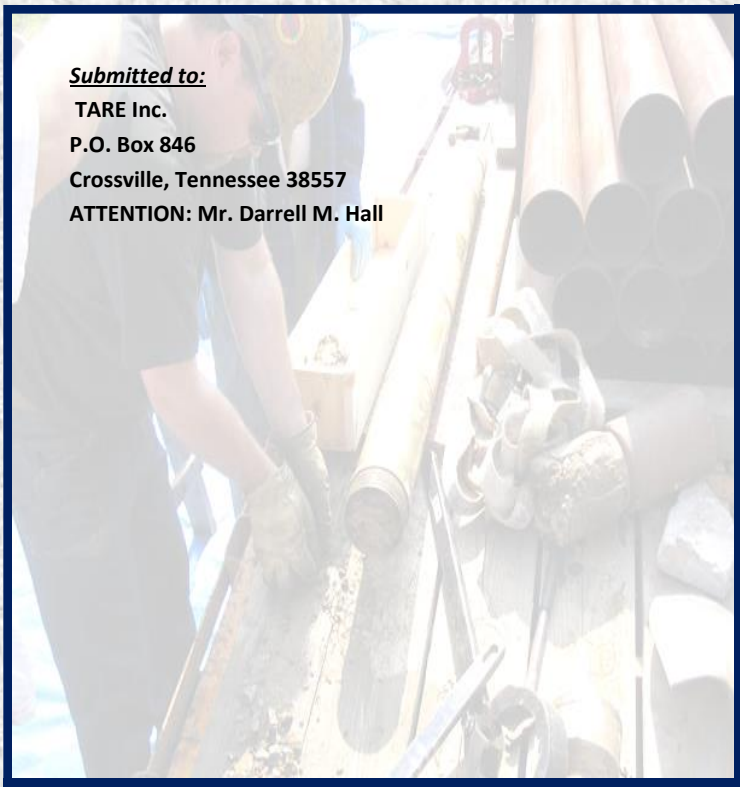
We are submitting the results of the geotechnical exploration performed for the subject project. The geotechnical exploration was performed, as authorized by you, in accordance with our Proposal number 11-17055R1 dated February 15, 2017 and as authorized by you. The following report presents our findings and recommendations for the proposed project. Should you have any questions regarding this report, or if we can be of any further assistance, please contact us at your convenience.

Sincerely,
GEOServices, LLC

T. Brian Williamson, P.E.
Project Manager
TN 118,861

Dennis R. Williams, P.E.
Senior Geotechnical Engineer
TN 15,603

TBW/DRW: tbw



Submitted to:
TARE Inc.
P.O. Box 846
Crossville, Tennessee 38557
ATTENTION: Mr. Darrell M. Hall

REPORT OF GEOTECHNICAL EXPLORATION

Submitted by:
GEOServices, LLC
2561 Willow Point Way
Knoxville, Tennessee 37931

Phone (865) 539-8242
Fax (865) 539-8252

Interchange Drive Facility Expansion

CROSSVILLE, TENNESSEE

GEOSERVICES, LLC

PROJECT NO. 21-17138

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of our geotechnical exploration was to explore the subsurface conditions in the project area and provide general recommendations for site preparation/grading and for design and construction of the foundation system, including allowable bearing pressure. Additionally, recommendations for light- and heavy-duty pavements are included.

1.2 PROJECT INFORMATION AND SITE DESCRIPTION

Project information was provided by Mr. Darrell Hall in the form of a conceptual site plan indicating the proposed building area. Based on the provided information, the project is anticipated to consist of a new 200,000 sf (approximate) facility. The site is located at the on the north side of Interchange Drive approximately 1,500 feet west of its intersection with Highway 127 North (Main Street) in Crossville, Tennessee.

We understand the building will be a single-story, steel-framed, pre-fabricated structure. Detailed information on anticipated foundation loads has not been provided. However, we have assumed that maximum column and continuous foundation loads will be on the order of 75 kips and 4 kips per linear foot respectively.

Although a topographic map has been provided, individual site grades were not indicated on the plan. Moreover, proposed grading information has not been provided. However, it appears the site is generally level and gently slopes downhill from the southeast to the northwest. We have assumed earthwork cuts and fills of less than 15 feet will be required to reach proposed final grades. We also understand that the owner plans to utilize the excavated rock as fill and requires an evaluation of the rock for this purpose and recommendations for rock fill placement.

The project site it bordered by interchange drive to the south, by residential properties to the north, by an existing industrial facility to the east and by a creek to the west. Based on available aerial imagery, general ground cover consists of short grasses and areas of overgrown vegetation.

1.3 SCOPE OF STUDY

This geotechnical exploration involved a site reconnaissance, field drilling, laboratory testing and engineering analysis. The following sections of this report present discussions of the field exploration, site conditions, and conclusions and recommendations. Following the text of this report, Appendix A presents figures and test boring records. Appendix B presents the results of the laboratory testing.

The scope of our geotechnical engineering services did not include an environmental assessment for determining the presence or absence of wetlands, or hazardous or toxic materials in the soil, bedrock, surface water, groundwater, or air, on, or below, or around this site. Any statements in this report or on the boring logs regarding odors, colors, and unusual or suspicious items or conditions are strictly for informational purposes.

2.0 EXPLORATION AND TESTING PROGRAMS

2.1 FIELD EXPLORATION

The existing subsurface conditions were explored with ten (10) soil test borings drilled within the footprint of proposed building and pavement areas. The boring locations were staked in the field by TARE, Inc. Drilling was performed on February 20, 2017 by our subcontractor. The borings were advanced using 3.25-inch inside diameter hollow stem augers (HSA) with a CME 550 ATV-mounted drill rig. The approximate locations of the test borings performed on site are referenced in Figure 2 of Appendix A of this report. Detailed logs for soil test borings can also be found in Appendix A.

Within each boring, standard penetration testing (SPT) and split-spoon sampling were performed at 2-1/2-foot intervals in the upper 10 feet and at 5-foot intervals thereafter. The drilling was performed in accordance with ASTM D6151 (hollow stem auger drilling). SPT and split-spoon sampling were performed in accordance with ASTM D 1586. Wireline rock coring was performed in accordance with ASTM D 2113.

In split–spoon sampling, a standard 2-inch O.D. split-spoon sampler is driven into the bottom of the boring with a 140-pound hammer falling a distance of 30 inches. The number of blows required to advance the sampler the last 12 inches of the standard 18 inches of total penetration is recorded as the Standard Penetration Resistance (N-value). These N-values are indicated on the boring logs at the testing depth, and provide an indication of consistency of subsurface materials.

2.2 LABORATORY TEST PROGRAM

The obtained soil and rock samples were returned to our laboratory where they were visually classified by a geotechnical professional. A bulk sample that was collected during the field exploration was tested for Atterberg limits (ASTM D 4318) and Standard Proctor (ASTM D 698). Additionally, three rock core samples were tested for unconfined compressive strength (ASTM D 7012). The results of the laboratory testing are discussed in the following sections. A summary of these results is presented in Appendix B.

3.0 SUBSURFACE CONDITIONS

3.1 GEOLOGIC CONDITIONS

The project site lies within the Cumberland Plateau physiographic province of eastern central Tennessee. This province is characterized by flat-topped mountains separated by narrow valley bottoms which wind between steep canyon walls. These walls are formed primarily on resistant beds of sandstone, siltstone, shale, and conglomerate from the lower portions of the Pennsylvanian strata. High terraces such as those associated with high-level fluvial deposits along the Cumberland River are remnants of earlier valley bottoms and are found throughout the province.

Published geologic information indicates that the site is underlain by bedrock of the Rockcastle Conglomerate formation of the Crab Orchard Mountains Group. This formation is generally composed of gray and brown conglomeratic sandstone and siltstone which is typically fine to

coarse-grained. This formation typically weathers to produce a thin sandy, silty residual overburden soil.

3.2 SOIL STRATIGRAPHY

The following subsurface description is of a generalized nature to highlight the subsurface stratification features and material characteristics at the boring locations. The boring logs included in Appendix A of this report should be reviewed for specific information at each boring location. Information on actual subsurface conditions exists only at the specific boring locations and is relevant only to the time that this exploration was performed. Variations may occur and should be expected at the site.

Surficial

All but two soil test borings drilled encountered a layer of topsoil that was between 1 and 6 inches in thickness. Boring B-7 encountered a layer of gravel that was 5 inches thick. Boring B-8 did not encounter a significant surficial layer, but encountered residual soils at ground surface.

Residual Soil

Residual soil was encountered to depths ranging from approximately 2.2 to 3 feet below ground surface in boring B-2, B-6, B-7 and B-8. Residual soils are formed from the in-place weathering of the underlying parent bedrock. The residual soils generally consisted of orangish brown and tan lean clay (CL) with varying amounts of silt and sandstone fragments. The SPT N-values used to evaluate the consistency of the residual soil ranged from 5 to 14 blows per foot (bpf) indicating a relative soil consistency ranging from firm to stiff. The Proctor testing resulted in a maximum dry density of 115.9 pcf at an optimum moisture content of 13.3 percent

Weathered Rock

Beneath the surficial layers encountered in borings B-1, B-3, B-4, B-5, B-9 and B-10, and below the residual soils in borings B-7 and B-8, weathered rock was encountered to depths ranging from 1 to 5.5 feet beneath the existing ground surface. The weathered rock encountered was generally weathered sandstone and was orangish brown and tan in color. The SPT N-values used

to evaluate the consistency of the weathered rock encountered was generally 50 blows per 1 inch of penetration, indicating soil consistencies of very hard.

Auger Refusal

Auger Refusal material was encountered in each of the ten borings performed on this site ranging in depths from 1 feet to 5.5 feet below existing ground surface. Auger refusal may indicate dense gravel or cobble layers, boulders, rock ledges or pinnacles, or the top of continuous bedrock. Rock coring, to explore the refusal material, was performed in Boring B-8. The refusal material encountered in boring B-8 was generally sandstone that was observed to be tan soft, moderately fractured and severely weathered to a depth of approximately 9 feet and reddish purple hard, slightly fractured and slightly weathered to approximately 20 feet below existing ground surface. Unconfined compressive strengths of the sandstone bedrock range from 10,819 pounds per square inch (psi) to 16,753 psi.

Coring of the refusal materials encountered in the remaining nine borings was beyond the scope of our services. Therefore, the character and continuity of the refusal material could not be determined in these areas. However, based on our experience in this geological setting and the SPT samples retrieved near refusal elevations, auger refusal at this site likely indicates top of sandstone bedrock.

Ground Water

Ground water was not encountered in any of the borings drilled on the site at time of drilling. Subsurface water levels may fluctuate due to seasonal changes in precipitation amounts. Additionally, areas of perched water may exist in the overburden and/or near the contact with bedrock. The groundwater data provided are from the time of our exploration and may differ at time of construction.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 SITE ASSESSMENT

The results of the subsurface exploration indicate that the site is generally overlain by stiff, or better, residual soil with isolated areas of firm soils. Based on the results of our geotechnical exploration, it is our opinion that the site is generally adaptable for the proposed construction. However, depending on proposed grades certain challenges may present themselves during construction. These challenges include, firm, or worse consistency, residual soils, difficult excavations, and differing bearing materials (i.e., rock and soil) below the foundations.

Firm residual soils were encountered in boring B-6 to a depth of auger refusal (3.1 feet). Based on the anticipated grades, it is likely that these soils will be exposed at or near subgrade elevations during site grading and/or foundation excavation. These firm soils will not provide adequate foundation or concrete slab-on-grade support. We recommend the suitability of all exposed subgrades be evaluated by a GEOServices representative. If the exposed soils are judged to unsuitable for foundation, slab, or pavement support proper remediation should be determined at that time. Proper remediation measures will be dependent on the actual subsurface conditions encountered during construction. However, remediation of the firm, or worse, soils will likely consist of undercutting and replacement with structural soil fill or compacted dense graded aggregate.

As previously mentioned, auger refusal materials were encountered in each boring drilled at depths ranging from about 1 foot to about 5.5 feet below the existing ground surface elevation. Based on anticipated grade changes, difficult excavation techniques will likely be required during mass grading. Additionally, it is possible that some very hard partially weathered rock, rock ledges, and/or competent bedrock requiring difficult excavation techniques may be encountered in areas of the site. Based on the results of the coring performed, we anticipate the upper few feet of the refusal materials will likely be able to be “ripped” with sizeable equipment (i.e. Caterpillar D-8 or equivalent) Additionally, we anticipate the sandstone bedrock will be acceptable as fill material. Fill placement recommendations are provided herein.

The combination of bearing conditions (i.e., soil and rock) can cause differential foundation settlement which can result in unsatisfactory long-term performance of the structure. To provide uniform support conditions, it may be necessary to undercut foundation excavations where bedrock is encountered to a depth of at least 1 foot beneath the foundation bearing elevation. The undercut areas should be replaced with compacted soil fill or dense graded aggregate to reduce the potential for differential stress caused by point loading. Foundations in transition areas between one or more bearing condition should be given special consideration. These considerations should include additional reinforcement or a thickened foundation section and closely spaced control joints in the masonry to either side of the transition.

Lastly, with the varying subsurface conditions encountered across this site, we recommend close foundation subgrade observations be performed by a qualified geotechnical engineer upon excavation of the proposed foundations. Any unsuitable areas observed upon foundation excavations should be undercut and replaced with compacted dense graded aggregate or lean concrete (flowable fill).

Based on the conditions encountered in the geotechnical exploration and provided the recommendations set forth in the following sections of this report are followed, the proposed structure can be supported using conventional shallow foundations and/or concrete slabs-on-grade bearing in the stiff, or better, residual soil or newly placed structural fill.

4.2 SITE PREPARATION RECOMMENDATIONS

4.2.1 Subgrade

Initially, all topsoil and deleterious materials (if encountered), as well as existing utilities (if required), loose rock fragments greater than 6 inches, and other debris must be removed from the areas proposed for construction and the resulting excavations backfilled with compacted fill as described below. Stripping operations should extend a minimum of 5 feet beyond the limits of proposed pavement areas and 10 feet beyond building limits. These areas should be observed by a geotechnical engineer upon grading to ensure the recommendations in this report are followed.

After completion of stripping operations and any required excavations to reach planned subgrade elevation, we recommend that the subgrade be proofrolled with a fully-loaded, single-axle dump truck or other pneumatic-tired construction equipment of similar weight. Four passes should be made, two at right angles to those preceding. The geotechnical engineer or his representative should observe proofrolling. Areas judged to perform unsatisfactorily (e.g., excessive pumping and/or rutting) by the engineer should be undercut and replaced with structural soil fill or remediated at the geotechnical engineer's recommendation. Areas to receive structural soil fill should also be proofrolled prior to the placement of any fill. Proofrolling operations shall be extended a minimum distance of 10 feet beyond the building perimeter and 5 feet beyond pavement areas.

4.2.2 Structural Soil Fill

Material considered suitable for use as structural fill should be clean soil free of organics, trash, and other deleterious material, containing no rock fragments greater than 6 inches in any one dimension. Preferably, structural soil fill material should have a standard Proctor maximum dry density of 90 pcf, or greater, and a plasticity index (PI) of 35 percent or less. All material to be used as structural fill should be tested by the geotechnical engineer to confirm that it meets the project requirements before being placed. Based on visual observation and limited laboratory results, the on-site residual soil and weathered sandstone appears to be generally suitable for use as structural soil fill.

Structural fill should be placed in loose, horizontal lifts not exceeding 8 inches in thickness. Each lift should be compacted to at least 98 percent of the soil’s maximum dry density per the standard Proctor method (ASTM D 698) and within the range of minus (-) 2 percent to plus (+) 3 percent of the optimum moisture content. Each lift should be tested by geotechnical personnel to confirm that the contractor’s method is capable of achieving the project requirements before placing any subsequent lifts. Any areas which have become soft or frozen should be removed before additional structural fill is placed.

4.2.3 Dense Graded Aggregate

Dense-graded aggregate (DGA) fill may be required as backfill, to reach finished floor elevation. The DGA used for this section should be Type A, Class A, and Grading E in accordance with Section 903.05 of the Tennessee Department of Transportation (TDOT) specifications. The DGA fill should be placed in loose, horizontal lifts not exceeding 8 inches in loose thickness. Each lift should be compacted to at least 98 percent of maximum dry density per the standard Proctor method (ASTM D 698). Each lift should be compacted, tested by geotechnical personnel and approved before placing any subsequent lifts.

4.2.4 Rock Fill

We anticipate that excavations in portions of this site will produce both non-degradable and degradable rock fill material consisting of sandstone in various stages of weathering. The following paragraphs list the placement and compaction requirements for non-degradable rock (shot rock fill). Degradable rock (i.e., "soft" weathered sandstone that is broken down to a soil-like consistency) should be placed in accordance with Section 4.2.2 of this report. Due to the amount of fill required in structural areas, we recommend that shot rock fill not be used in structural areas in the upper 5 feet below proposed subgrade elevations. Shot rock fill is suitable for the remaining areas of the site requiring fill to reach finished grade. The shot rock fill should be placed under the full-time observation of a representative of the geotechnical engineer.

Shot Rock Fill

We anticipate that mechanical breaking (hoe-ramming) or blasting will be required to facilitate the excavation of competent sandstone bedrock encountered during site excavations. This material, with acceptable gradation, can be used as fill in non-structural areas (i.e. parking areas outside of 5 feet below subgrade elevation, slopes, green space etc.). Shot rock utilized as structural fill should be well-graded with a maximum rock size of 18 inches in any one dimension and placed in lifts not to exceed 18 inches thick. Shot rock fill should have adequate fines to effectively fill in any voids or open spaces between the larger rock pieces. The larger rock pieces should lie flat and not allowed to overlap each other. The percentage of soil in the shot rock fill should be limited to 10 percent of the total mass. Shot rock fill should be compacted with at least 6 to 8 complete passes using a large bulldozer (Caterpillar D-8 or equivalent). A pass is defined as a complete coverage of the surface

with the track overlapping 50 percent. Half of the passes should be in each perpendicular direction. Since no testing is performed during placement, shot rock fill placement should be accomplished under the full-time observation of a representative of the geotechnical engineer.

Other equipment has been used to successfully place shot rock fill in the past; however, it is very important that the material is properly densified, with little to no obvious void space present at the completion of each lift. The geotechnical engineer should be thoroughly involved in the initial shot rock placement at the site. If the methods utilized by the grading contractor do not produce a well-graded, well consolidated lift, modifications to the means and methods implemented should be expected.

4.3 FOUNDATION RECOMMENDATIONS

4.3.1 Shallow Foundations

Foundations for the proposed construction are anticipated to bear in stiff, or better, residual soils, sandstone bedrock and/or properly compacted structural fill. The recommended allowable soil bearing capacity for design of the foundations is 3,000 psf or less. We recommend that continuous foundations be a minimum of 18 inches wide and isolated spread footings be a minimum of 24 inches wide to reduce the possibility of a localized punching shear failure. All exterior footings should be designed to bear at least 18 inches below finished exterior grade to protect against frost heave.

A geotechnical representative should be retained to perform foundation subgrade tests to confirm that the recommendations provided in this report are consistent with the site conditions encountered. Some undercutting of soft soils which may be found between boring locations during foundation excavations should be anticipated. A dynamic cone penetrometer (DCP) is commonly utilized to provide information that is compared to the data obtained in the geotechnical report. Where unacceptable materials are encountered, the material should be excavated to stiff, suitable soils or remediated at the geotechnical engineer's direction.

4.3.2 Slabs-on-Grade

For slab-on-grade construction, the site should be prepared as previously described. We recommend that the subgrade be topped with a minimum 4-inch layer of crushed stone to act as a capillary moisture block. The subgrade should be proofrolled and approved prior to the placement of the crushed stone. Based on the conditions encountered on this site, we recommend that the floor slabs be designed using a subgrade modulus of 125 pounds per cubic inch (pci). This modulus is appropriate for small diameter loads (i.e. a 1ft x 1ft plate) and should be adjusted for wider loads.

4.3.3 Settlement

We have estimated the total and differential settlements for the proposed foundations expected at this site. The method is based on the Federal Highways Administration (FHWA) Empirical Settlement Analysis Procedure. This FHWA empirical method allows the use of the SPT N-values in this calculation and includes the type of soil encountered. Based on this empirical method, we anticipate total settlements of less than 1.0 inch and differential settlements of less than 0.75 inch. The settlement information provided was with a maximum column and continuous foundation load of 75 kips and 3 kips per linear foot as well as an allowable bearing pressure of 3,000 psf. Additionally, the settlement information provide assumes that the site is prepared within accordance to the recommendations presented within this report.

4.3.4 Differential Bearing Conditions

Due to the presence of varying refusal depths in portions of this site, bedrock may be encountered during foundation excavation. This combination of bearing conditions (i.e., soil and rock) can cause differential foundation settlement which can result in unsatisfactory long-term performance of the structure. To provide uniform support conditions, it will be necessary to undercut any foundation excavations where rock is encountered to a depth of at least 1 foot beneath the anticipated foundation bearing elevation. The undercut areas should be replaced with compacted dense graded aggregate to reduce the potential for differential stress caused by point loading.

Foundations in transition areas between one or more bearing condition should be given special consideration. These considerations should include additional reinforcement or a thickened

foundation section and closely spaced control joints in the masonry to either side of the transition.

4.4 SEISMIC DESIGN CRITERIA

International Building Code, 2012

In accordance with the International Building Code, 2012, we have provided the following table of seismic design information. After evaluating the subsurface conditions it was determined that the structure would be located within seismic site class C. If it is determined that an improvement of site class could produce a significant economic impact to the project, we recommend a site-specific shear wave velocity analysis be performed. A table follows showing the calculated spectral response accelerations for both a short and 1-second period.

Table 1: Seismic Design Parameters

Structure	S_s g	S_1 g	S_{DS} g	S_{D1} g
Proposed Interchange Drive Facility	0.254	0.112	0.203	0.126

4.5 PAVEMENT DESIGN RECOMMENDATIONS

4.5.1 Flexible Pavement Design

AASHTO flexible pavement design methods have been utilized for pavement recommendations. Our recommendations are based on the assumptions that the subgrade has been properly prepared as described previously. Based on our experience with similar developments, we recommend the following light and heavy-duty flexible pavement sections:

Table 2: Flexible Pavement Recommendations

Pavement Materials	Light-Duty (in)	Heavy-Duty (in)
Bituminous Asphalt Surface Mix	1.5	1.5
Bituminous Asphalt Base Mix	2.0	2.5
Compacted Crushed Aggregate Base	6.0	8.0

We recommend a base stone equivalent to a Type A, Class A and Grading D in accordance with Section 903.05 of the Tennessee Department of Transportation specifications. The bituminous asphalt pavement should be Grading "E" as per Section 411 for the surface mix and Grading "BM/BM2" as per section 307 for the binder mix. Compaction requirements for the crushed aggregate base and the bituminous asphalt pavement should generally follow Tennessee Department of Transportation specifications.

4.5.2 Rigid Pavement Design

AASHTO rigid pavement design methods have been utilized for pavement recommendations. In areas of trash dumpster pads or areas where large trucks will be parked on the pavement, we recommend the use of a concrete paving section. Our recommendations are based on the assumptions that the subgrade has been properly prepared. Based on our experience with similar developments, we recommend the following rigid pavement section:

Table 3: Rigid Pavement Recommendations

Pavement Materials	Light-Duty (in)	Heavy-Duty (in)
4,000 psi Type I Concrete	5.0	6.0
Compacted Crushed Aggregate Base	4.0	6.0

Concrete should be reinforced with welded wire fabric or reinforcing bars to assist in controlling cracking from drying shrinkage and thermal changes. Sawed or formed control joints should be included for each 225 square feet of area or less (15 feet by 15 feet). Saw cuts should not cut through the welded wire fabric or reinforcing steel and dowels should be utilized at formed and/or cold joints.

4.5.3 General

Our recommendations are based upon the assumption that the subgrade has been properly prepared as described previously and that any off-site soil borrows to be used to backfill to the final subgrade meets the requirements provided in this report.

All paved areas should be constructed with positive drainage to direct water off-site and to minimize surface water seeping into the pavement subgrade. The subgrade should be designed with positive drainage to prevent ponding and premature deterioration of the pavement. The subgrade should have a minimum slope of 1 percent. In down grade areas, the basestone should extend through the slope to allow any water entering the basestone a path to exit. For rigid pavements, water-tight seals should also be provided at formed construction and expansion joints.

4.6 LATERAL EARTH PRESSURES

We are currently unaware of any below grade walls associated with the project. However, with the possibility, we are providing equivalent fluid pressures for three backfill conditions for cantilever-type walls. These are 1) active earth pressure for granular backfill (clean sand or gravel), 2) at-rest earth pressure for granular backfill, and 3) at-rest earth pressure for fine-grained (clay) backfill. The equivalent fluid pressures provided have assumed a level backfill and a wall with a vertical face.

Condition 1 - The active earth pressure for granular backfill will result in an equivalent fluid pressure of 30 pounds per cubic foot (pcf). If the granular backfill is to develop active earth pressure conditions, walls must be flexible and/or free to rotate or translate at the top approximately one inch laterally for every 20 feet of wall height.

Condition 2 - The at-rest earth pressure for granular backfill will result in an equivalent fluid pressure of 47 pcf. For retaining walls that will not rotate or translate, such as building walls or other walls rigidly connected to structures, at-rest conditions will develop.

Condition 3 - Walls backfilled with fine-grained material (silt or clay) should be designed using the at-rest earth pressure whether restrained at the top, or not. Fine-grained soils typically creep over time which produces additional lateral stresses to the wall. The equivalent fluid pressure for this case is 70 pcf

In all cases, forces from any expected surcharge loading including sloping backfill should be added to the equivalent fluid pressures. The walls should be properly drained to remove water or hydrostatic pressure should be added to the design pressure. Also, all backfill for the walls should be placed in accordance with the structural fill recommendations described hereinafter.

For rigid, cast-in-place concrete walls, an ultimate friction factor of 0.35 between foundation concrete and the bearing soils may be used when evaluating friction. Also, an ultimate passive earth pressure resistance of well-compacted soil fill can be approximated by a uniformly acting resistance of 300 psf. However, to limit deformation when relying on passive strength, we recommend using a minimum safety factor of 3.0 applied to the ultimate passive resistance value.

5.0 CONSTRUCTION CONSIDERATIONS

5.1 FOUNDATION CONSTRUCTION

Foundation excavations should be opened, the subgrade evaluated, remedial work performed (if required), and concrete placed in an expeditious manner. Exposure to weather often reduces foundation support capabilities, thus necessitating remedial measures prior to concrete placement. If foundation excavation are to be left open for an extended period of time, we recommend a thin layer of concrete (or flowable fill) be placed in efforts to protect the subgrade soils from water intrusion It is also important that proper surface drainage be maintained both during construction (especially in terms of maintaining dry footing trenches) and after construction. Soil backfill for footings should be placed in accordance with the recommendations for structural fill presented herein.

5.2 EXCAVATIONS

As previously mentioned, auger refusal materials were encountered in each boring drilled on site at depths ranging from 1.0 to 5.5 beneath the existing ground surface. Auger refusal conditions generally correspond to materials which require difficult excavation techniques for removal. Typically, soils penetrated by augers can be removed with conventional earthmoving equipment. However, excavation equipment varies, and field refusal conditions may vary. Generally, the weathering process is erratic and variations in the rock profile can occur in small lateral distances, particularly in this type of geology. Depending on proposed grades and based on subsurface conditions encountered, difficult excavation techniques will be required across the site during grading and will likely be required during excavations that will extend much deeper than a few feet below existing ground surface elevations in some areas. Sandstone bedrock and very hard weathered sandstone will likely require special removal equipment (pneumatic splitters, hydraulic hammer, etc.) for excavation.

5.2.1 Excavation Safety

Excavations should be sloped or shored in accordance with local, state, and federal regulations, including OSHA (29 CFR Part 1926) excavation trench safety standards. The contractor is usually solely responsible for site safety. This information is provided only as a service, and under no circumstances should GEOServices be assumed responsible for construction site safety.

5.3 MOISTURE SENSITIVE SOILS

The fine-grained soils encountered at this site will be sensitive to disturbances caused by construction traffic and changes in moisture content. During wet weather periods, increases in the moisture content of the soil can cause significant reduction in the soil strength and support capabilities. Construction traffic patterns should be varied to prevent the degradation of previously stable subgrade. In addition, the soils at this site which become wet may be slow to dry and thus significantly retard the progress of grading and compaction activities. We caution if site grading is performed during the wet weather season increases in the undercut volume required due to the marginal fills should be expected. Further, for site fills, methods such as discing and allowing the

material to dry will be required to meet the required compaction recommendations. It will, therefore, be advantageous to perform earthwork and foundation construction activities during dry weather. However, November through March is typically the difficult grading period due to the limited drying conditions that exist.

5.4 DRAINAGE AND SURFACE WATER CONCERNS

To reduce the potential for additional undercut, water should not be allowed to collect in the foundation excavations, on floor slab areas, or on prepared subgrades of the construction area either during or after construction. Undercut or excavated areas should be sloped toward one corner to facilitate removal of any collected rainwater, subsurface water, or surface runoff. Positive site surface drainage should be provided to reduce infiltration of surface water around the perimeter of the building and beneath the floor slab. The grades should be sloped away from the building and surface drainage should be collected and discharged such that water is not permitted to infiltrate the backfill and floor slab areas of the building.

6.0 LIMITATIONS

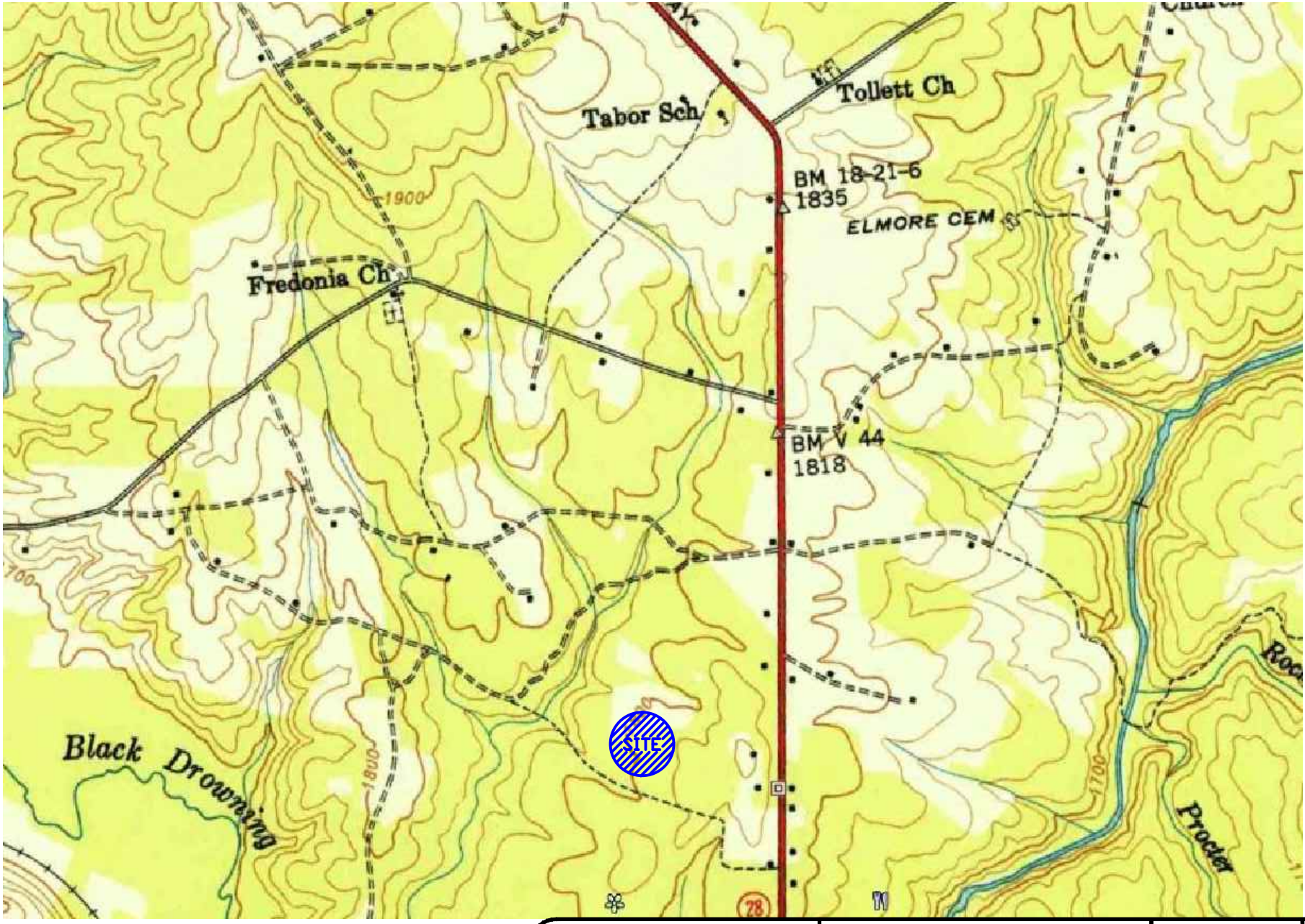
This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. This report is for our geotechnical work only, and no environmental assessment efforts have been performed. The conclusions and recommendations contained in this report are based upon applicable standards of our practice in this geographic area at the time this report was prepared. No other warranty, express or implied, is made.

The analyses and recommendations submitted herein are based, in part, upon the data obtained from the exploration. The nature and extent of variations between the borings will not become evident until construction. We recommend that GEOServices be retained to observe the project construction in the field. GEOServices cannot accept responsibility for conditions which deviate from those described in this report if not retained to perform construction observation and testing. If variations appear evident, then we will re-evaluate the recommendations of this report. In the event that any changes in the nature, design, or location of the structures are planned, the conclusions and

recommendations contained in this report will not be considered valid unless the changes are reviewed and conclusions modified or verified in writing. Also, if the scope of the project should change significantly from that described herein, these recommendations may need to be re-evaluated.

APPENDIX A

Figures and Test Boring Records



NOTES:

1.) BASE MAP: USGS QUADRANGLE (ISOLINE TENNESSEE)

GEOS
GEOServices, LLC-Geotechnical and Materials Engineers
2561 Willow Point Way
Knoxville, Tennessee 37931
Office: 865-539-8242
Fax: 865-539-8252

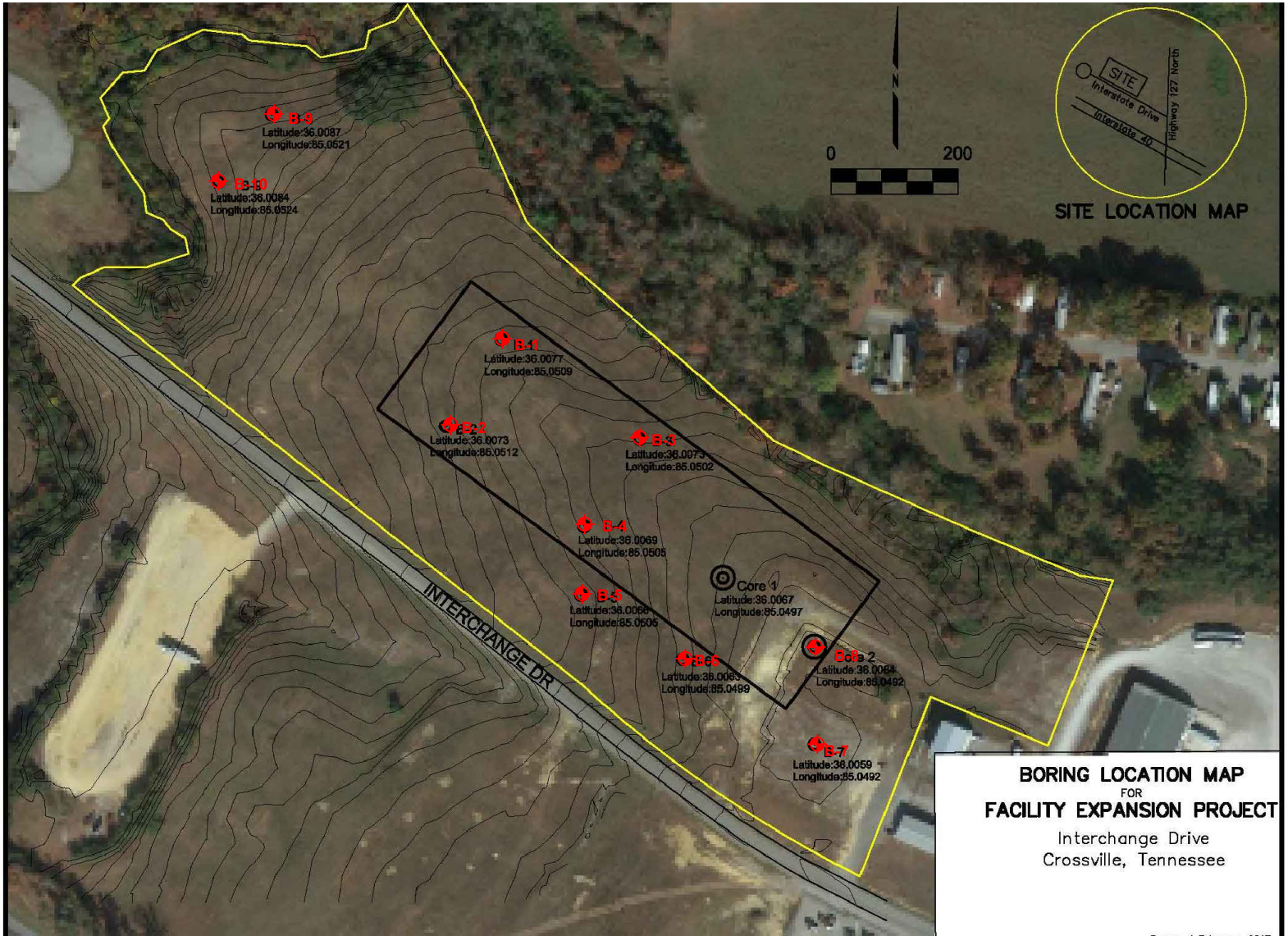
SITE VICINITY MAP

INTERCHANGE DRIVE FACILITY

CROSSVILLE, TN

DRAWN BY:	TBW
APPROVED BY:	WRK
SCALE:	N.T.S.
JOB NO.:	21-17138
DATE:	02/22/17

FIGURE 1



NOTES:

1.) BORING LOCATIONS ARE SHOWN IN GENERAL ARRANGMENT ONLY.
2.) DO NOT USE BORING LOCATIONS FOR DETERMINATIONS OF DISTANCES OR QUANTITIES.
3.) BASE MAP PROVIDED BY: TARE, INC

LOCATION OF SOIL TEST BORING

GEOS
GEOServices, LLC-Geotechnical and Materials Engineers
2561 Willow Point Way
Knoxville, Tennessee 37931
Office: 865-539-8242
Fax: 865-539-8252

BORING LOCATION PLAN

INTERCHANGE DRIVE
FACILITY
CROSSVILLE, TN

DRAWN BY:	TBW
APPROVED BY:	WRK
SCALE:	N.T.S.
JOB NO.:	21-17138
DATE:	02/22/17

FIGURE
2

GENERAL NOTES

FINE AND COARSE GRAINED SOIL PROPERTIES

PARTICLE SIZE

BOULDERS:	GREATER THAN 300 mm
COBBLES:	75 mm to 300 mm
GRAVEL:	4.74 mm to 75 mm
COARSE SAND:	2 mm to 4.74 mm
MEDIUM SAND:	0.425 mm to 2 mm
FINE SAND:	0.075 mm to 0.425 mm
SILTS & CLAYS:	LESS THAN 0.075 mm

COARSE GRAINED SOILS (SANDS & GRAVELS)

N-VALUE	RELATIVE DENSITY
0 - 4	VERY LOOSE
5 - 10	LOOSE
11 - 30	MEDIUM DENSE
31 - 50	DENSE
OVER 50	VERY DENSE

FINE GRAINED SOILS (SILTS & CLAYS)

N-VALUE	CONSISTENCY	Qu, PSF
0 - 2	VERY SOFT	0 - 500
3 - 4	SOFT	500 - 1000
5 - 8	FIRM	1000 - 2000
9 - 15	STIFF	2000 - 4000
16 - 30	VERY STIFF	4000 - 8000
OVER 31	HARD	8000 +

STANDARD PENETRATION TEST (ASTM D1586)

THE STANDARD PENETRATION TEST AS DEFINED BY ASTM D1586 IS A METHOD TO OBTAIN A DISTURBED SOIL SAMPLE FOR EXAMINATION AND TESTING AND TO OBTAIN RELATIVE DENSITY AND CONSISTENCY INFORMATON. THE 1.4 INCH I.D./2.0 INCH O.D. SAMPLER IS DRIVEN 3-SIX INCH INCREMENTS WITH A 140 LB. HAMMER FALLING 30 INCHES. THE BLOW COUNTS REQUIRED TO DRIVE THE SAMPLER THE FINAL 2 INCREMENTS ARE ADDED TOGETHER AND DESIGNATED THE N-VALUE. AT TIMES, THE SAMPLER CAN NOT BE DRIVEN THE FULL 18 INCHES. THE FOLLOWING REPRESENTS OUR INTERPRETATION OF THE STANDARD PENETRATION TEST WITH VARIATIONS.

BLOWS/FOOT (N-VALUE)	DESCRIPTION
25	25 BLOWS DROVE SAMPLER 12" AFTER INITIAL 6" SEATING
75/10"	75 BLOWS DROVE SAMPLER 10" AFTER INITIAL 6" SEATING
50/PR	PENETRATION REFUSAL OF SAMPLER AFTER INITIAL 6" SEATING

SAMPLING SYMBOLS

ST:	UNDISTURBED SAMPLE
SS:	SPLIT SPOON SAMPLE
CORE:	ROCK CORE SAMPLE
AU:	AUGER OR BAG SAMPLE

SOIL PROPERTY SYMBOLS

N:	STANDARD PENETRATION, BPF
M:	MOISTURE CONTENT %
LL:	LIQUID LIMIT %
PI:	PLASTICITY INDEX %
Qp:	POCKET PENETROMETER VALUE, TSF
Qu:	UNCONFINED COMPRESSIVE STRENGTH, TSF
DUW:	DRY UNIT WEIGHT, PCF

ROCK PROPERTIES

ROCK QUALITY DESIGNATION (RQD)

PERCENT	QUALITY
90 TO 100	EXCELLENT
75 TO 90	GOOD
50 TO 75	FAIR
25 TO 50	POOR
0 TO 25	VERY POOR

ROCK HARDNESS

VERY SOFT:	ROCK DISINTEGRATES OR EASILY COMPRESSES TO TOUCH: CAN BE HARD TO VERY HARD SOIL.
SOFT:	ROCK IS COHERANT BUT BREAKS EASILY TO THUMB PRESSURE AT SHARP EDGES AND CRUMBLES WITH FIRM HAND PRESSURE.
MODERATELY HARD:	SMALL PIECES CAN BE BROKEN OFF ALONG SHARP EDGES BY CONSIDERABLE HARD THUMB PRESSURE: CAN BE BROKEN BY LIGHT HAMMER BLOWS.
HARD:	ROCK CAN NOT BE BROKEN BY THUMB PRESSURE, BUT CAN BE BROKEN BY MODERATE HAMMER BLOWS.
VERY HARD:	ROCK CAN BE BROKEN BY HEAVY HAMMER BLOWS.

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Crossville, Tennessee
GEOServices Project # 21-153734

LOG OF BORING B-1
SHEET 1 OF 1

DRILLER M. Bowens
ON-SITE REP.

BORING NO. / LOCATION B-1 DRY ON COMPLETION ? Yes

DATE February 20, 2017 SURFACE ELEV. FT.
REFUSAL: Yes DEPTH 1.5 FT. ELEV. -1.5 FT.
SAMPLED 1.5 FT. 0.5 M
TOP OF ROCK DEPTH FT. ELEV. FT.
BEGAN CORING DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF) FT.
BOTTOM OF HOLE DEPTH 1.5 FT. ELEV. -1.5 FT.
BORING ADVANCED BY: POWER AUGERING X PROPOSED FINISHED FLOOR ELEVATION: FT.

WATER LEVEL DATA (IF APPLICABLE)
COMPLETION: DEPTH Dry FT.
ELEV. FT.
AFTER 1 HRS: DEPTH TNP FT.
ELEV. FT.
AFTER 24 HRS. DEPTH TNP FT.
ELEV. FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Topsoil (1 Inches)
		1.0	1.5	1	SS	50/5"					Weathered Sandstone - orangish and tan- dry - very hard (RESIDUUM)
2.5	-2.5										Auger Refusal at 1.5 feet
5.0	-5.0										
7.5	-7.5										
10.0	-10.0										
12.5	-12.5										
15.0	-15.0										
17.5	-17.5										
20.0	-20.0										

REMARKS: Offset boring drilled 10 feet south: refusal at 1.0 feet

GEOServices, LLC-Geotechnical and Materials Engineers

Interchange Drive Facility
Crossville, Tennessee
GEOServices Project # 21-153734

LOG OF BORING B-2
SHEET 1 OF 1

DRILLER M. Bowens
ON-SITE REP.

BORING NO. / LOCATION B-2 DRY ON COMPLETION ? Yes

DATE February 20, 2017 SURFACE ELEV. FT.
REFUSAL: Yes DEPTH 2.2 FT. ELEV. -2.2 FT.
SAMPLED 2.2 FT. 0.7 M
TOP OF ROCK DEPTH FT. ELEV. FT.
BEGAN CORING DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF) FT.
BOTTOM OF HOLE DEPTH 2.2 FT. ELEV. -2.2 FT.

BORING ADVANCED BY: POWER AUGERING X

WATER LEVEL DATA (IF APPLICABLE)
COMPLETION: DEPTH Dry FT.
ELEV. FT.
AFTER 1 HRS: DEPTH TNP FT.
ELEV. FT.
AFTER 24 HRS. DEPTH TNP FT.
ELEV. FT.

PROPOSED FINISHED FLOOR ELEVATION: FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Topsoil (5 inches)
		1.0	1.5	1	SS	11					Sandy Lean Clay (CL) w/ weathered sandstone - tan and oragish brown - stiff (RESIDUUM)
2.5	-2.5										Auger Refusal at 2.2 feet
5.0	-5.0										
7.5	-7.5										
10.0	-10.0										
12.5	-12.5										
15.0	-15.0										
17.5	-17.5										
20.0	-20.0										

REMARKS: Offset boring drilled 10 feet south: refusal at 2.6 feet

GEOServices, LLC-Geotechnical and Materials Engineers

Interchange Drive Facility
Crossville, Tennessee
GEOServices Project # 21-153734

LOG OF BORING B-3
SHEET 1 OF 1

DRILLER M. Bowens
ON-SITE REP.

BORING NO. / LOCATION B-3 DRY ON COMPLETION ? Yes

DATE February 20, 2017 SURFACE ELEV. FT.
REFUSAL: Yes DEPTH 1.1 FT. ELEV. -1.1 FT.
SAMPLED 1.1 FT. 0.3 M
TOP OF ROCK DEPTH FT. ELEV. FT.
BEGAN CORING DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF) FT.
BOTTOM OF HOLE DEPTH 1.1 FT. ELEV. -1.1 FT.

BORING ADVANCED BY: . POWER AUGERING X PROPOSED FINISHED FLOOR ELEVATION: FT.

WATER LEVEL DATA (IF APPLICABLE)
COMPLETION: DEPTH Dry FT.
ELEV. FT.
AFTER 1 HRS: DEPTH TNP FT.
ELEV. FT.
AFTER 24 HRS. DEPTH TNP FT.
ELEV. FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Topsoil (5 Inches)
		1.0	1.5	1	SS	50/2"					Weathered Sandstone - orangish and tan- dry - very hard (RESIDUUM)
2.5	-2.5										Auger Refusal at 1.1 feet
5.0	-5.0										
7.5	-7.5										
10.0	-10.0										
12.5	-12.5										
15.0	-15.0										
17.5	-17.5										
20.0	-20.0										

REMARKS: Offset boring drilled 5 feet north: refusal at 1.0 feet

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Interchange Drive Facility
Crossville, Tennessee
GEOServices Project # 21-153734

LOG OF BORING B-4
SHEET 1 OF 1

DRILLER M. Bowens
ON-SITE REP.

BORING NO. / LOCATION B-4 DRY ON COMPLETION ? Yes

DATE February 20, 2017 SURFACE ELEV. FT.
REFUSAL: Yes DEPTH 2.5 FT. ELEV. -2.5 FT.
SAMPLED 2.5 FT. 0.8 M
TOP OF ROCK DEPTH FT. ELEV. FT.
BEGAN CORING DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF) FT.
BOTTOM OF HOLE DEPTH 2.5 FT. ELEV. -2.5 FT.

BORING ADVANCED BY: . POWER AUGERING X PROPOSED FINISHED FLOOR ELEVATION: FT.

WATER LEVEL DATA (IF APPLICABLE)
COMPLETION: DEPTH Dry FT.
ELEV. FT.
AFTER 1 HRS: DEPTH TNP FT.
ELEV. FT.
AFTER 24 HRS. DEPTH TNP FT.
ELEV. FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Topsoil (3 inches)
		1.0	1.2	1	SS	50/2"					Weathered Sandstone - orangish and tan- dry - very hard (RESIDUUM)
2.5	-2.5										Auger Refusal at 2.5 feet
5.0	-5.0										
7.5	-7.5										
10.0	-10.0										
12.5	-12.5										
15.0	-15.0										
17.5	-17.5										
20.0	-20.0										

REMARKS: Offset boring drilled 10 feet east: refusal at 2.7 feet

GEOServices, LLC-Geotechnical and Materials Engineers

Interchange Drive Facility
Crossville, Tennessee
GEOServices Project # 21-153734

LOG OF BORING B-5
SHEET 1 OF 1

DRILLER M. Bowens
ON-SITE REP.

BORING NO. / LOCATION B-5 DRY ON COMPLETION ? Yes

DATE February 20, 2017 SURFACE ELEV. FT.
REFUSAL: Yes DEPTH 1.1 FT. ELEV. -1.1 FT.
SAMPLED 1.1 FT. 0.3 M
TOP OF ROCK DEPTH FT. ELEV. FT.
BEGAN CORING DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF) FT.
BOTTOM OF HOLE DEPTH 1.1 FT. ELEV. -1.1 FT.

BORING ADVANCED BY: . POWER AUGERING X PROPOSED FINISHED FLOOR ELEVATION: FT.

WATER LEVEL DATA (IF APPLICABLE)
COMPLETION: DEPTH Dry FT.
ELEV. FT.
AFTER 1 HRS: DEPTH TNP FT.
ELEV. FT.
AFTER 24 HRS. DEPTH TNP FT.
ELEV. FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Topsoil (6 Inches)
		1.0	1.1	1	SS	50/1"					Weathered Sandstone - orangish and tan- dry - very hard (RESIDUUM)
2.5	-2.5										Auger Refusal at 1.1 feet
5.0	-5.0										
7.5	-7.5										
10.0	-10.0										
12.5	-12.5										
15.0	-15.0										
17.5	-17.5										
20.0	-20.0										

REMARKS: Offset boring drilled 10 feet south: refusal at 0.8 feet

GEOServices, LLC-Geotechnical and Materials Engineers

Interchange Drive Facility
Crossville, Tennessee
GEOServices Project # 21-153734

LOG OF BORING B-6
SHEET 1 OF 1

DRILLER M. Bowens
ON-SITE REP.

BORING NO. / LOCATION B-6 DRY ON COMPLETION ? Yes

DATE February 20, 2017 SURFACE ELEV. FT.
REFUSAL: Yes DEPTH 3.1 FT. ELEV. -3.1 FT.
SAMPLED 3.1 FT. 0.9 M
TOP OF ROCK DEPTH FT. ELEV. FT.
BEGAN CORING DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF) FT.
BOTTOM OF HOLE DEPTH 3.1 FT. ELEV. -3.1 FT.

WATER LEVEL DATA (IF APPLICABLE)
COMPLETION: DEPTH Dry FT.
ELEV. FT.
AFTER 1 HRS: DEPTH TNP FT.
ELEV. FT.
AFTER 24 HRS. DEPTH TNP FT.
ELEV. FT.

BORING ADVANCED BY: POWER AUGERING X PROPOSED FINISHED FLOOR ELEVATION: FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Topsoil (5 Inches)
		1.0	2.5	1	SS	5					Lean CLAY (CL) w/ sand - brown - dry to moist (RESIDUUM)
2.5	-2.5										Auger Refusal at 3.1 feet
5.0	-5.0										
7.5	-7.5										
10.0	-10.0										
12.5	-12.5										
15.0	-15.0										
17.5	-17.5										
20.0	-20.0										

REMARKS: Offset boring drilled 10 feet south: refusal at 0.8 feet

GEOServices, LLC-Geotechnical and Materials Engineers

Interchange Drive Facility
Crossville, Tennessee
GEOServices Project # 21-153734

LOG OF BORING B-7
SHEET 1 OF 1

DRILLER M. Bowens
ON-SITE REP.

BORING NO. / LOCATION B-7
DRY ON COMPLETION ? Yes

DATE February 20, 2017
SURFACE ELEV. FT.
REFUSAL: Yes DEPTH 5.5 FT. ELEV. -5.5 FT.
SAMPLED 5.5 FT. 1.7 M
TOP OF ROCK DEPTH FT. ELEV. FT.
BEGAN CORING DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF) FT.
BOTTOM OF HOLE DEPTH 5.5 FT. ELEV. -5.5 FT.
BORING ADVANCED BY: POWER AUGERING X
PROPOSED FINISHED FLOOR ELEVATION: FT.

WATER LEVEL DATA (IF APPLICABLE)
COMPLETION: DEPTH Dry FT.
ELEV. FT.
AFTER 1 HRS: DEPTH TNP FT.
ELEV. FT.
AFTER 24 HRS. DEPTH TNP FT.
ELEV. FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Gravel (5 Inches)
		1.0	2.5	1	SS	14					Sandy Lean CLAY (CL) w/ sandstone fragments - orange and tan -dry - stiff (RESIDUUM)
2.5	-2.5										
		3.5	4.8	2	SS	74/9"					Weathered Sandstone - orangish and tan- dry - very hard (RESIDUUM)
5.0	-5.0										
											Auger Refusal at 5.5 feet
7.5	-7.5										
10.0	-10.0										
12.5	-12.5										
15.0	-15.0										
17.5	-17.5										
20.0	-20.0										

REMARKS: Offset boring drilled 10 feet south: refusal at 0.8 feet

GEOServices, LLC-Geotechnical and Materials Engineers

Interchange Drive Facility
Crossville, Tennessee
GEOServices Project # 21-153734

LOG OF BORING B-8
SHEET 1 OF 1

DRILLER A. Bisching
ON-SITE REP.

BORING NO. / LOCATION B-8
DRY ON COMPLETION ? Yes

DATE February 20, 2017
SURFACE ELEV. ____ FT.
REFUSAL: Yes DEPTH 5.5 FT. ELEV. -5.5 FT.
SAMPLED 20.5 FT. 6.2 M
TOP OF ROCK DEPTH 5.5 FT. ELEV. -5.5 FT.
BEGAN CORING DEPTH 5.5 FT. ELEV. -5.5 FT.
FOOTAGE CORED (LF) 15.0 FT.
BOTTOM OF HOLE DEPTH 20.5 FT. ELEV. -20.5 FT.

WATER LEVEL DATA (IF APPLICABLE)
COMPLETION: DEPTH Dry FT.
ELEV. ____ FT.
AFTER 1 HRS: DEPTH TNP FT.
ELEV. ____ FT.
AFTER 24 HRS. DEPTH TNP FT.
ELEV. ____ FT.

BORING ADVANCED BY: . POWER AUGERING X
PROPOSED FINISHED FLOOR ELEVATION: ____ FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
		1.0	2.5	1	SS	16					Sandy Lean CLAY (CL) w/ sandstone fragments - orange and tan -dry - stiff (RESIDUUM)
2.5	-2.5										
		3.5	3.6	2	SS	50/1"					Weathered Sandstone - orangish and tan- dry - very hard (RESIDUUM)
5.0	-5.0										
		RUN 1	Began (ft) 5.5	End (ft) 10.5	REC 100%	RQD 80%					Auger Refusal at 5.5 feet (began coring)
											Sandstone - soft, tan, moderately fractured and severely weathered
7.5	-7.5										
								UC Strength (psi) 10,819			
10.0	-10.0										
		RUN 1	Began (ft) 10.5	End (ft) 15.5	REC 100%	RQD 95%					
12.5	-12.5										
								UC Strength (psi) 16,753			
											Sandstone - hard - tan and purple/red - slightly fractured and weathered
15.0	-15.0										Unconfined Compressive Strength: 25,000 psi
		RUN 1	Began (ft) 15.5	End (ft) 20.5	REC 100%	RQD 80%					
								UC Strength (psi) 15,060			
17.5	-17.5										
20.0	-20.0										

Coring Terminated at 20.5 feet

REMARKS: ____

GEOServices, LLC-Geotechnical and Materials Engineers

Interchange Drive Facility
Crossville, Tennessee
GEOServices Project # 21-153734

LOG OF BORING B-9
SHEET 1 OF 1

DRILLER M. Bowens
ON-SITE REP.

BORING NO. / LOCATION B-9 DRY ON COMPLETION ? Yes

DATE February 20, 2017 SURFACE ELEV. FT.
REFUSAL: Yes DEPTH 2.3 FT. ELEV. -2.3 FT.
SAMPLED 2.3 FT. 0.7 M
TOP OF ROCK DEPTH FT. ELEV. FT.
BEGAN CORING DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF) FT.
BOTTOM OF HOLE DEPTH 2.3 FT. ELEV. -2.3 FT.

BORING ADVANCED BY: . POWER AUGERING X PROPOSED FINISHED FLOOR ELEVATION: FT.

WATER LEVEL DATA (IF APPLICABLE)
COMPLETION: DEPTH Dry FT.
ELEV. FT.
AFTER 1 HRS: DEPTH TNP FT.
ELEV. FT.
AFTER 24 HRS. DEPTH TNP FT.
ELEV. FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Topsoil (3 inches)
		1.0	1.2	1	SS	50/2"					Weathered Sandstone - orangish and tan- dry - very hard (RESIDUUM)
2.5	-2.5										Auger Refusal at 2.3 feet
5.0	-5.0										
7.5	-7.5										
10.0	-10.0										
12.5	-12.5										
15.0	-15.0										
17.5	-17.5										
20.0	-20.0										

REMARKS: Offset boring drilled 10 feet west: refusal at 2.8 feet

GEOServices, LLC-Geotechnical and Materials Engineers

Interchange Drive Facility
Crossville, Tennessee
GEOServices Project # 21-153734

LOG OF BORING B-10.
SHEET 1 OF 1

DRILLER M. Bowens
ON-SITE REP.

BORING NO. / LOCATION B-10. DRY ON COMPLETION ? Yes

DATE February 20, 2017 SURFACE ELEV. FT.
REFUSAL: Yes DEPTH 1.1 FT. ELEV. -1.1 FT.
SAMPLED 1.1 FT. 0.3 M
TOP OF ROCK DEPTH FT. ELEV. FT.
BEGAN CORING DEPTH FT. ELEV. FT.
FOOTAGE CORED (LF) FT.
BOTTOM OF HOLE DEPTH 1.1 FT. ELEV. -1.1 FT.

WATER LEVEL DATA (IF APPLICABLE)
COMPLETION: DEPTH Dry FT.
ELEV. FT.
AFTER 1 HRS: DEPTH TNP FT.
ELEV. FT.
AFTER 24 HRS. DEPTH TNP FT.
ELEV. FT.

BORING ADVANCED BY: . POWER AUGERING X PROPOSED FINISHED FLOOR ELEVATION: FT.

STRATUM DEPTH FT.	STRATUM DEPTH ELEV.	SAMPLE DEPTH FROM FT.	SAMPLE DEPTH TO FT.	SAMPLE OR RUN NO.	SAMPLE TYPE	FIELD RESULTS N-Value	FIELD RESULTS Qu	LABORATORY RESULTS LL	LABORATORY RESULTS PI	LABORATORY RESULTS %M	STRATUM DESCRIPTION
											Topsoil (3 inches)
											Weathered Sandstone - orangish and tan- dry - very hard (RESIDUUM)
		1.0	1.1	1	SS	50/1"					Auger Refusal at 1.0 feet
2.5	-2.5										
5.0	-5.0										
7.5	-7.5										
10.0	-10.0										
12.5	-12.5										
15.0	-15.0										
17.5	-17.5										
20.0	-20.0										

REMARKS: Offset boring drilled 5 feet east: refusal at 0.8 feet

APPENDIX B

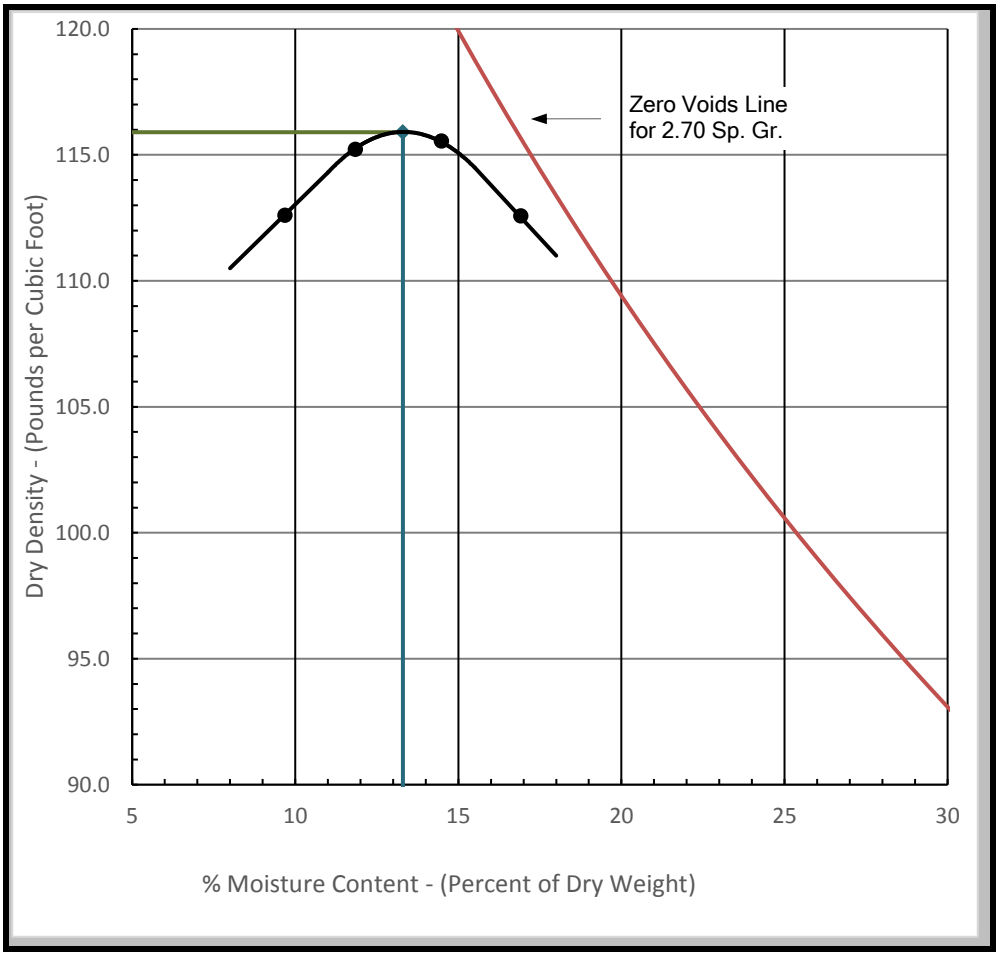
Laboratory Testing Results

LABORATORY COMPACTION OF SOILS
ASTM D 698 Method B

GEOServices, LLC-Geotechnical and Materials Engineers

GEOS Project Name:	Interchange Drive Facility		
GEOS Project Number:	21-17138	Report Date:	February 26, 2017
GEOS Log #:		Date Received:	February 22, 2017

Sample Location:	Boring B-7
Sample Depth:	0-5 feet
Sample Description:	Tan Sandy Lean Clay with Sandstone



Max. Dry Density (pcf)
115.9
Optimum Moisture (%)
13.3

As Received W%	TNP
Rammer Type	Manual
Prep Method	Dry

ASTM D4718
Percent Oversize Material
TNP < 5%
OS Bulk Specific Gravity
TNP
Oversize Corrected Data Corrected MDD (pcf)
TNP
Corrected Opt Moisture %
TNP

LL / PL / PI - Data By:	ASTM D4318		
Liquid Limit	27	Plasticity Index	12
Plastic Limit	15	Soil Type	CL

SOIL SPECIFIC GRAVITY BY ASTM D854
ASSUMED 2.70

NOTES

COMPRESSIVE STRENGTH OF INTACT ROCK CORES

ASTM D7012 Method C

GEOS Project Name: Interchange Drive Facility

Report Date: March 2, 2017

GEOS Project Number: 21-17138

Date Received:

Sample ID	Depth Feet	Average Diameter	Average Length	Weight Grams	Area Sq. In.	Dry Unit Weight PCF	Total Load Pounds	Compressive Strength PSI
B-8	9	1.864	4.029		2.729		29,525	10,819
B-8	13'	1.865	4.091		2.732		45,770	16,753
B-8	16.5	1.864	4.017		2.729		41100	15,060

Notes:

GEOServices, LLC, Geotechnical and Materials Engineers

April 11, 2022

City of Crossville
Engineering Department
392 North Main Street
Crossville, Tennessee 38555

ATTENTION: Mr. Don Cole
don.cole@crossvilletn.gov

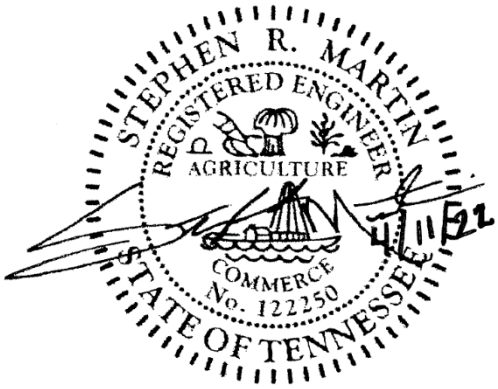
Subject: **REPORT OF GEOTECHNICAL EXPLORATION**
Interchange Business Park Site
340 Interchange Drive
Crossville, Tennessee
GEOServices Project No. 21-22452

Dear Mr. Cole:

We are submitting the results of the geotechnical exploration performed for the subject project. The geotechnical exploration was performed following our Proposal No. 11-22080, dated February 1, 2022, and authorized by you. The following report presents our findings and recommendations for the proposed project. Should you have any questions regarding this report, or if we can be of any further assistance, please contact us at your convenience.

Sincerely,

GEOServices, LLC



Stephen R. Martin, P.E.
Geotechnical Project Manager
TN PE 122,250

Ibrahim M. Aklouk, E.I.
Geotechnical Staff Professional

REPORT OF

GEOTECHNICAL EXPLORATION

Interchange Business Park Site

340 Interchange Drive

Crossville, Tennessee

GEOServices Project No. 21-22452

Submitted to:

City of Crossville Engineering Department
392 N Main Street
Crossville, Tennessee 38555

Submitted by:

GEOServices, LLC
2561 Willow Point Way
Knoxville, TN 37931

Phone (865) 539-8242
Fax (865) 539-8252

GEOServices, LLC, Geotechnical and Materials Engineers

TABLE OF CONTENTS

Contents **Page**

APPENDICES

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of our geotechnical exploration was to explore the subsurface conditions for the proposed development to be located at 340 interchange Drive in Crossville, Tennessee; and provide geotechnical recommendations for site preparation, grading, and design and construction of the foundation system. Additionally, recommendations for light and heavy-duty pavements are included.

1.2 PROJECT INFORMATION AND SITE DESCRIPTION

Project information was provided via email correspondence between Mr. Don Cole of City of Crossville and Mr. Brian Williamson of GEOServices, LLC on January 27, 2022. Included with the email was two drawings titled *Site Grading Plan* dated September 2018 as prepared by TARE, Inc. and *Updated TOPO* dated January 2019 as prepared by City of Crossville Engineering Department. In addition, we were provided *Report of Geotechnical Exploration* dated March 6, 2017 as prepared by GEOServices, LLC.

We understand the City of Crossville is in the process of obtaining Select Tennessee Site Certification for an approximately 20-acre parcel located north of Interchange Drive in the Interchange Business Park in Crossville, Tennessee. Since our exploration completed in 2017, we understand that the site has been graded and covered with crushed aggregate to provide a pad ready building site. Based on our review of the provided topographic drawings, it appears maximum earthwork cuts and fills of about 12 feet were required to form the relatively level building pad.

Since the project is in the predevelopment phase, detailed information regarding structural types, locations, or finished grades is not yet available. However, we have assumed potential structural types will generally consist of warehouse/light industrial, steel-framed buildings with CMU or composite walls supported using shallow foundations and concrete slabs-on-grade. The maximum anticipated individual column and continuous wall foundation loads for structures of this type are expected to be on the order of 200 kips and 5 kips per linear foot, respectively.

Since the site is relatively level, we anticipate additional grading may consist of cuts/fills less than 5 feet will be necessary to reach proposed grades.

The site is immediately bordered by Interchange Drive to the south, commercial property to the southeast, and undeveloped properties to remaining sides. The site has remained relatively unchanged since grading activities between 2017 and 2019.

1.3 SCOPE OF STUDY

This geotechnical exploration involved site reconnaissance, field drilling, and engineering analysis. The following sections of this report present discussions of the field exploration, site conditions, and conclusions and recommendations. Following the text of this report, Appendix A presents figures and test boring records.

The scope of our geotechnical engineering services did not include an environmental assessment for determining the presence or absence of wetlands, or hazardous or toxic materials in the soil, bedrock, surface water, groundwater, or air, on, or below, or around this site. Therefore, statements in this report or on the boring logs regarding odors, colors, and unusual or suspicious items or conditions are strictly for informational purposes.

2.0 EXPLORATION AND TESTING PROGRAMS

The site subsurface conditions were explored by drilling fifteen (15) soil test borings across the proposed development. The borings were located in the field by GEOServices personnel using the provided site plan and a hand-held GPS unit. The soil test borings were drilled on March 28, 2022, and advanced using 3¼-inch hollow stem augers and a GeoProbe 6620 track mounted drill rig. The approximate locations of the soil test borings are shown in Figure 2 of Appendix A of this report. The elevations shown on the logs were obtained by interpolating from the provided topographic drawing and should be considered approximate. Detailed logs for soil test borings can also be found in Appendix A.

Within each boring, Standard Penetration Testing (SPT) and split-spoon sampling were performed on 2½-foot intervals in the upper 10 feet and on 5-foot centers thereafter. SPT and split-spoon sampling were performed in accordance with ASTM D 1586.

In split-spoon sampling, a standard 2-inch O.D. split-spoon sampler is driven into the bottom of the boring with a 140-pound hammer falling a distance of 30 inches. The number of blows required to advance the sampler the last 12 inches of the standard 18 inches of total penetration (or second and third 6-inch increments when sampling 24 inches) is recorded as the SPT resistance (N-value). These N-values are indicated on the boring logs at the test depth and indicate the consistency or relative density of the soil.

After completion of the field drilling and sampling phase of this project, the soil samples were returned to our laboratory where they were visually classified in general accordance with the Unified Soil Classification System (USCS – ASTM D 2487) by a GEOServices staff member.

3.0 SUBSURFACE CONDITIONS

3.1 GEOLOGIC CONDITIONS

The project site lies within the Cumberland Plateau Physiographic Province of eastern central Tennessee. This Province is characterized by flat-topped mountains separated by narrow valley bottoms which wind between steep canyon-type walls. These canyon walls are formed primarily on resistant beds of sandstone, siltstone, shale, and conglomerate form the lower part of the Pennsylvanian strata. High terraces such as those associated with high-level fluvial deposits along the Cumberland River are remnants of earlier valley bottoms and are found throughout the province.

Published geologic information indicates that the site is underlain by bedrock of the Crab Orchard Mountains Group. This Group is composed of the Rockcastle Conglomerate, Vandever, Newton Sandstone, Whitwell Shale, and Sewanee Conglomerate formations. However, the Crab Orchard Mountains Group is not differentiated into its individual formations in the area of the project site. Where undifferentiated, this Group is typically composed of fine to coarse-grained sandstone, gray shale and siltstone, and sandstone/sandstone conglomerate which typically weathers to produce a thin sandy, silty residual overburden. Bedrock from this group is generally not susceptible to the development of karst conditions and has a low potential for the development of overburden sinkholes.

3.2 SOIL STRATIGRAPHY

The following subsurface description is generalized to highlight the subsurface stratification features and material characteristics at the soil boring locations. The logs in Appendix A of this report should be reviewed for specific information at each location. Information on actual subsurface conditions exists only at the specific locations and is relevant only to the time this exploration was performed. Variations may occur and should be expected at the site.

Surficial & Fill Materials

Each boring location initially encountered surficial material, generally consisting of approximately 1 to 2 inches of gravel. The encountered gravel is a part of the crushed aggregate on the pad. We anticipate the actual depth of the surficial layer to vary significantly across the site and between our widely spaced borings. Therefore, we recommend the contractor evaluate the surficial material depth for bidding purposes.

Underlying the surficial gravel, apparent fill materials were encountered in the majority of the locations consisting of orangish-brown, brown, pink, brown, dark brown, tan, black, and dark gray sands and gravels which extended to depths ranging from approximately 3 to 12.8 feet below the existing grade. Six borings (C-1, C-9, C-10, C-11, C-14, and C-15) refused in fill; therefore, the fill may extend to greater depths in these locations while fill materials were not encountered in borings C-5 and C-8.

The exceptions include five locations (C-1, C-2, and C-11 through C-13) encountered clays and/or some organics within the fill matrix. In addition, an apparent petroleum odor was noted in five locations (C-4, C-9, C-10, C-14, and C-15).

The SPT N-values within the fill soils generally ranged from 9 blows per foot (bpf) to 50/3” (50 blows per 3inches), indicating loose to very dense relative densities within the coarse-grained materials and stiff to hard consistencies within the fine-grained materials.

Residuum

Apparent residual material was encountered in two boring locations (C-5 and C-8) underlying the surficial layer. The residual material generally consisted of pink and orangish-brown sand with varying amounts of sandstone fragments. The SPT N-values within the residual soils generally ranged from 24 bpf to 50/0", indicating medium dense to very dense relative densities within the coarse-grained materials.

Weathered Rock

Beneath the fill materials, eight boring locations (C-2 through C-4, C-6 through C-8, C-12, and C-13) encountered weathered rock at depths ranging from approximately 3 to 8.5 feet below existing grade. The weathered rock generally consisted of sandstone with varying amounts of sand.

Auger Refusal

Auger refusal was encountered in each of the boring locations at depths ranging from approximately 2.6 to 12.8 feet below the existing grade. As mentioned, six locations (C-1, C-9, C-10, C-11, C-14, and C-15) encountered fill to refusal depths. Therefore, these depths may be indicative of denser fill materials and not the underlying bedrock. Auger refusal is a designation applied to any material that cannot be readily penetrated by the drill auger and is ordinarily indicative of a very hard or very dense material, such as large boulders or the upper surface of bedrock.

Groundwater

Apparent groundwater was encountered in three boring locations (C-3, C-4, and C-14) at depths ranging from approximately 3.5 to 7 feet below existing ground. We note that stabilized water levels can sometimes be challenging to obtain as the encountered soils are known to be relatively impermeable. In addition, each boring was backfilled upon completion in consideration of safety, so delayed water levels were not recorded. Groundwater levels may fluctuate due to seasonal changes in precipitation amounts, construction activities in the area, and/or other factors. Some of the soil types present at this site (gravelly fill) can transmit significant amounts of water in open excavations. Additionally, discontinuous zones of perched water may exist within the overburden materials.

Groundwater can exist within the depths explored during other times of the year, depending upon climatic and rainfall conditions. Therefore, the groundwater information presented in this report is the information collected during our field activities.

The following table summarizes approximate surficial and fill materials thicknesses, groundwater depths, and approximate refusal depths relative to the estimated ground elevation.

Table 1 –Boring Summary Information

Location #	Estimated Ground Surface Elevation (feet MSL)	Approximate Depth of Surficial Gravel (inches)	Approximate Depth of Fill (feet)	Approximate Depth of Groundwater (feet)	Approximate Refusal Depth (feet)	Approximate Refusal Elevation (feet MSL)
C-1	1795	2”	12.8	NA	12.8	1782.3
C-2	1797	1”	8	NA	8.5	1788.5
C-3	1797	1”	3	3.5	6.3	1790.8
C-4	1797.5	1”	3	3.5	6.0	1791.5
C-5	1798	1”	NE	NA	3.3	1794.7
C-6	1796.5	1”	8	NA	8.5	1788
C-7	1798	2”	3	NA	4.5	1793.5
C-8	1798	1”	NE	NA	4.0	1794
C-9	1798	1”	3.1	NA	3.1	1794.9
C-10	1798.5	1”	2.6	NA	2.6	1795.9
C-11	1795	2”	12	NA	12.0	1783
C-12	1796.5	2”	8	NA	8.5	1788
C-13	1797	1”	3	NA	3.5	1793.5
C-14	1797.5	2”	7.6	7.0	7.6	1789.9
C-15	1797.5	2”	3	NA	3.0	1794.5

NOTES: NA – Not Apparent / NE – Not Encountered
Elevations interpolated from provided topographic map. Should be considered approximate.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 SITE ASSESSMENT

Based on the results of our geotechnical exploration, it is our opinion that the site is generally adaptable for the proposed construction. However, particular geotechnical challenges may present during site development, including the existing fill materials, groundwater, and difficult excavation.

4.1.1 Apparent Fill

GEOServices, LLC previously completed an exploration and issued a *Report of Geotechnical Exploration* dated March 6, 2017 with existing conditions and our recommendations. Since that time, we understand the site has been graded and covered with crushed aggregate to provide a pad ready building site. Based on our review of the provided topographic drawings, it appears maximum earthwork cuts and fills of about 12 feet were completed to form the relatively level building pad. We have not been provided with documentation regarding the fill placement and understand this information may not exist. If documentation of the placement and density testing of the fill is available, GEOS should be provided this information for inclusion in our analysis.

During this exploration, apparent fill materials were encountered in the majority of our boring locations consisting of gravels and sands extended to depths ranging from approximately 3 to 12.8 feet below the existing grade. We note six borings (C-1, C-9, C-10, C-11, C-14, and C-15) refused in fill; therefore, the fill may extend to greater depths in these locations.

Based on our exploration and materials encountered, the majority of the fill materials does appear to have been compacted within industry standards and capable of supporting of the assumed structures/pavements. However, we do note five locations (C-1, C-2, and C-11 through C-13) encountered clays and/or some organics within the fill matrix. Therefore, the client should anticipate and budget undercutting and replacement of unsuitable materials that may be encountered during construction should be included. At a minimum debris laden fill, deleterious, or soft materials encountered during grading or construction and/or between our boring locations, should be completely undercut and disposed off-site.

We strongly recommend performing close construction observations during earthwork and foundation excavations to observe the consistency and suitability of supporting the proposed construction. Any areas observed unsuitable for use as foundation or subgrade support should be remediated accordingly. Generally, remediation of these soils consists of undercutting and replacing a minimum of 2 feet below foundation bearing elevation and pavement and slab subgrade with properly compacted structural soil fill or compacted dense graded aggregate. The depth of undercutting should be determined at the time of construction.

Subgrades for lightly loaded slabs and/or pavement areas can typically be supported on materials that proofroll successfully. Proofrolling should be observed by a geotechnical engineer or a qualified representative to help identify areas requiring subgrade support correction. Where the subgrade does not pass proofrolling, remediation should be anticipated.

We anticipate the majority of the residual soils will be suitable for re-use as structural soil fill; however, the client should understand that some variation should be expected between our widely spaced borings, and selective undercut and replacement may be necessary during construction activities.

4.1.2 Groundwater

Apparent groundwater was encountered in three locations, C-3, C-4, and C-14, at depths ranging from approximately 3.5 to 7 feet below existing grade. Where encountered, these depths typically correlated to the transition between fill/weathered rock or just above refusal depths which may be an indication of perched water. While we do not anticipate that groundwater will be encountered during most construction activities, some dewatering may be required both during and upon completion of the proposed construction, especially if excavations extend near the soil/rock interface. We strongly recommend maintaining positive drainage and prevent ponding within structural areas. Furthermore, every effort should be made to keep site construction traffic at a minimum, especially during periods of wetter weather.

4.1.3 Difficult Excavation

Auger refusal was encountered in each of the boring locations at depths ranging from approximately 2.6 to 12.8 feet below the existing grade. Although the site is relatively level, we anticipate that difficult excavation may be encountered for portions of the site during footing and utility excavations, especially along the eastern perimeter and central portion of the site. We anticipate that if shallow rock is encountered, it can be removed with hydraulic hammers or other conventional construction equipment methods. We note that removing weathered rock or rock in confined excavations such as for utilities can be challenging.

We recommend that foundations bear on only one type of material to reduce the risk of differential settlement. If massive bedrock is exposed underneath the floor slab, foundations, or pavement subgrade, we recommend excavating to a minimum of 12 inches and replacing it with structural soil fill, suitable residual soils, or dense graded aggregate. Once grading plans are finalized, GEOServices should be allowed to review and revise our recommendations, if necessary

We strongly encourage the client to confer with the design team and a contractor concerning the recommendations contained in this report to assess potential costs and schedules. Additional on-site testing during construction can further classify the fill materials suitability for re-use as structural soil fill.

4.2 SITE PREPARATION RECOMMENDATIONS

4.2.1 Subgrade

Site stripping within the proposed construction areas (building and pavement) should include the removal of unsuitable fill, deleterious materials, rock fragments greater than 6 inches, and gravel. In addition, any existing utilities and gravel not to be incorporated in the proposed development should also be removed. The stripping operations should extend a minimum of 5 feet beyond the limits of proposed pavement areas and 10 feet beyond building footprints. A geotechnical engineer should observe these areas upon grading to confirm that the recommendations in this report are followed.

After the completion of stripping operations and excavation to reach the planned subgrade elevation, we recommend that the subgrade be proofrolled with a fully loaded, tandem-axle dump truck or other pneumatic-tired construction equipment of similar weight. The geotechnical engineer or his representative should observe proofrolling. Areas judged to perform unsatisfactorily (e.g., pumping and/or rutting) by the engineer should be undercut and replaced with structural soil fill or remediated at the geotechnical engineer's recommendation. Areas to receive structural soil fill should also be proofrolled prior to the placement of new fill. Proofrolling operations should extend a minimum distance of 10 feet beyond the building perimeter.

4.2.2 Structural Soil Fill

Material considered suitable for use as structural fill should be clean soil free of organics and other deleterious material, containing no rock fragments greater than 6 inches in dimension. Structural soil fill material should have a standard Proctor maximum dry density of 90 pounds per cubic foot (pcf) or greater and a PI value of 35 percent or less. The geotechnical engineer should test the material used as structural fill to confirm that it meets the project requirements before being placed.

Based on our exploration, the soils classified as low plasticity (lean) clay and free of deleterious materials may be suitable for re-use as structural soil fill. Further assessment of the on-site materials can be made during observation of the undercut and earthwork activities performed on-site or prior to construction using test pits.

Structural fill should be placed in loose, horizontal lifts not exceeding 8 inches in thickness. Each lift should be compacted to at least 98 percent of the soil's maximum dry density per the standard Proctor method (ASTM D 698) and within the range of minus (-) 2 percent to plus (+) 3 percent of the optimum moisture content. Each lift should be tested by geotechnical personnel to confirm that the contractors' method can achieve the project requirements before placing subsequent lifts. Areas that have become soft or frozen should be removed before the additional structural fill is placed.

4.2.3 Dense Graded Aggregate

Dense graded aggregate (DGA) fill may be required as backfill in undercut excavations and utility trench excavations. The DGA used for this section should be Type A and Grading D or E in accordance with Section 903.05 of the Tennessee Department of Transportation (TDOT) specifications. The DGA fill should be placed in loose, horizontal lifts not exceeding 8 inches in loose thickness. Each lift should be compacted to at least 98 percent of maximum dry density per the standard Proctor method (ASTM D 698). Each lift should be compacted, tested by geotechnical personnel, and approved before subsequent lifts.

4.3 FOUNDATION RECOMMENDATIONS

4.3.1 Shallow Foundations

Upon completion of site preparation, as previously recommended, our opinion is that the proposed building can be supported on conventional spread footing foundations bearing on approved properly compacted structural soil fill or suitable existing materials following the recommendations of this report. We recommend that if lower consistency soils are encountered during footing excavations, they be undercut and backfilled with compacted structural soil fill in the building area. Spread and continuous footings supported on adequately placed and compacted structural soil fill or suitable residual soils can be designed for an allowable soil bearing pressure of 3,000 psf.

We recommend that continuous foundations be a minimum of 18 inches wide and isolated spread footings be a minimum of 24 inches wide to reduce the possibility of a localized punching shear failure. In addition, exterior foundations should be designed to bear at least 18 inches below the finished exterior grade to develop the design bearing pressure and protect against frost heave.

A combination of differing bearing conditions (i.e., soil and rock) can cause differential foundation settlement and result in unsatisfactory long-term performance of the structure. In the event only a small area of bedrock is exposed within an individual building footprint, the remedial treatment may consist of removing the bedrock to a depth of at least 12 inches below the foundation bearing level. The excavation may then be backfilled using structural soil fill or compacted dense graded aggregate to the foundation bearing elevation to reduce the potential for differential stresses caused by point loading. The removal of rock from foundations will likely require the use of a pneumatic hammer (difficult excavation).

The available lateral capacity of shallow foundations includes a soil lateral pressure and coefficient of friction as described in the IBC, Section 1806. Footings will be embedded in a material similar to those described as Class 5 in Table 1806.2. Where footings are cast neat against the sides of excavations, an allowable lateral bearing pressure of 100 psf per foot depth below natural grade may be used in computations. Resistance to lateral sliding represented by a value of adhesion of 130 psf may be used for clays similar to those described as soil Class 5. An increase of one-third in the allowable lateral capacity may be considered for transient load combinations, including wind or earthquake unless otherwise restricted by design code provisions.

A geotechnical representative should be retained to perform foundation subgrade tests to confirm that the recommendations provided in this report are consistent with the site conditions encountered. Some undercutting of lower consistency fill soils encountered in foundation excavations should be anticipated. A dynamic cone penetrometer (DCP) is commonly utilized to provide information compared to the data obtained in the geotechnical report. Where inappropriate materials are encountered, the material should be excavated to stiff, suitable soils or remediated at the geotechnical engineer's direction.

Based on the known subsurface conditions, geology, and experience, we estimate foundations supported on recommended structural soil fill or other approved soils should experience maximum total and differential settlements of 1 inch and ½ inch, respectively. The settlement information is provided with assumed maximum column and continuous foundation loads of 200 kips and 5 kips per linear foot (kpf), respectively,

and an allowable bearing pressure of 3,000 psf. Additionally, this information assumes that the site is prepared following our recommendations provided in this report, including allowing the proposed fill time to consolidate under its own weight. If these parameters are determined to be incorrect, we should be notified to re-evaluate the settlements for the building.

4.3.2 Slabs-on-Grade

Following the recommended site preparation activities, we believe that the floor slab can be grade supported on structural soil fill materials or suitable residual soils. Observing proofrolling of the subgrade, as discussed earlier in this report, should be accomplished to identify soft or unstable soils which should be removed from the floor slab area before fill placement and/or floor slab construction. Based on our exploration, some isolated areas of remediation may be necessary.

In addition, we recommend more competent bedrock encountered during grading activities be removed a minimum of 12 inches below the floor slab to reduce the potential for point loading the slabs. The excavation to remove the rock should be backfilled using compacted granular fill or structural soil fill.

We recommend placing a minimum 4-inch-thick granular mat beneath the floor slab to enhance drainage and provide a capillary break. The subgrade should be proofrolled and approved before placing the crushed stone. Based on the conditions encountered on this site, we recommend that the floor slabs be designed using a subgrade modulus of 125 pounds per cubic inch (pci). This modulus is appropriate for small diameter loads (i.e., a 1ft x 1ft plate) and should be adjusted for wider loads.

4.4 SEISMIC DESIGN CRITERIA

In accordance with the International Building Code (IBC), 2018, we are providing the following seismic design information. After evaluating the SPT N-value data from the soil test borings and considering the changes to the site and foundation types, it was determined that the subsurface conditions at the site most closely matched the description for “Seismic Site Class C” or “ Very Dense Soil and Soft Rock.” Table 2 provides the spectral response accelerations for both short and 1-second periods, which may be used for design.

Table 2 – Seismic Design Parameters

Structure	S_s g	S_1 g	S_{DS} g	S_{D1} g
Interchange Business Park Site – Crossville, TN	0.299	0.107	0.259	0.107

The short and 1-second period values indicate the structure should be assigned a Seismic Design Category "B" using the published information. The provided values are based on the results of our field exploration and the assumption that the structure will be designed utilizing a Risk Category I, II, or III. If these assumptions are incorrect, we should be contacted to re-evaluate the seismic design information.

4.5 PAVEMENT DESIGN RECOMMENDATIONS

Following site preparation as previously recommended, the pavements can be grade supported on suitable residual soils, shotrock fill, or properly placed structural soil fill. Proofrolling should be accomplished regardless of these options to assist in identifying any soft or unstable soils, which should be removed from the pavement area prior to fill placement and/or pavement construction. Pavement materials may be placed after the subgrade has been properly compacted, fine graded, and proofrolled as recommended in the site preparation section of this report.

Similar to slab construction, we recommend more competent rock, if encountered, near the proposed elevation be removed during grading activities a minimum of 12 inches below the proposed pavement section.

4.5.1 Flexible Pavement Design

AASHTO flexible pavement design methods have been utilized for pavement recommendations. Our recommendations are based on the assumptions that the subgrade has been properly prepared as described previously. Based on our experience with similar developments, we recommend the following light and heavy-duty flexible pavement sections:

Table 3 - Flexible Pavement Recommendations

Pavement Materials	Light-Duty (inches)	Heavy-Duty (inches)
Bituminous Asphalt Surface Mix	1.5	1.5
Bituminous Asphalt Base Mix	2.0	2.5
Compacted Crushed Aggregate Base	6.0	8.0

We recommend a base stone equivalent to a Type A and Grading D in accordance with Section 903.05 of the TDOT specifications. The bituminous asphalt pavement should be Grading "E" as per Section 411 for the surface mix and Grading “BM” as per section 307 for the binder mix. Compaction requirements for the crushed aggregate base and the bituminous asphalt pavement should generally follow TDOT specifications.

4.5.2 Rigid Pavement Design

AASHTO rigid pavement design methods have been utilized for pavement recommendations. In areas of trash dumpster pads or areas where large trucks will be parked on the pavement, we recommend the use of a concrete pavement section. Our recommendations are based on the assumptions that the subgrade has been properly prepared. Based on our experience with similar developments, we recommend the following rigid pavement section:

Table 4 - Rigid Pavement Recommendations

Pavement Materials	Light-Duty (inches)	Heavy-Duty (inches)
4,000 psi Type I Concrete	5.0	6.0
Compacted Crushed Aggregate Base	4.0	6.0

Concrete should be reinforced with welded wire fabric or reinforcing bars to assist in controlling cracking from drying shrinkage and thermal changes. Sawed or formed control joints should be included for each 225 square feet of area or less (15 feet by 15 feet). Saw cuts should not cut through the welded wire fabric or reinforcing steel and dowels should be utilized at formed and/or cold joints.

4.5.3 General

Our recommendations are based upon the assumption that the subgrade has been properly prepared as described in previous sections and that if used, off-site soil borrow to be used to backfill to the final subgrade meets the requirements of the structural fill section.

The paved areas should be constructed with positive drainage to direct water off-site and to minimize surface water seeping into the pavement subgrade. The subgrade should have a minimum slope of 1 percent. In down grade areas, the basestone should extend through the slope to allow water entering the basestone to exit. For rigid pavements, water-tight seals should also be provided at formed construction and expansion joints.

We understand that budgetary considerations sometimes warrant thinner pavement sections than those presented. However, the client, owner, and project designers should be aware that thinner pavement sections may result in increased maintenance costs and lower than anticipated pavement life. If thinner pavement sections are warranted, alternate reinforced pavement sections can be considered, including the use of geogrid reinforcement.

4.6 LATERAL EARTH PRESSURES

For the design of below grade and site cast-in-place concrete retaining walls, we have provided equivalent fluid pressures for two backfill conditions for cantilever-type walls. These are 1) active earth pressure for granular backfill (clean sand or gravel) and 2) at-rest earth pressure for granular backfill. The equivalent fluid pressures provided have assumed a level backfill and a wall with a vertical face. The designer should confirm other aspects of retaining wall design, including an evaluation of local and global stability, with respect to the proposed walls and site design.

Condition 1 - The active earth pressure for granular backfill will result in an equivalent fluid pressure of 35 pounds per cubic foot (pcf). If the granular backfill is to develop active earth pressure conditions, walls must be flexible and/or free to rotate or translate at the top approximately one inch laterally for every 20 feet of wall height.

Condition 2 - The at-rest earth pressure for granular backfill will result in an equivalent fluid pressure of

55 pcf. For retaining walls that will not rotate or translate, such as basement walls or other walls rigidly connected to structures, at-rest conditions will develop.

In each case, forces from surcharge loading including sloping backfill should be added to the equivalent fluid pressures. The walls should be properly drained to remove water or hydrostatic pressure should be added to the design pressure.

The wedge of clean aggregate backfill should have a minimum width of 1 foot at the base of the wall or the width of the footing heel, whichever is greater, and increase in width a minimum of 0.6 feet per foot of wall height. The aggregate should be fully encapsulated with a properly designed geotextile (filter fabric) to prevent migration of the adjacent soils into the aggregate. Aggregate placed behind the retaining wall should be placed in accordance with the compaction recommendations of this report. However, we caution that operating compaction equipment directly behind the wall can create lateral earth pressures far in excess of those recommended for design. Therefore, we recommend using hand operated, smaller compaction equipment in non-vibratory modes within 5 feet of the front of the wall.

For rigid, cast-in-place concrete walls, an ultimate friction factor of 0.35 between foundation concrete and the bearing soils may be used when evaluating friction. Also, an ultimate passive earth pressure resistance of well-compacted soil fill can be approximated by a uniformly acting resistance of 1,000 psf. However, to limit deformation when relying on passive strength, we recommend using a minimum safety factor of 3.0 applied to the ultimate passive resistance value.

5.0 CONSTRUCTION CONSIDERATIONS

5.1 FOUNDATION CONSTRUCTION

Foundation excavations should be opened, the subgrade evaluated, remedial work performed (if required), and concrete placed expeditiously. Exposure to weather often reduces foundation support capabilities, thus necessitating remedial measures before concrete placement. It is also essential that proper surface drainage be maintained during construction (especially in terms of maintaining dry footing trenches) and after construction. Soil backfill for footings should be placed following the recommendations for structural fill presented herein.

5.2 EXCAVATIONS

Refusal was encountered in each of the boring locations at depths ranging from approximately 2.6 to 12.8 feet below the existing grade. Refusal conditions generally correspond to materials that require difficult excavation methods such as ripping, chipping (by track-mounted hydraulic hammers), or blasting for removal. However, excavation equipment varies, and field refusal conditions may vary. Generally, the weathering process is erratic, and variations in the rock profile can occur in small lateral distances.

We anticipate that difficult excavation may be encountered for portions of the site during footing and utility excavations. Therefore, at this time, we anticipate that challenging excavation may be encountered, but not for large areas of the site. For shallow removal of rock, we anticipate that using a track-mounted hydraulic hammer or heavy excavator equipment would be appropriate. We recommend the owner budget for removing rock and challenging excavation at this site. The client should confer with the contractor should determine the most efficient method of rock removal. Removing weathered rock can be extremely difficult in confined excavations such as foundations or utilities.

Excavations should be sloped or shored per local, state, and federal regulations, including OSHA (29 CFR Part 1926) excavation trench safety standards. The contractor is usually solely responsible for site safety. This information is provided only as a service, and under no circumstances should GEOServices be assumed responsible for construction site safety.

5.3 MOISTURE-SENSITIVE SOILS

The plastic fine-grained soils encountered at this site will be sensitive to disturbances caused by construction traffic and changes in moisture content. During wet weather periods, increases in the moisture content of the soil can cause significant reduction in the soil strength and support capabilities. Construction traffic patterns should be varied to prevent the degradation of previously stable subgrade. In addition, the soils at this site that become wet may be slow to dry and thus significantly retard the progress of grading and compaction activities. We caution if site grading is performed during the wet weather season; increases in the undercut volumes should be expected.

Further, methods such as discing and allowing the material to dry will be required to meet the required compaction recommendations for site fills. It will, therefore, be advantageous to perform earthwork and foundation construction activities during dry weather. However, November through March is typically the difficult grading period due to the limited drying conditions.

5.4 DRAINAGE AND SURFACE WATER CONCERNS

To reduce the potential for additional undercut and construction-induced sinkholes, water should not be allowed to collect in the foundation excavations, on floor slab areas, or prepared subgrades of the construction area either during or after construction. Undercut or excavated areas should be sloped toward one corner to facilitate the removal of collected rainwater, subsurface water, or surface runoff. Positive site surface drainage should be provided to reduce infiltration of surface water around the perimeter of the building and beneath the floor slab. The grades should be sloped away from the building, and surface drainage should be collected and discharged such that water is not permitted to infiltrate the backfill and floor slab areas of the building.

Significant construction dewatering is not anticipated for site grading based on our limited understanding of the proposed grading. However, seasonal fluctuations and runoff from adjacent properties may occur once construction begins. If seepage or runoff is encountered at shallow depths, it is anticipated that it can be controlled by simple means such as pumping from sumps or perimeter trenches to collect and discharge the water away from the work area. We recommend that all excavations where groundwater is encountered be observed individually to determine if interior drain systems are required.

6.0 LIMITATIONS

This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. This report is for our geotechnical work only, and no environmental assessment efforts have been performed. The conclusions and recommendations contained in this report are based upon applicable standards of our practice in this geographic area at the time this report was prepared. No other warranty, express or implied, is made.

The analyses and recommendations submitted herein are based, in part, upon the data obtained from the exploration. The nature and extent of variations between the borings will not become evident until construction. We recommend that GEOServices be retained to observe the project construction in the field. GEOServices cannot accept responsibility for conditions which deviate from those described in this report if not retained to perform construction observation and testing. If variations appear evident, then we will re-evaluate the recommendations of this report. In the event that any changes in the nature, design, or location of the structures are planned, the conclusions and recommendations contained in this report will not be considered valid unless the changes are reviewed, and conclusions modified or verified in writing. Also, if the scope of the project should change significantly from that described herein, these recommendations may need to be re-evaluated.

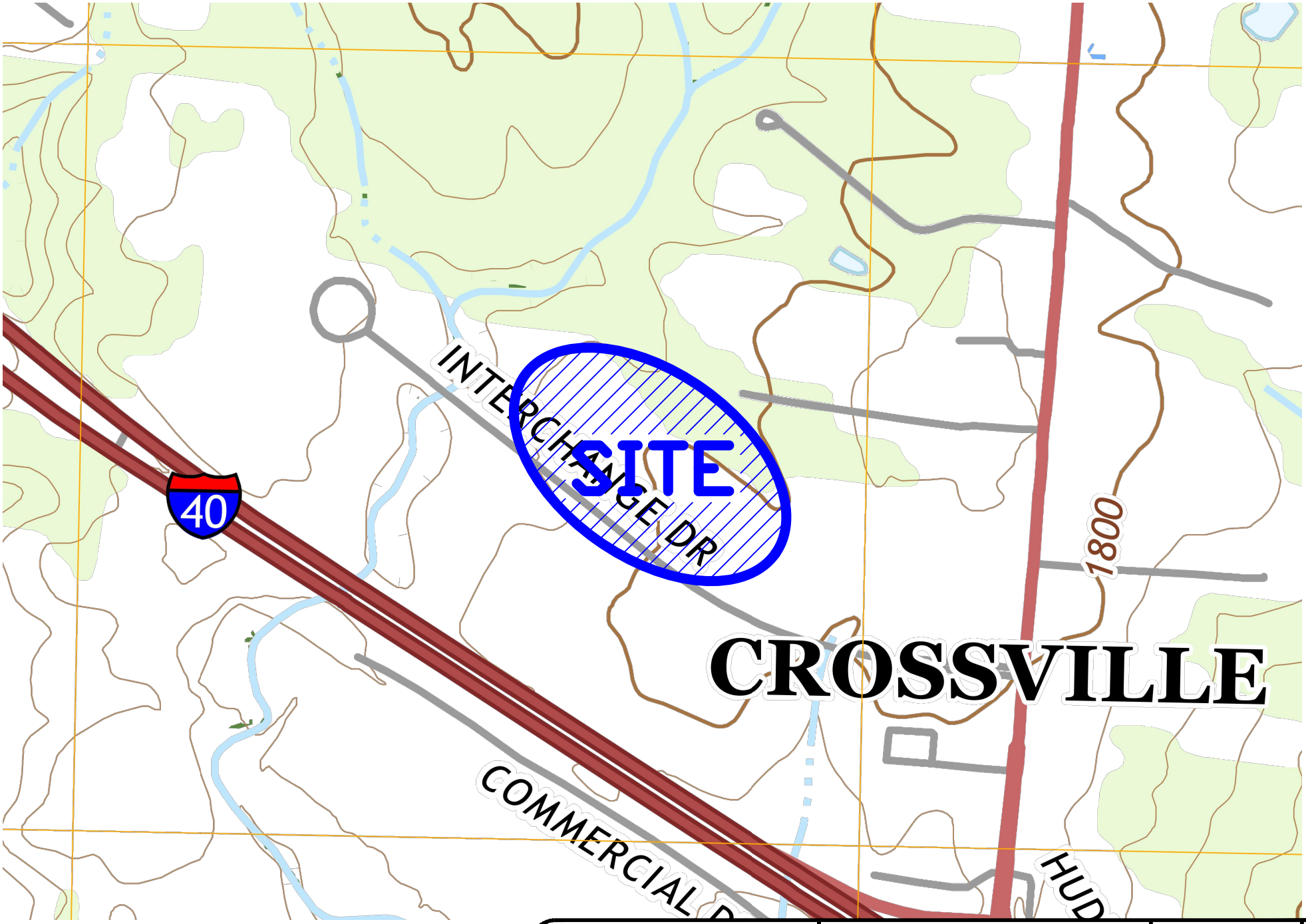
GEOServices, LLC, Geotechnical and Materials Engineers

ATTACHMENTS

GEOServices, LLC, Geotechnical and Materials Engineers

APPENDIX A

Figures, General Notes and Boring Logs



NOTES:

1.) BASE MAP: USGS QUADRANGLE (ISOLINE, TENNESSEE)

GEOS
GEOServices, LLC, Geotechnical and Materials Engineers
2561 Willow Point Way
Knoxville, Tennessee 37931
Office: 865-539-8242
Fax: 865-539-8252

SITE VICINITY MAP

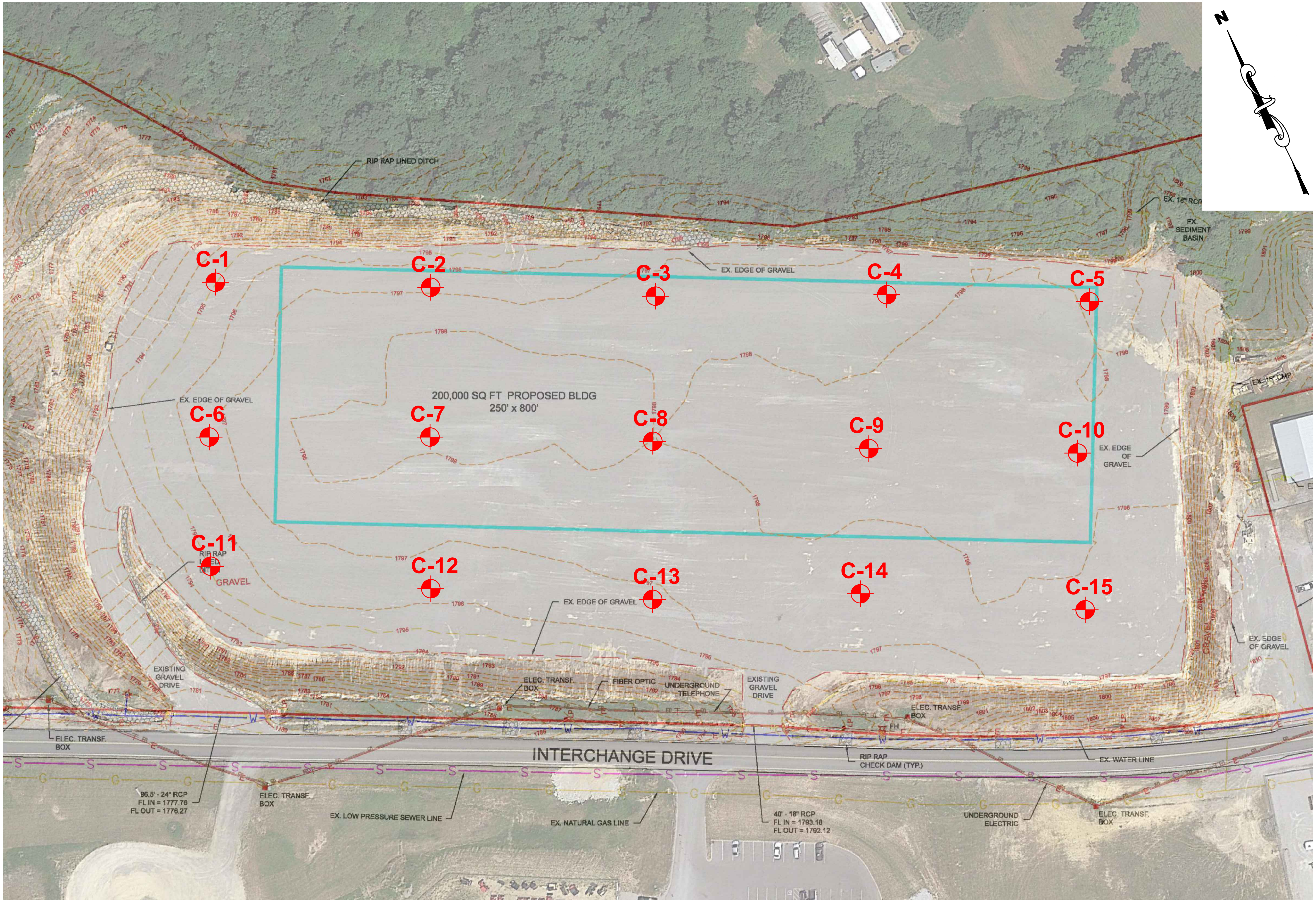
INTERCHANGE BUSINESS PARK SITE

340 INTERCHANGE DRIVE

CROSSVILLE, TENNESSEE 38571

DRAWN BY:	KSR
APPROVED BY:	TBW
SCALE:	N.T.S.
JOB NO.:	21-22452
DATE:	3/31/22

FIGURE 1



NOTES:

1.) BORING LOCATIONS ARE SHOWN IN GENERAL ARRANGEMENT ONLY.
2.) DO NOT USE BORING LOCATIONS FOR DETERMINATIONS OF DISTANCES OR QUANTITIES.
3.) BASE MAP PROVIDED BY: City of Crossville Engineering Department

⊕ LOCATION OF SOIL TEST BORINGS

SOIL TEST BORING LOCATION PLAN

INTERCHANGE BUSINESS PARK SITE

340 INTERCHANGE DRIVE

CROSSVILLE, TENNESSEE 38571

DRAWN BY:	KSR
APPROVED BY:	TBW
SCALE:	N.T.S.
JOB NO.:	21-22452
DATE:	3/31/22

GEOServices, LLC, Geotechnical and Materials Engineers
2561 Willow Point Way
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Figure 2

GENERAL NOTES

FINE AND COARSE GRAINED SOIL PROPERTIES

PARTICLE SIZE

BOULDERS:	GREATER THAN 300 mm
COBBLES:	75 mm to 300 mm
GRAVEL:	4.74 mm to 75 mm
COARSE SAND:	2 mm to 4.74 mm
MEDIUM SAND:	0.425 mm to 2 mm
FINE SAND:	0.075 mm to 0.425 mm
SILTS & CLAYS:	LESS THAN 0.075 mm

COARSE GRAINED SOILS (SANDS & GRAVELS)

N-VALUE	RELATIVE DENSITY
0 - 4	VERY LOOSE
5 - 10	LOOSE
11 - 30	MEDIUM DENSE
31 - 50	DENSE
OVER 50	VERY DENSE

FINE GRAINED SOILS (SILTS & CLAYS)

N-VALUE	CONSISTENCY	Qu, PSF
0 - 2	VERY SOFT	0-500
3 - 4	SOFT	500 -1000
5 - 8	FIRM	1000 - 2000
9 - 15	STIFF	2000 - 4000
16 - 30	VERY STIFF	4000 - 8000
OVER 31	HARD	8000 +

STANDARD PENETRATION TEST (ASTM D1586)

THE STANDARD PENETRATION TEST AS DEFINED BY ASTM D1586 IS A METHOD TO OBTAIN A DISTURBED SOIL SAMPLE FOR EXAMINATION AND TESTING AND TO OBTAIN RELATIVE DENSITY AND CONSISTENCY INFORMATON. THE 1.4 INCH I.D./2.0 INCH O.D. SAMPLER IS DRIVEN 3-SIX INCH INCREMENTS WITH A 140-LB. HAMMER FALLING 30 INCHES. THE BLOW COUNTS REQUIRED TO DRIVE THE SAMPLER THE FINAL 2 INCREMENTS ARE ADDED TOGETHER AND DESIGNATED THE N-VALUE. AT TIMES, THE SAMPLER CAN NOT BE DRIVEN THE FULL 18 INCHES. THE FOLLOWING REPRESENTS OUR INTERPRETATION OF THE STANDARD PENETRATION TEST WITH VARIATIONS.

BLOWS/FOOT (N-VALUE)	DESCRIPTION
25	25 BLOWS DROVE SAMPLER 12" AFTER INITIAL 6" SEATING
75/10"	75 BLOWS DROVE SAMPLER 10" AFTER INITIAL 6" SEATING
50/PR	PENETRATION REFUSAL OF SAMPLER AFTER INITIAL 6" SEATING

SAMPLING SYMBOLS

ST:	UNDISTURBED SAMPLE
SS:	SPLIT SPOON SAMPLE
CORE:	ROCK CORE SAMPLE
AU:	AUGER OR BAG SAMPLE

SOIL PROPERTY SYMBOLS

N:	STANDARD PENETRATION, BPF
M:	MOISTURE CONTENT %
LL:	LIQUID LIMIT %
PI:	PLASTICITY INDEX%
Qp:	POCKET PENETROMETER VALUE, TSF
Qu:	UNCONFINED COMPRESSIVE STRENGTH, TSF
DUW:	DRY UNIT WEIGHT, PCF

ROCK PROPERTIES

ROCK QUALITY DESIGNATION (RQD)

PERCENT	QUALITY
90 TO 100	EXCELLENT
75 TO 90	GOOD
50 TO 75	FAIR
25 TO 50	POOR
O TO 25	VERY POOR

ROCK HARDNES

VERY SOFT:	ROCK DISINTEGRATES OR EASILY COMPRESSES TO TOUCH: CAN BE HARD TO VERY HARD SOIL.
SOFT:	ROCK IS COHERANT BUT BREAKS EASILY TO THUMB PRESSURE AT SHARP EDGES AND IT CRUMBLES WITH FIRM HAND PRESSURE.
MODERATELY HARD:	SMALL PIECES CAN BE BROKEN OFF ALONG SHARP EDGES BY CONSIDERABLE HARD THUMB PRESSURE: CAN BE BROKEN BY LIGHT HAMMER BLOWS.
HARD:	ROCK CAN NOT BE BROKEN BY THUMB PRESSURE, BUT CAN BE BROKEN BY MODERATE HAMMER BLOWS.
VERY HARD:	ROCK CAN BE BROKEN BY HEAVY HAMMER BLOWS.

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KEY TO SYMBOLS

LITHOLOGIC SYMBOLS
(Unified Soil Classification System)

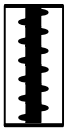
- ASPHALT: Asphalt
- CH: USCS High Plasticity Clay
- CL: USCS Low Plasticity Clay
- CL-ML: USCS Low Plasticity Silty Clay
- CONCRETE: Concrete
- DOLOMITE: Dolomite
- GRAVEL: Gravel / Basestone
- LIMESTONE: Limestone
- ML: USCS Silt
- SANDSTONE: Sandstone
- SC: USCS Clayey Sand
- SC-SM: USCS Silty Clayey Sand
- SHALE: Shale
- SLATE: Slate
- SM: USCS Silty Sand
- SW: USCS Well-graded Sand
- SP: USCS Poorly-graded Sand
- TOPSOIL: Topsoil
- WEATHERED ROCK: Weathered Bedrock
- WOOD: Wood / Mulch

SAMPLE SYMBOLS


Grab Sample


No Recovery


Rock Core


AUGER: Auger Probe


Shelby Tube


Split Spoon

COLOR CODES FOR LITHOLOGIC SYMBOLS

- RED: Fill
- GREEN: Cultivated
- BLUE: Residuum
- MAGENTA: Alluvium
- PINK: Colluvium
- LIGHT GRAY: Weathered Rock
- ORANGE: Loess
- DARK GRAY: Rock Core
- YELLOW: Void
- TEAL: Glacial Outwash / Glacial Till
- PURPLE: Marine

ABBREVIATIONS

LL - LIQUID LIMIT (%)
PI - PLASTIC INDEX (%)
W - MOISTURE CONTENT (%)
DD - DRY DENSITY (PCF)
NP - NON PLASTIC
-200 - PERCENT PASSING NO. 200 SIEVE
PP - POCKET PENETROMETER (TSF)

▽ Water Level at Time Drilling, or as Shown
▼ Water Level at End of Drilling, or as Shown
▼ Water Level After 24 Hours, or as Shown

TV - TORVANE
PID - PHOTOIONIZATION DETECTOR
UC - UNCONFINED COMPRESSION
ppm - PARTS PER MILLION

BORING NUMBER C-1

GEOServices, LLC, Geotechnical and Materials Engineers

PROJECT NAME Interchange Business Park Site
GEOServices PROJECT# 21-22452
DATE 3/28/22
PROJECT LOCATION 340 Interchange Drive, Crossville, TN 38571
DRILLING CONTRACTOR M&W Drilling
LOGGED BY KSR **ON-SITE REP.** ---
DRILLING METHOD Geoprobe 6620
LATITUDE / LONGITUDE ---
GROUND ELEVATION 1795 ft **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL Depth 12.8 ft / Elev 1782.3 ft
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING --- Dry
FOOTAGE CORED (LF) ---
AFTER 1 HOUR --- Backfilled
BOTTOM OF HOLE Depth 12.8 ft / Elev 1782.3 ft
AFTER 24 HOURS --- Backfilled

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX
0	1795.0		Gravel (2 Inches)						
			(SP) **SAND** - with large gravel - orangish brown, pink and brown - moist (FILL)	SS 1		6-5-7 (12)			
				SS 2		13-11-10 (21)			
5	1790.0		(CL) **Sandy Lean CLAY** - with mica, trace organics and strong organic odor - dark gray, dark brown, black and orangish brown - moist (FILL)	SS 3		13-11-11 (22)			
				SS 4		12-6-5 (11)			
10	1785.0								

Refusal at 12.8 feet.
Bottom of borehole at 12.8 feet.

NOTES:

BORING NUMBER C-2

GEOServices, LLC, Geotechnical and Materials Engineers

PROJECT NAME Interchange Business Park Site
GEOServices PROJECT# 21-22452
DATE 3/28/22
PROJECT LOCATION 340 Interchange Drive, Crossville, TN 38571
DRILLING CONTRACTOR M&W Drilling
LOGGED BY KSR **ON-SITE REP.** ---
DRILLING METHOD Geoprobe 6620
LATITUDE / LONGITUDE ---
GROUND ELEVATION 1797 ft **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL Depth 8.5 ft / Elev 1788.5 ft
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING --- Dry
FOOTAGE CORED (LF) ---
AFTER 1 HOUR --- Backfilled
BOTTOM OF HOLE Depth 8.5 ft / Elev 1788.5 ft
AFTER 24 HOURS --- Backfilled

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX
0	1797.0		Gravel (1 Inch)						
			(SP) **SAND** - with gravel and organic odor - dark brown, orangish brown, pink and tan - very moist to moist (FILL)	SS 1		6-6-6 (12)			
				SS 2		10-8-8 (16)			
5	1792.0		(SC) **Clayey SAND** - with organics, trace wood fragments and strong organic odor - dark gray, black and orangish brown - very moist (FILL)	SS 3		6-5-6 (11)			
			Weathered ROCK - sandstone - brown and orangish brown - moist - hard (RESIDUUM)	SS 4		50/0"			

Refusal at 8.5 feet.
Bottom of borehole at 8.5 feet.

NOTES:

BORING NUMBER C-3

GEOServices, LLC, Geotechnical and Materials Engineers

PROJECT NAME Interchange Business Park Site
GEOServices PROJECT# 21-22452
DATE 3/28/22
PROJECT LOCATION 340 Interchange Drive, Crossville, TN 38571
DRILLING CONTRACTOR M&W Drilling
LOGGED BY KSR **ON-SITE REP.** ---
DRILLING METHOD Geoprobe 6620
LATITUDE / LONGITUDE ---
GROUND ELEVATION 1797 ft **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL Depth 6.3 ft / Elev 1790.8 ft
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
▽ **AT END OF DRILLING** 3.50 ft / Elev 1793.50 ft
FOOTAGE CORED (LF) ---
AFTER 1 HOUR --- Backfilled
BOTTOM OF HOLE Depth 6.3 ft / Elev 1790.8 ft
AFTER 24 HOURS --- Backfilled

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX
0	1797.0		Gravel (1 Inch)						
			(SP) **SAND** - with gravel and organic odor - dark brown, orangish brown, pink and tan - very moist to moist (FILL)	SS 1		4-8-19 (27)			
			▽ **Weathered ROCK** - sandstone with sand - tan, pink and orangish brown - moist to very moist - hard (RESIDUUM)	SS 2		6-7-50/0"			
5	1792.0			SS 3		50/3"			

Refusal at 6.3 feet.
Bottom of borehole at 6.3 feet.

NOTES:

BORING NUMBER C-4

GEOServices, LLC, Geotechnical and Materials Engineers

PROJECT NAME Interchange Business Park Site
GEOServices PROJECT# 21-22452
DATE 3/28/22
PROJECT LOCATION 340 Interchange Drive, Crossville, TN 38571
DRILLING CONTRACTOR M&W Drilling
LOGGED BY KSR **ON-SITE REP.** ---
DRILLING METHOD Geoprobe 6620
LATITUDE / LONGITUDE ---
GROUND ELEVATION 1797.5 ft **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL Depth 6.0 ft / Elev 1791.5 ft
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
▽ **AT END OF DRILLING** 3.50 ft / Elev 1794.00 ft
FOOTAGE CORED (LF) ---
AFTER 1 HOUR --- Backfilled
BOTTOM OF HOLE Depth 6.0 ft / Elev 1791.5 ft
AFTER 24 HOURS --- Backfilled

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX
0	1797.5		Gravel (1 Inch)						
			(SP) **SAND** - with gravel and petroleum odor - orangish brown and tan - moist (FILL)	SS 1		6-9-7 (16)			
			▽ **Weathered ROCK** - sandstone with sand and strong petroleum odor - tan, dark brown and orangish brown - wet - hard (RESIDUUM)	SS 2		7-3-50/4"			
5	1792.5		**Weathered ROCK** - sandstone - orangish brown - moist - hard (RESIDUUM)	SS 3		50/0"			

Refusal at 6.0 feet.
Bottom of borehole at 6.0 feet.

NOTES:

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER C-5

PROJECT NAME Interchange Business Park Site
GEOServices PROJECT# 21-22452
DATE 3/28/22
PROJECT LOCATION 340 Interchange Drive, Crossville, TN 38571
DRILLING CONTRACTOR M&W Drilling
LOGGED BY KSR **ON-SITE REP.** ---
DRILLING METHOD Geoprobe 6620
LATITUDE / LONGITUDE ---
GROUND ELEVATION 1798 ft **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL Depth 3.3 ft / Elev 1794.7 ft
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING --- Dry
FOOTAGE CORED (LF) ---
AFTER 1 HOUR --- Backfilled
BOTTOM OF HOLE Depth 3.3 ft / Elev 1794.7 ft
AFTER 24 HOURS --- Backfilled

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX
0	1798.0		Gravel (1 Inch)						
			(SP) **SAND** - with trace sandstone fragments - pink - moist - medium dense (RESIDUUM)	SS 1		7-14-15 (29)			

Refusal at 3.3 feet.
Bottom of borehole at 3.3 feet.

NOTES:

BORING NUMBER C-6

GEOServices, LLC, Geotechnical and Materials Engineers

PROJECT NAME Interchange Business Park Site
GEOServices PROJECT# 21-22452
DATE 3/28/22
PROJECT LOCATION 340 Interchange Drive, Crossville, TN 38571
DRILLING CONTRACTOR M&W Drilling
LOGGED BY KSR **ON-SITE REP.** ---
DRILLING METHOD Geoprobe 6620
LATITUDE / LONGITUDE ---
GROUND ELEVATION 1796.5 ft **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL Depth 8.5 ft / Elev 1788.0 ft
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING --- Dry
FOOTAGE CORED (LF) ---
AFTER 1 HOUR --- Backfilled
BOTTOM OF HOLE Depth 8.5 ft / Elev 1788.0 ft
AFTER 24 HOURS --- Backfilled

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX
0	1796.5		Gravel (1 Inch)						
			(SPG) **Gravelly SAND** - orangish brown, brown and tan - moist (FILL)	SS 1		7-14-14 (28)			
			GRAVEL - with trace sand - orangish brown - moist (FILL)	SS 2		50/1"			
5	1791.5		(SP) **SAND** - with large gravel - tan and dark brown - moist (FILL)	SS 3		12-15-13 (28)			
			Weathered ROCK - sandstone - tan and orangish brown - moist - hard (RESIDUUM)	SS 4		50/0"			

Refusal at 8.5 feet.
Bottom of borehole at 8.5 feet.

NOTES:

BORING NUMBER C-7

GEOServices, LLC, Geotechnical and Materials Engineers

PROJECT NAME Interchange Business Park Site
GEOServices PROJECT# 21-22452
DATE 3/28/22
PROJECT LOCATION 340 Interchange Drive, Crossville, TN 38571
DRILLING CONTRACTOR M&W Drilling
LOGGED BY KSR **ON-SITE REP.** ---
DRILLING METHOD Geoprobe 6620
LATITUDE / LONGITUDE ---
GROUND ELEVATION 1798 ft **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL Depth 4.5 ft / Elev 1793.5 ft
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING --- Dry
FOOTAGE CORED (LF) ---
AFTER 1 HOUR --- Backfilled
BOTTOM OF HOLE Depth 4.5 ft / Elev 1793.5 ft
AFTER 24 HOURS --- Backfilled

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX
0	1798.0		Gravel (2 Inches)						
			(SP) **SAND** - with trace gravel - brown, pink, orangish brown and tan - moist (Possible FILL)	SS 1		12-24-11 (35)			
			Weathered ROCK - sandstone - pink - moist - hard (RESIDUUM)	SS 2		50/0"			

Refusal at 4.5 feet.
Bottom of borehole at 4.5 feet.

NOTES:

BORING NUMBER C-8

GEOServices, LLC, Geotechnical and Materials Engineers

PROJECT NAME Interchange Business Park Site
GEOServices PROJECT# 21-22452
DATE 3/28/22
PROJECT LOCATION 340 Interchange Drive, Crossville, TN 38571
DRILLING CONTRACTOR M&W Drilling
LOGGED BY KSR **ON-SITE REP.** ---
DRILLING METHOD Geoprobe 6620
LATITUDE / LONGITUDE ---
GROUND ELEVATION 1798 ft **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL Depth 4.0 ft / Elev 1794.0 ft
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING --- Dry
FOOTAGE CORED (LF) ---
AFTER 1 HOUR --- Backfilled
BOTTOM OF HOLE Depth 4.0 ft / Elev 1794.0 ft
AFTER 24 HOURS --- Backfilled

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX
0	1798.0		Gravel (1 Inch)						
			(SP) **SAND** - with trace sandstone fragments - pink and orangish brown - moist - medium dense (RESIDUUM)	SS 1		7-12-12 (24)			
			Weathered ROCK - sandstone with sand - orangish brown and pink - moist - hard (RESIDUUM)	SS 2		29-50/0"			

Refusal at 4.0 feet.
Bottom of borehole at 4.0 feet.

NOTES:

BORING NUMBER C-9

GEOServices, LLC, Geotechnical and Materials Engineers

PROJECT NAME Interchange Business Park Site
GEOServices PROJECT# 21-22452
DATE 3/28/22
PROJECT LOCATION 340 Interchange Drive, Crossville, TN 38571
DRILLING CONTRACTOR M&W Drilling
LOGGED BY KSR **ON-SITE REP.** ---
DRILLING METHOD Geoprobe 6620
LATITUDE / LONGITUDE ---
GROUND ELEVATION 1798 ft **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL Depth 3.1 ft / Elev 1794.9 ft
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING --- Dry
FOOTAGE CORED (LF) ---
AFTER 1 HOUR --- Backfilled
BOTTOM OF HOLE Depth 3.1 ft / Elev 1794.9 ft
AFTER 24 HOURS --- Backfilled

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX
0	1798.0		Gravel (1 Inch)						
			(SP) **SAND** - with large gravel and petroleum odor - orangish brown and tan - moist (Possible FILL)	SS 1		7-15-12 (27)			

Refusal at 3.1 feet.
Bottom of borehole at 3.1 feet.

NOTES:

BORING NUMBER C-10

GEOServices, LLC, Geotechnical and Materials Engineers

PROJECT NAME Interchange Business Park Site
GEOServices PROJECT# 21-22452
DATE 3/28/22
PROJECT LOCATION 340 Interchange Drive, Crossville, TN 38571
DRILLING CONTRACTOR M&W Drilling
LOGGED BY KSR **ON-SITE REP.** ---
DRILLING METHOD Geoprobe 6620
LATITUDE / LONGITUDE ---
GROUND ELEVATION 1798.5 ft **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL Depth 2.6 ft / Elev 1795.9 ft
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING --- Dry
FOOTAGE CORED (LF) ---
AFTER 1 HOUR --- Backfilled
BOTTOM OF HOLE Depth 2.6 ft / Elev 1795.9 ft
AFTER 24 HOURS --- Backfilled

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX
0	1798.5		Gravel (1 Inch)						
			(SP) **SAND** - with gravel and petroleum odor - pink and tan - moist (Possible FILL)	SS 1		16-15-17 (32)			

Refusal at 2.6 feet.
Bottom of borehole at 2.6 feet.

NOTES:

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER C-11

PROJECT NAME Interchange Business Park Site
GEOServices PROJECT# 21-22452
DATE 3/28/22
PROJECT LOCATION 340 Interchange Drive, Crossville, TN 38571
DRILLING CONTRACTOR M&W Drilling
LOGGED BY KSR **ON-SITE REP.** ---
DRILLING METHOD Geoprobe 6620
LATITUDE / LONGITUDE ---
GROUND ELEVATION 1795 ft **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL Depth 12.0 ft / Elev 1783.0 ft
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING --- Dry
FOOTAGE CORED (LF) ---
AFTER 1 HOUR --- Backfilled
BOTTOM OF HOLE Depth 12.0 ft / Elev 1783.0 ft
AFTER 24 HOURS --- Backfilled

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX
0	1795.0		Gravel (2 Inches)						
			(SC) **Clayey SAND** - with large gravel - dark brown, tan and orangish brown - very moist (FILL)	SS 1		4-4-6 (10)			
			(SPG) **Gravelly SAND** - dark brown, orangish brown and tan - moist (FILL)	SS 2		30-6-10 (16)			
5	1790.0			SS 3		12-14-12 (26)			
			(CL) **Sandy Lean CLAY** - with organics, trace wood fragments, trace gravel and strong organic odor - dark brown and black - very moist (FILL)	SS 4		8-8-9 (17)			
10	1785.0								

Refusal at 12.0 feet.
Bottom of borehole at 12.0 feet.

NOTES:

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER C-12

PROJECT NAME Interchange Business Park Site
GEOServices PROJECT# 21-22452
DATE 3/28/22
PROJECT LOCATION 340 Interchange Drive, Crossville, TN 38571
DRILLING CONTRACTOR M&W Drilling
LOGGED BY KSR **ON-SITE REP.** ---
DRILLING METHOD Geoprobe 6620
LATITUDE / LONGITUDE ---
GROUND ELEVATION 1796.5 ft **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL Depth 8.5 ft / Elev 1788.0 ft
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING --- Dry
FOOTAGE CORED (LF) ---
AFTER 1 HOUR --- Backfilled
BOTTOM OF HOLE Depth 8.5 ft / Elev 1788.0 ft
AFTER 24 HOURS --- Backfilled

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX
0	1796.5		Gravel (2 Inches)						
			GRAVEL - with sand - dark brown and orangish brown - moist (FILL)	SS 1		15-46-40 (86)			
			(SP) **SAND** - with clay and gravel - dark brown, dark gray, orangish brown and tan - moist (FILL)	SS 2		17-17-20 (37)			
5	1791.5		(CL) **Sandy Lean CLAY** - with significant organics, trace wood fragments and strong organic odor - black - moist (FILL)	SS 3		10-5-4 (9)			
			Weathered ROCK - sandstone - orangish brown - moist - hard (RESIDUUM)	SS 4		50/0"			

Refusal at 8.5 feet.
Bottom of borehole at 8.5 feet.

NOTES:

BORING NUMBER C-13

GEOServices, LLC, Geotechnical and Materials Engineers

PROJECT NAME Interchange Business Park Site
GEOServices PROJECT# 21-22452
DATE 3/28/22
PROJECT LOCATION 340 Interchange Drive, Crossville, TN 38571
DRILLING CONTRACTOR M&W Drilling
LOGGED BY KSR **ON-SITE REP.** ---
DRILLING METHOD Geoprobe 6620
LATITUDE / LONGITUDE ---
GROUND ELEVATION 1797 ft **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL Depth 3.5 ft / Elev 1793.5 ft
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING --- Dry
FOOTAGE CORED (LF) ---
AFTER 1 HOUR --- Backfilled
BOTTOM OF HOLE Depth 3.5 ft / Elev 1793.5 ft
AFTER 24 HOURS --- Backfilled

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX
0	1797.0		Gravel (1 Inch)						
			(SP) **SAND** - with clay, trace gravel and trace organics - dark gray, dark brown, tan and orangish brown - moist (FILL)	SS 1		24-26-13 (39)			
			Weathered ROCK - sandstone - orangish brown - moist - hard (RESIDUUM)	SS 2		50/0"			

Refusal at 3.5 feet.
Bottom of borehole at 3.5 feet.

NOTES:

BORING NUMBER C-14

GEOServices, LLC, Geotechnical and Materials Engineers

PROJECT NAME Interchange Business Park Site
GEOServices PROJECT# 21-22452
DATE 3/28/22
PROJECT LOCATION 340 Interchange Drive, Crossville, TN 38571
DRILLING CONTRACTOR M&W Drilling
LOGGED BY KSR **ON-SITE REP.** ---
DRILLING METHOD Geoprobe 6620
LATITUDE / LONGITUDE ---
GROUND ELEVATION 1797.5 ft **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL Depth 7.6 ft / Elev 1789.9 ft
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
▽ **AT END OF DRILLING** 7.00 ft / Elev 1790.50 ft
FOOTAGE CORED (LF) ---
AFTER 1 HOUR --- Backfilled
BOTTOM OF HOLE Depth 7.6 ft / Elev 1789.9 ft
AFTER 24 HOURS --- Backfilled

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX
0	1797.5		Gravel (2 Inches)						
			(SP) **SAND** - with trace large gravel and petroleum odor - pink, orangish brown and tan - moist to very moist (FILL)	SS 1		10-50/3"			
5	1792.5			SS 2		14-24-8 (32)			
			GRAVEL - with trace sand and strong petroleum odor - orangish brown - wet (FILL) ▽	SS 3		2-1-12 (13)			

Refusal at 7.6 feet.
Bottom of borehole at 7.6 feet.

NOTES:

GEOServices, LLC, Geotechnical and Materials Engineers

BORING NUMBER C-15

PROJECT NAME Interchange Business Park Site
GEOServices PROJECT# 21-22452
DATE 3/28/22
PROJECT LOCATION 340 Interchange Drive, Crossville, TN 38571
DRILLING CONTRACTOR M&W Drilling
LOGGED BY KSR **ON-SITE REP.** ---
DRILLING METHOD Geoprobe 6620
LATITUDE / LONGITUDE ---
GROUND ELEVATION 1797.5 ft **PROPOSED FFE** ---
NORTHING / EASTING ---
REFUSAL Depth 3.0 ft / Elev 1794.5 ft
TOP OF ROCK ---
GROUND WATER LEVELS:
BEGAN CORING ---
AT END OF DRILLING --- Dry
FOOTAGE CORED (LF) ---
AFTER 1 HOUR --- Backfilled
BOTTOM OF HOLE Depth 3.0 ft / Elev 1794.5 ft
AFTER 24 HOURS --- Backfilled

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX
0	1797.5		Gravel (2 Inches)						
			(SP) **SAND** - with gravel and petroleum odor - pink, dark brown, orangish brown and tan - moist (FILL)	SS 1		16-19-20 (39)			

Refusal at 3.0 feet.
Bottom of borehole at 3.0 feet.

NOTES: