ADDENDUM #2
ITB/RFP NUMBER: 2017005-PW-B
Harrisonburg Solid Waste Transfer Station ITB

DATE: September 13, 2016

TO: All Potential Bidders/Offerors

City of Harrisonburg's Solid Waste Transfer Station ITB, is modified as follows:

On September 8, 2016 at 10:00am local time the City held a mandatory pre-bid meeting for the above-listed ITB. Below are notes, meeting minutes and questions and answers received prior to and during the pre-bid meeting. Also attached and made part of this addendum is the sign-in sheet from the pre-bid meeting as well as a revised building layout.

Note: The R-19 and R-30 insulation requirement has been removed from the building narrative. A revised building narrative is attached and made part of this addendum.

1. Question: Will testing be needed on this project? If so, will it come through the City?

   Answer: Correct. All required testing will be coordinated by the City and will not be the responsibility of the Contractor.

2. Question: Will the testing be handled through the annual contract?

   Answer: The City will procure these services outside of this ITB.

3. Question: Question: What is the anticipated review time for drawings submitted to Community Development? Will this project be put on a fast track?

   Answer: Currently there is a 5 week backlog in project review; however, the Building Official stated that this is due to some rather large plans being reviewed. Actual review times vary based on scale of project and its location in the review queue.

4. Question: Does the City want electric operators for the 24' doors?

   Answer: All roll up doors shall include electric operators.

5. Question: Will the City require seals, pits, edge levelers or bumpers for the loading dock areas?

   Answer: The loading dock areas shall have a solid compression block that is continuous along the bottom of the dock door.

6. Question: Can the canopy be a "lean to" structure?

   Answer: The canopy structure located over the side loading dock doors shall be a cantilevered canopy that slopes away from the main structure. The drive aisle in this area must remain clear of any supports.

7. Question: What does the City require for the finish of the interior of the tipping area? Galvanized, painted, primed steel, liner panels, etc.

Answer: The steel beams within the building shall be finished with a standard primer. A Metal Wall Liner Panel (MWLP) shall be installed above the four foot (4') concrete wall section of the interior and shall be four feet (4') in height. The MWLP shall not be installed on top of the eight foot (8') concrete wall section.

8. Question: It was mentioned that any 3rd party inspections (i.e. welding inspections) that would be needed for the building would be provided for by the city. Is that the case any site work inspections as well (i.e. compaction testing)?

Answer: Special inspections (for example welding, site compaction, concrete testing, etc) will be handled by the City.

9. Question: Are there any PEMB drawings the Final Plans listed are only Civil Drawings? There are no elevations locating the doors etc, windows, insulation etc. Please advise.

Answer: The building narrative lists the number and size of doors and the building layout sketch indicates the general location of all doors. The provided support building sketch shows location of windows. The building narrative also lists the insulation for the buildings. The specific location of windows and doors is an item that will be discussed during the final building design with the successful contractor.

All other requirements, terms and conditions of the ITB/RFP remain unchanged.

Addendum page must be signed and returned with your bid/proposal to acknowledge receipt of this addendum.

_____

Authorized Signature

By: Pat Hilliard, CPPB
Procurement Manager

City of Harrisonburg
Public Works Department

Solid Waste Transfer Station Project
Pre-Bid Meeting

Date: September 8, 2016
Time: 10:00 AM
Location: Public Works Office

Introduction of City Staff by Tom Hartman

Sign-in Sheets attached.

Important Dates:

- Last Day for questions is Sept.21, 2016 by 12:00 PM EST to Pat Hillard.
- Bids are due September 28, 2016 at 2:00 PM EST to 409 South Main Street, Third Floor Purchasing Office. DO NOT bring sealed bids to the Public Works Office.

Important Project Manual Items:

- List of items required for a responsive bid are on page 4 of the Project Manual under Instructions to Bidders #3E. Please make sure your bid has all those items.
- Seed Specification – please note the special seed mix required for use by the City. It is on page 32 in the Project Manual.

Building:

- A narrative is included with the Project Manual on page 38 and provides an outline of items that need to be included in the design of the building. The contractor is responsible for the design. Details will be worked out via submittals.
- No mechanical equipment will be installed in this facility.
- Permits will be obtained by the contractor. The City will pay for all fees associated with obtaining the permits.
- The City will do the SWPPP, but the contractor will be responsible for maintaining it and having the appropriate responsible person on site in charge of the SWPPP.
- The site plan has been through one review already and should be approved by bid time.
- Contractor is responsible for all building related drawings to be submitted for this project to Community Development for approval.
- Special inspections (for example welding, site compaction, concrete testing, etc) will be handled by the City.
- Sprinkler system in the office part and a fire suppression system for the transfer part as called out in the project manual.
- A geotechnical study was performed and is included in the Project Manual.
    - It is based on the basic needs of the facility and can be modified based on the contractor's design.
    - Contactor will be the Engineer of Record for this project.

Layout:

- See updated sketch for changes to quantity of doors needed for the facility. Some doors have been deleted.
- The limits of the 8' push wall have been extended. See attached sketch.
- There is only one canopy area and that is where the loading dock is.

- Exterior appearance of facility should be similar in style and color as the building adjacent to the property, which is the Central Stores Warehouse building.
- Concrete pads are denoted on the site plans.

Site:

- Buildings have been removed and the concrete has been broken up.
- Scales for the new facility are to be included.
- Rainwater Harvesting System will need further design by the contractor.
- Contractor will need to relocate the electric gate. City will provide coordination with re-connecting the gate.
- Office space for new facility does not need to be fancy, just functional. Exterior should be similar to the front of the adjacent building to the property, which is Central Stores Warehouse. The Central Stores building has a brick front and a blue "overhang" piece.
- All excavation shall be UNCLASSIFIED.

Site Visit:

- Tom Hartman gave a rough orientation of where the building would be built.
- The pit and push wall still standing on the site will need to be removed and concrete broken up, by the contractor.
- The blue bin will need to be moved by the contractor with City coordination as to new placement.
- The site will be cleared of all sweeper dumpings and roll-offs.
- The rubble onsite can be reused by the contractor and rubble that cannot be reused shall be transported by the contractor to the Ramblewood site.
- All excess material (dirt, concrete, stone) may be taken to the Ramblewood site.
- Rebar and other recyclable materials should be taken to a recycling facility.
- There is a buried wall next to Beery Road. It shall remain in place and will be covered over.
- There is a pile of clay on site available for use by the contractor.
- There are fences that will need to be constructed. See Project Manual and Site Plans for details.
- There is a man gate located on the plans with steps that gives access from the Central Stores Warehouse to the site.
- If anyone needs to come onto the site prior to bidding please check in with the Public Works Office on Mosby Road first.

PRE-BID MEETING ATTENDANCE
HARRISONBURG SOLID WASTE TRANSFER STATION
Thursday September 8, 2016

NAME (Please Print)	COMPANY	PHONE/FAX	EMAIL
MICHAEL ARETZ	KANAWHA STONE CO.	(304) 514-1419	MICHAEL.ARETZ@KANAWHASTONE.COM
Edward Myers	CONSTRUCTURE INC	571-533-1112	Emyers@c-cc.com.
JIM ELLINGER	HARMAN CONST. INC.	540-434-4459	JELLINGER@HARMANCONSTRUCTION.COM
DANIEL MICHAEL	VALLEY ENGINEERING	540 434 6365	dmichael@valleyesp.com
JOHN LONG	LANTZ CONST. CO.	540-896-8911	jlong@lantzcc.com
CHRIS DRIVER	LANTZ CONST. CO.	540-896-8911	cdriver@lantzcc.com
Earl Mottley	WW ASSOCIATES	(434) 960-7539	EMOTTLEY@WWASSOCIATES.NET

PRE-BID MEETING ATTENDANCE
HARRISONBURG SOLID WASTE TRANSFER STATION
Thursday September 8, 2016

NAME (Please Print)	COMPANY	PHONE/FAX	EMAIL
CHRIS PUFFENBARGER	MATHERS CONSTRUCTION	540-932-2300 540-241-9391	cpuff@mathers-team.com
Brian Hess	A-Able Plumbing	540-421-4774	Brian@ableplumbinginc.com
CAROL KIRCHMEIER	ET ENVIRONMENTAL CORPORATION	281-797-7108	ckirchmeier@eteno.com
STEVE LOSIE	ET ENVIRONMENTAL CORPORATION	407-508-9053	slosie@eteno.com
Steve Freed	Partners Excavating	540-433-1475	Steve@Partners-Excavating.com
Eric Good	Goods Services	(540) 879-3149	goodsservices@verizon.net
Jonathan Buckholder	Goods Services	540-879-3149	Dictestimating@gmail.com

BUILDING NARRATIVE – prepared by Valley Engineering:

Overview:

This project will consist of a solid waste transfer facility totaling approximately 19300 square feet. The buildings will consist of a Pre-engineered Metal Building (PEMB) approximately 175 feet in length by 100 feet in width with an eave height of 35 feet (175ft X 100ft X 35ft), and a two-story support building with a first floor office and second floor mezzanine area measuring approximately 30 feet in width by 30 feet in length with an eave height of 30ft (30ft X 30ft X 30ft). There will be a drive/under thru cantilevered canopy attached to the PEMB approximately 58 feet in length by 25 feet in width with an eave height of 27 feet (58ft X 25ft X 27ft). (Preliminary PEMB and Support Building floor plans are attached)

<u>Structural Narrative</u>

General:

The facility shall be classified as an Occupancy Category II, and designed for loading prescribed by the IBC and ASCE-7. All structural system sizes, quantities, types, etc. indicated in the following sections are for estimating and bidding purposes only. The design of all structural systems shall be delegated to the Contractor's engineer who shall be licensed to practice in the Commonwealth of Virginia. Final building details, doors, equipment locations, push walls, bollards, canopies, and similar requirements shall be coordinated with the Owner and incorporated into the final design.

The Structural systems design will incorporate the requirements of the following building codes and guidelines:

- 2012 Virginia Uniform Statewide Building Code
  Including the all adopted codes and standards, some of which are shown below.
- 2012 ICC International Building Code
- ASCE/SEI 7-10
- AISC Steel Construction Manual, 14th Edition

A subsurface geotechnical investigation was completed and a report issued by Froehling & Roberson, INC. dated July 22, 2016 (See attached report). The recommendations provided in this report shall be used to design the foundation systems for the buildings.

Pre-Engineered Metal Building: (See preliminary floor plan)

The PEMB shall utilize clear span frames with no interior columns. The foundations shall bear 3 feet minimum below finish grade, and shall consist of 8 feet square by 16-inch-thick reinforced concrete spread footings at frame columns, and a continuous 3-foot-wide wall footing to support foundation walls. Foundation walls shall be 12-inch-thick reinforced concrete walls.

The floor slab shall be a 10-inch-thick reinforced concrete slab, and the tipping floor shall include #4 wearing bars at 16 inches on center 2 inches below the top of the slab. 8-foot-high reinforced concrete push walls will be required where indicated.

~~The PEMB exterior wall construction will have a R-19 value and the roof construction will have a R-30 value~~

Canopy: (See preliminary floor plan)

There will be a cantilevered drive/under thru canopy attached to the PEMB approximately 58 feet in length by 25 feet in width with an eave height of 27 feet (58ft X 25ft X 27ft) along the side of the building with the entry door(s) and adjacent dock door measuring 14 feet X 14 feet. (See attached plans)

Roll-up Doors:

This facility will require five (5) industrial grade roll-up doors. (See preliminary floor plan for locations)

(1) 14FT X 14FT Roll-up Doors
(2) 10 FT X 10 FT Roll-up Doors
(2) 24 FT X 24 FT Roll-up Doors

Support Building: (See preliminary floor plans)

The support building will be structurally separate from PEMB, and shall be constructed with 8-inch concrete masonry unit (CMU) load bearing walls, reinforced with #5 bars at 32 inches on center. The wall will be supported on 4-foot-wide 12 in thick continuous reinforced concrete footings. The building's first floor will be slab-on-grade consisting of 4-inch thick cast-in-place concrete. The slab will be placed on a 15-mil vapor barrier over 6" of compactable crushed aggregate. The slab will be reinforced with #4 bars at 16 inches on center each way in the middle of the slab. Control joints will be cut by an early entry dry-cutting system equal to "Soff-Cut" such that:

1. Each area bounded by control joints does not exceed 324 sf.
2. The distance between control joints does not exceed 18 feet in either direction.
3. The ratio of length to width of any area bounded by control joints does not exceed 2 to 1.

The building's second floor will consist of 4 inches of concrete on 0.6C (9/16 inch) 22-gauge steel floor deck, supported by 20K5 steel joists at 3 feet (maximum) on center.

The roof structure for the support building will consist of 1.5 inch 20-gauge steel deck on a 20K6 steel joists at 6 feet on center.

The lateral force resisting system for the support building will consist of reinforced masonry bearing walls.

Miscellaneous structural bracing and deck edge angle will be required.

Structural Specification Items:
Concrete:
Install concrete work in conformance with the requirements of the American Concrete Institute Standard ACI-318 (current edition). Provide concrete conforming to the following:

Minimum 28-day compressive strength:

Footings:	3,000 psi
Walls:	4,000 psi

Slabs on grade:	4,000 psi
Walks:	4,000 psi
Air entrainment:	4 to 6 % (Exterior Concrete only)
Bar Reinforcing Steel:	Grade 60
Welded Wire Reinforcing:	ASTM A185

Structural Steel:
Provide structural steel conforming to the requirements of the American Institute of Steel Construction (AISC) specification (current edition) and conforming to the following:

W-Shapes:	ASTM A992, Grade-50
Channels and Angles:	ASTM A36 or ASTM A572, Grade-50
Plates and Bars:	ASTM A36 or A572, grade-50
Steel Tubing (HSS):	ASTM A500, Grade B
Steel Pipe:	ASTM A53, E or S, Grade B
Round HSS:	ASTM A500, Grade B
Structural Bolts:	ASTM A325
Anchor Rods:	ASTM F1554, Grade 36/55, Weld-ability Supplement S1
Anchor Bolts:	ASTM F1554, Grade 36 L-bolts
Shear Studs:	ASTM A108 & AWS D1.1 - 7.3.1 Type-B

Provide shop priming only for steel surfaces scheduled to receive High Performance Coatings or for structure located outside of the conditioned building envelope. Provide surface preparation SSPC-SP3 Power Tool Cleaning unless indicated otherwise for high performance coatings.

Steel Joists:
Manufacture steel joists according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.

Steel Deck:
Provide steel deck design, fabrication, and erection in conformance with the specifications of the Steel Deck institute (SDI) and the American Iron and Steel Institute (AISI).

Design Loads:

Live Loads:	
Roof	30 psf
First Floor	100 psf
Elevated Floors	100 psf
Elevated Corridors	80 psf
Partition Allowance	15 psf (unreduced)
Snow Loads:	
Ground Snow Load	42.5 psf
Wind Loads:	
Design Wind Speed (Ultimate)	115 MPH

Special Inspections:

Special Inspections will be required per Chapter 17 of the International Building Code. Special inspectors shall be employed by the Owner. The Contractor shall coordinate the inspections during construction.

MECHANICAL NARRATIVE - prepared by Valley Engineering**:**

Overview:

The project will consist of a solid waste transfer facility approximately 19300 square feet.

The project will consist of a single-story solid waste transfer building, which will have approximately 17,500 square feet (GSF) and an attached two-story support building which will have approximately 900 square feet (GSF) office on the first floor and an equipment mezzanine on the second floor.

Mechanical systems for the Solid Waste Transfer Facility are described in the following section of this schematic narrative.

The MEP systems design will incorporate the requirements of the following building codes and guidelines:

- 2012 Virginia Uniform Statewide Building Code
  Including the all adopted codes and standards, some of which are shown below.
- 2012 ICC International Building Code
- 2012 ICC International Mechanical Code
- 2012 ICC International Plumbing Code
- 2012 ICC International Energy Conservation Code
- 2012 ICC International Fire Code
- 2011 National Electrical Code NFPA 70
- 2010 National Fire Alarm Code NFPA 72
- 2009 Life Safety Code Handbook NFPA 101
- ASHRAE Standard 62.1-2010: Ventilation for Acceptable Indoor Air Quality
- NFPA 90A Standard for the Installation of Air conditioning and Ventilating Systems, 2015 Edition
- SMACNA HVAC Duct Construction Standards: Metal and Flexible 2005, 3rd Edition.
- ASHRAE Standard 90.1-2010: Energy Standard for Buildings Except Low-Rise Residential Buildings
- Applicable State and Local Ordinances

Heating Ventilating and Air Conditioning Systems:
The HVAC design shall provide a slight positive pressurization of the building to prevent infiltration of unconditioned outdoor air.

~~The wall construction will have a R-19 value and the roof construction will have a R-30 value~~

The heating, ventilating and air conditioning systems shall be designed to produce the desired space temperature, humidity, pressurization, and air quality conditions while employing the following design criteria.

Weather Conditions:
Site Location: Harrisonburg, Virginia

1325 ft. Elev.

Climatic Location: Roanoke, Virginia

Summer Dry Bulb Temperature[1]: 91° F
Wet Bulb Temperature[1]: 74° F

[1] Source: ASHRAE 2013 Fundamentals 99.0% Design Condition

Winter Dry Bulb Temperature[2]: 16° F

[2] Source: ASHRAE 2013 Fundamentals 1.0% Design Condition

Wind Speed 17.9 mph wind[3]

[3] Source: ASHRAE 2013 Fundamentals 1.0% Design Condition

Building Operating Schedule
The facility is expected to operate twelve (12) hours per day, five days a week.

Internal Heat Gains
Lighting loads will be based on the design standards defined hereinafter and the minimum requirements of ASHRAE/IESNA 90.1 2010.

a. Office Lighting – 1.5 Watts per square foot minimum or as required by lighting design.
b. General Lighting – 2.0 Watts per square foot minimum or as required by lighting design.
b. General Equipment – 0.5 Watts per square foot or as determined by specific equipment in each room

The proposed material handling area is not conditioned. Ventilation will be provided with sidewall propeller exhaust fans and intake louvers on opposite walls.

The proposed office area HVAC to be supplied a 2.5-ton heat pump system with auxiliary electric heat coil. Exterior condenser unit and indoor A-Coil with blower. Supply duct shall be galvanized steel; 2-inch pressure class. Ductwork trunk shall be sized to accommodate future capacity for the second floor and a blanked off future connection point shall be provided.

Low pressure ductwork shall convey air to ceiling diffusers.

Ceiling diffusers shall be aluminum construction. Supply registers shall be aluminum construction, double deflection type. Return and exhaust grilles shall be aluminum construction with a perforated face.

Return ductwork shall be low pressure galvanized steel. A return plenum shall be utilized; however, ducted transfers will be required at each room to allow airflow into central corridor plenums.

Exhaust ductwork shall be low pressure galvanized steel.

All supply ductwork shall be externally wrapped with 2.2" thick fiberglass blanket insulation with aluminum skin vapor barrier facing and 0.27 K factor. Exhaust ductwork shall be un-insulated except for 5' of duct from the roof deck and the 5' section of insulated duct shall match the return duct insulation specifications.

Toilets and janitors' closets shall be exhausted to the outdoors through a ducted central exhaust system. Electrical rooms shall be provided with conditioned air to offset heat gains from electrical equipment.

Condensate Piping:
Condensate piping at Rooftop Units shall be Type L hard copper. Fittings shall be copper solder joint fittings, 150 pound ANSI B16.22-73. Joints shall be solder, ASTM B32-78 tin-antimony 95-5.

ELECTRICAL NARRATIVE - prepared by Valley Engineering**:**

Overview:

The project will consist of a single-story solid waste transfer building, which will have approximately 17,500 square feet (GSF) and an attached two-story office building which will have approximately 900 square feet (GSF) per floor.

Electrical systems for the Solid Waste Transfer Facility are described in the following section of this schematic narrative. The narrative accounts for the base electrical systems of the Shell and Core of the building.

The design of the electrical systems for this building shall comply with the building codes and guidelines listed below:

- 2012 ICC International Building Code
- 2012 ICC International Energy Conservation Code
- 2012 ICC International Fire Code
- 2012 Virginia Uniform Statewide Building Code
- 2011 National Electrical Code NFPA 70
- 2007 National Fire Alarm Code NFPA 72
- 2009 Life Safety Code Handbook NFPA 101

Main Service:
A new 600A, 480/277V, 3-phase, 4-wire service will be installed on the mezzanine located above the office inside the space. The new service will be fed underground from the power company transformer to the power company service equipment located on the exterior of the building. A single building meter will be provided on the exterior of the building located next to the power company service equipment.

Normal Power Distribution:
A new 600A, 480/277V, 3-phase, 4-wire, service entrance rated, main circuit breaker "MDP" panel will be located on the mezzanine. This panel shall have a short-circuit rating of 65 KAIC. This panel will provide power to a 45 kVA 480 to 208/120V, 3-phase, 4 wire step down transformer and also serve as the power panel for all 480/277V circuit requirements. The mezzanine 208/120V power panel "M-1" (150 amperes, 3-phase, 4-wire) shall be fed by the 45Kva transformer. The first floor office power panel "P-1", will be fed by the mezzanine power panel "M-1."

Typical receptacle and tele/data outlet placement:

Typical office
- Minimum of four duplex receptacles; one on each wall (coordinate exact locations and quantity with owner)
- Two telephone/data outlets; on two different walls

Corridor
- Minimum of one duplex receptacle

Restroom(s)
- One duplex GFCI receptacle adjacent to each vanity/sink above counter height

Tipping Floor/Bale Staging Area
- Duplex GFCI receptacles are to be located above the 4 Foot concrete wall so a 50' cord can reach from anywhere along that 4 Foot wall perimeter
- No receptacles are to be located around the "Push Wall" perimeter (See Floor Plan)

Exterior at building entrances
- At least one duplex GFCI receptacle located at each entrance

Lighting Fixtures:
Occupancy sensors shall be used in rooms for lighting controls. Occupancy sensors shall not be used in janitor's closets, equipment rooms, or any other area critical to employee safety.

Lighting Fixtures Selections:

2'x4' Recessed Direct
- Office/Meeting Room/Corridor/Kitchenette/Restroom
  - Recessed LED
  - Direct/Indirect

4' Industrial Strip
- Electrical/Mechanical Mezzanine
  - Pendant/Surface Fluorescent
  - Wire Guard

Exit
- Emergency Egress Paths

Surface Mounted
Single or Double Faced
High Impact Thermoplastic
RED LED
Battery Backup

4' Wall Direct/Indirect
Stairwells
Surface LED
33% Perforated
Battery Backup for Stairwells

Wall Packs
Building Exterior
Surface LED
Neutral White Color Temperature (4000K)

Design Criteria:

Types of Conduit Systems:
Definitions

EMT: Electrical metallic tubing.
FMC: Flexible metal conduit.
IMC: Intermediate metal conduit.
LFMC: Liquid tight flexible metal conduit.
RNC: Rigid nonmetallic conduit.

Conduit Systems:

1. Indoors
   a. Exposed: EMT.
   b. Exposed and Subject to Sever Damage: Rigid Steel.
   c. Concealed: EMT.
   d. Connection to Vibrating Equipment: FMC, except LFMC in damp or wet locations.
   e. Damp or Wet Locations: IMC.
2. Outdoors
   a. Exposed: Rigid Steel.
   b. Concealed Aboveground: IMC.
   c. Underground: RNC Schedule 40-PVC.
   d. Connection to Vibrating Equipment: LFMC

Conductor Systems:

1. Conductors and Cables
   a. Conductors: Copper.
   b. Conductor Insulation: Types THHN-THWN.
2. Conductor and Insulation Application
   a. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
   b. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.
   c. Feeders Concealed in Concrete, below Slabs-On-Grade, and underground: Type THHN-THWN, single conductors in raceway.

d. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.
e. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
f. Branch Circuits Concealed in Concrete, below Slabs-On-Grade, and underground: Type THHN-THWN, single conductors in raceway.
g. Class 1 & 2 Control Circuits: Type THHN-THWN, in raceway.

Standards of Design:

1. Voltage Drop: Conductors for branch circuits are sized to prevent a voltage drop exceeding 3 percent at the farthest outlet of power, heating, and lighting loads, or combination of such loads, and where the maximum total voltage drop on both feeders and branch circuits to the farthest outlet does not exceed 5 percent.
2. Receptacles shall be 20A specification grade.
3. All wiring devices connected to an emergency circuit shall be factory finished red in color and all wiring devices connected to a normal circuit shall be factory finished ivory in color.
4. Device cover plates shall be brushed stainless steel and engraved with the panel name and circuit number.
5. Minimum conduit size shall be 3/4”.
6. Minimum wire size shall be #12AWG.
7. All branch circuits shall be provided with dedicated neutrals.
8. All new power distribution equipment shall match the base building distribution equipment manufacturer.

Grounding:

1. An equipment grounding conductor sized in accordance with the NEC shall be installed with all feeders and branch circuits.
2. A grounding electrode conductor shall be provided at all separately derived systems and as required by the linear accelerator equipment manufacturer.
3. A 3/4"x10’ copper-clad ground rod shall be installed at each new column for the building addition. Connect ground rods to building steel. The new addition shall be connected to the existing building main grounding system.

Fire Alarm System:

Fire Alarm system not required pursuant to the 2012 Virginia Construction Code, Section(s) 907.2.2 and 907.2.4

Cable Television System, Security System, Telecommunication/Data Systems:

Except as noted below, these systems will be furnished and installed by the Owner or the Owner’s vendors. The electrical contractor’s scope of work for these systems includes: telephone, data network, security, cable TV, and satellite TV. The electrical contractor will install back-boxes and 3/4" conduit stub-ups to the nearest accessible corridor ceiling space for these systems along with cable supports above corridor ceilings and sleeves through walls to deck. The Contractor will also provide back-boxes and conduits for architecturally specified low voltage systems such as access control (keypads and magnetic locks) and power operated doors (push plates).

Wiring Methods:

Types of Conduit Systems:

Definitions

EMT: Electrical metallic tubing.
FMC: Flexible metal conduit.
IMC: Intermediate metal conduit.
LFMC: Liquid-tight flexible metal conduit.
RNC: Rigid nonmetallic conduit.

Outdoors

Exposed: Rigid Steel.
Concealed Aboveground: IMC.
Underground: RNC EPC-40-PVC.
Connection to Vibrating Equipment: LFMC

Indoors

Exposed: EMT.
Exposed and Subject to Sever Damage: Rigid Steel.
Concealed: EMT.
Connection to Vibrating Equipment: FMC, except LFMC in damp or wet locations.
Damp or Wet Locations: IMC.

Types of Conductor Systems:

Conductors and Cables

Conductors: Copper.
Conductor Insulation: Types THHN-THWN.
Multi-conductor Cable: Metal-clad cable, Type MC with ground wire.

Conductor and Insulation Application

Service Entrance: Type THHN-THWN, single conductors in raceway.
Exposed Feeders: Type THHN-THWN, single conductors in raceway.
Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN-THWN, single conductors in raceway.
Feeders Concealed in Concrete, below Slabs-On-Grade, and underground: Type THHN-THWN, single conductors in raceway.
Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.
Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
Branch Circuits Concealed in Concrete, below Slabs-On-Grade, and underground: Type THHN-THWN, single conductors in raceway.
Class 1 & 2 Control Circuits: Type THHN-THWN, in raceway.

Generator:

At this point in time a generator will not be required.

Lightning protection system:

A lightning protection system (optional) shall be provided for the building. The system, if provided, shall comply with both UL and NFPA.

PLUMBING NARRATIVE - prepared by Valley Engineering**:**

Overview:
The project will consist of a single-story solid waste transfer building, which will have approximately 17,500 square feet (GSF) and an attached two-story support building which will have approximately a 900 square feet (GSF) office on the first floor and mezzanine on the second floor.

Plumbing systems for the Solid Waste Transfer Facility are described in the following section of this schematic narrative.

The design of plumbing systems for this building shall comply with the building codes and guidelines listed below:

- 2012 ICC International Building Code
- 2012 ICC International Mechanical Code
- 2012 ICC International Plumbing Code
- 2012 ICC International Fire Code
- 2012 Virginia Uniform Statewide Building Code

Plumbing Systems:
The following site utilities shall be provided to the new addition:

1. 6" Sanitary (PEMB)
2. 4" Sanitary (Support Bldg.)
3. 2" Domestic Cold Water
4. 6" Sprinkler System Main

Sanitary:

1. PVC DWV above and below grade.
2. PEMB: Connect trench drains (4" each) to 6" sanitary to oil interceptor noted on civil plans.
3. PEMB Provide 6" main with 4" branch connections to floor sinks with removable sediment baskets evenly spaced throughout the tipping floor (50 max between drains). Drain 6" sanitary to oil interceptor noted on civil plans.

Storm Drainage:

1. The PEMB will be served by gutter and downspout continuous along the exterior. Gutters shall have multiple short sections of downspout, turning down and into the building just below the eave, for connection to gravity storm mains along both sides of the building. Provide downspout boots/transition fittings as required for complete operable system. Provide watertight seal where downspout/piping transitions into the building. Gravity lines (anticipated height 30' or higher) will drain toward the support building, tie together and turn down into the top of the 12,000 gallon storage tank shown on Civil plans. Provide two first flush filters, one in each corner for the wall adjoining the PEMB and support building. Pipe overflow discharge from first flush filters to the exterior, 24" above grade. See Civil plans for coordination and additional information on rainwater harvesting system.
2. Support Bldg.: Individually piped primary and secondary drainage systems (4" Max) are required. Include roof drains, overflow drains, overflow scuppers, and piping. Primary drain shall be piped in the second floor ceiling to the exterior and turn down into the top of the 12,000 gallon storage tank shown on Civil plans. See Civil plans for coordination and additional information on rainwater harvesting system.

4. Support Bldg.: Secondary storm (overflow) drainage piping will be provided independent multiple leaders running through the building addition and discharging to grade. (Discharge approximately 24" AFG.)
5. PVC DWV above and below grade.

Domestic Cold Water:

1. Copper Pipe, Type L hard throughout. Fittings shall be copper solder joint fittings, 150 pound ANSI B16.22-73. Joints shall be lead free solder, ASTM B32-78 tin-antimony 95-5.
2. Backflow prevention – dual 2" Reduced Pressure Zone backflow preventers shall be provided at service entrance.
3. Ball valves, lead free bronze with stainless trim, extended handles where required for insulation thickness.
    a. Full port throughout.
4. Insulation – ½" heavy density fiberglass pipe insulation with SSL vapor barrier jacket throughout.
5. Recessed nickel bronze wall hydrants every 100' along the building exterior.
6. All piping, valves, backflow preventers, and accessories shall comply with the 2011 Reduction of Lead in Drinking Water Act

Domestic Hot Water:

1. Copper Pipe, Type L throughout with cast copper fittings. Solder joints.
2. Ball valves, lead free bronze with stainless trim, extended handles where required for insulation thickness.
    a. Full port throughout.
3. Insulation – 1" heavy density fiberglass pipe insulation with SSL vapor barrier jacket throughout.
4. 60-gallon electric water heater.
    a. One (1) ASSE 1070 compliant master mixing valve.
5. All piping, valves, backflow preventers, and accessories shall comply with the 2011 Reduction of Lead in Drinking Water Act

Wall Hydrants and Hose Bibbs:

1. Support Bldg.: One (1) ¾" key operated wall hydrant located on the face of the building every 100 feet.
2. Isolation ball valve for each wall hydrant.
3. PEMB: Post/Yard hydrants mounted approximately 3' above floor, every 75 feet along building interior, with crushed stone drainage basin.
    a. Provide 1" DCW main below frost depth around PEMB perimeter, with above grade shutoff valve, servicing yard hydrants. This system shall be fed from the rainwater harvesting system.
    b. Provide ASSE 1013 rated backflow preventer for any supplemental makeup water required for the rainwater harvesting system. See Civil plans for coordination and additional information on rainwater harvesting system.
    c. Provide bollards at each hydrant location for protection from equipment and other damage.
    d. Drainage basin shall be below slab. Finished slab shall be sealed continuous for waterproof operation. Provide underslab drainage as required.

Plumbing Fixtures

1. Plumbing fixtures will be provided where indicated on the architectural drawings. Fixture trim will be consistent with the intended use.
    a. Vitreous China, Flush Valve Water Closets.
    b. Vitreous China Wall Mount lavatories, commercial solid brass faucets (Single Toilets).
    c. Stainless Steel Sinks (double and single bowl), commercial solid brass faucets, (Break Rooms, Work Areas).
    d. Concrete/marble janitors closet sinks with stainless steel trim, commercial solid brass faucet with bucket hook, mop hangers, hose, hose hanger.
2. Public lavatories and sinks require tempered water and shall be provided with a below deck mixing valve.

FIRE PROTECTION NARRATIVE - prepared by Valley Engineering**:**

Overview:

The project will consist of a single-story solid waste transfer building, which will have approximately 17,500 square feet (GSF) and an attached two-story office building which will have approximately 900 square feet (GSF) per floor.

Fire protection systems for the Solid Waste Transfer Facility are described in the following section of this schematic narrative.

The design of fire protection systems for this building shall comply with the building codes and guidelines listed below:

- 2012 Virginia Uniform Statewide Building Code
- 2012 Life Safety Code Handbook NFPA 101
- 2010 Standard for the Installation of Sprinkler Systems NFPA 13
- 2011 National Electrical Code NFPA 70
- 2007 National Fire Alarm Code NFPA 72
- 2002 Standard for the Installation of Air-Conditioning and Ventilating Systems NFPA 90A

Building Hazard Classification:
Group B/F-1 Business/Factory (Moderate Hazard) Occupancy Group

Sprinkler System Criteria:

1. A 6” fire protection main shall be provided for the facility.
2. Sprinkler piping and sprinkler heads shall be provided according to the following criteria:
    a. Protection area shall not exceed 225 sf per head per Chapter 5 of NFPA 13.
    b. PEMB: Protection area shall not exceed 120 sf per head per Chapter 5 of NFPA 13.

Standpipe Criteria:
Not required.

Sprinkler Design Densities:

1. Light hazard - 0.10 gallons per minute (GPM) per SF over the hydraulically most remote 1,500 SF.
    a. For areas such as exam rooms, office areas, public areas, corridors, lobbies, and public elevator lobbies
2. Ordinary hazard Group II - 0.20 GPM per SF over the hydraulically most remote 3,000 SF.
    a. For areas such as storage rooms, mechanical rooms, electrical switchgear, and transfer rooms.
    b. For the PEMB in its entirety.

HVAC Systems:

1. Smoke detectors in HVAC systems shall be installed and controlled as required in Chapter 4 of NFPA 90A.

Incoming Fire Service:

1. A 6" sprinkler main shall be provided for the facility.
2. Vertical RPDA backflow preventer at service entrance.
3. Remote post mounted Fire Department Connection for alternate supply to PEMB and support building.

Standpipe:

Standpipe risers are not required for this project.

Sprinkler:

1. Support Bldg.: Fully sprinkled wet sprinkler system.
2. Designed and installed according to NFPA 13.
3. Sprinkler Heads
    a. Fully recessed sprinklers shall be provided in all hard ceiling areas.
    b. Semi-recessed sprinklers will be provided in all suspended acoustical tile areas.
    c. Upright brass pendants will be provided in mechanical areas, and areas without ceilings.
4. PEMB: Dry pipe system according to NFPA 13:
    a. Provide 3 HP air compressor for pressure maintenance and system recharging.
    b. Upright brass pendants will be provided in warehouse areas, and areas without ceilings.
5. Materials:
    a. Wet pipe: Standard-Weight, Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. 2" threaded ends for piping 2" NPS or less.
    b. Wet pipe: Standard-Weight, Black -Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Cut or rolled grooved ends for piping 2-1/2" NPS or larger.
    c. Dry pipe: Standard-Weight, Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. 2" threaded ends for piping 2" NPS or less.
    d. Dry pipe: Standard-Weight, Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Cut or rolled grooved ends for piping 2-1/2" NPS or larger.

FIRE ALARM SYSTEMS NARRATIVE - prepared by Valley Engineering**:**

Overview:

Building Hazard Classification:

Occupancy Group: B Business/Factory (Moderate Hazard)

Fire Alarm System Overview:

Fire Alarm system not required pursuant to the 2012 Virginia Construction Code, Section(s) 907.2.2 and 907.2.4.

FROEHLING & ROBERTSON, INC.

Report of Geotechnical Study

Harrisonburg Solid Waste Transfer Station
Harrisonburg, Virginia
F&R Project No. 71U0078

Prepared For:
City of Harrisonburg
320 East Mosby Road
Harrisonburg, Virginia 22801

Prepared By:
Froehling & Robertson, Inc.
6181 Rockfish Gap Turnpike
Crozet, Virginia 23932-3330

July 22, 2016

SINCE 1881

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Engineering Stability Since 1881

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July 22, 2016

City of Harrisonburg
320 East Mosby Road
Harrisonburg, Virginia 22801

Attn: Mr. Thomas Hartman, PE, LEED AP

Reference: Report of Geotechnical Study
Harrisonburg Solid Waste Transfer Station
Harrisonburg, Virginia
F&R Project No. 71U0078

Dear Mr. Hartman:

The purpose of this study is to present the results of the subsurface exploration program and geotechnical engineering evaluation undertaken by Froehling & Robertson, Inc. (F&R) in connection with the referenced project. Our services were performed in general accordance with F&R Proposal No. 1771-0084G dated June 6, 2016. The attached report presents our understanding of the project, reviews our exploration procedures, describes existing site and general subsurface conditions, and presents our geotechnical evaluations and recommendations.

We have enjoyed working with you on this project, and we are prepared to assist you with the recommended quality assurance monitoring and testing services during construction. Please contact us if you have any questions regarding this report or if we may be of further service.

Sincerely,
FROEHLING & ROBERTSON, INC.

COMMONWEALTH OF VIRGINIA
CLYDE A. SIMMONS, III
Lic. No. 037906
7/22/16
PROFESSIONAL ENGINEER

Thomas DeGaetano, P.E.
Staff Geotechnical Engineer

Clyde A. Simmons, III, P.E.
Senior Engineer/Branch Manager

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ASFE Document "Important Information about Your Geotechnical Engineering Report"

EXECUTIVE SUMMARY

This Executive Summary is provided as a brief overview of our geotechnical engineering evaluation for the project and is not intended to replace more detailed information contained elsewhere in this report. As an overview, this summary inherently omits details that could be very important to the proper application of the provided geotechnical design recommendations. This report should be read in its entirety prior to implementation into design and construction.

- The site was explored by four soil test borings and two offset probes performed on June 17 and 23, 2016. Site subsurface conditions generally consisted of existing fill materials overlying alluvial soils and residual soils. Auger refusal materials were encountered in borings B-3 and B-4, B-4A, and B-4B at depths ranging from 2 feet to 12.5 feet below existing grades.
- Soils considered Fill material were encountered below the surficial gravels in each soil test boring and extended to depths of 2 feet to 8.5 feet below the existing ground surface. We anticipate that portions of the foundations will bear on existing fill materials encountered in the borings. Although excessively soft materials or debris laden materials were not encountered in the borings, given the variability associated with fill materials, it is possible that they could be present between boring locations. Some undercutting could be required if poor quality fill materials are encountered at subgrade levels.
- Based on the subsurface information obtained during our exploration, we expect that the proposed structure can be supported a shallow foundation system bearing on firm natural soils, controlled, compacted fill materials, or approved existing fill materials. We recommend foundations located within the footprint be designed for a net allowable bearing pressure not to exceed 2,000 pounds per square feet (psf). Since records regarding the placement and compaction of the existing fill were not provided to F&R, there are some risks related to structural support on these fill materials. These risks are discussed in section 5.3 of this report.
- The following Seismic Site Class Definition was established per Section 1613.5.2 of the 2012 International Building Code (IBC). Based on our experience in this area and the data from our testing and subsurface exploration, a **Site Classification "D"** should be used for further evaluations relative to earthquake load design.

1.0 PURPOSE & SCOPE OF SERVICES

The purpose of the subsurface exploration and geotechnical engineering evaluation was to explore the subsurface conditions on the project site and provide geotechnical engineering evaluation and construction recommendations that can be used during planning process of the proposed structure and site work.

F&R's scope of services included the following:

- Visited the site to observe existing surface conditions;
- Coordinated utility clearance with Miss Utility;
- Reviewed readily available geologic and subsurface information relative to the project site;
- Completion of four soil test borings (and two offset probes) to depths of 2 feet to 15 feet below the existing ground surface;
- Performed laboratory testing on selected soil samples, consisting of water content, wash sieve analysis, and Atterberg Limits;
- Preparation of typed Boring Logs and development of a Subsurface Profile;
- Performing a geotechnical engineering evaluation of the subsurface conditions with regard to their suitability for the proposed construction;
- Provided recommendations for slab on grade design and construction;
- Provided lateral earth pressure parameters for the design of below grade walls;
- Provided recommendations regarding the placement and compaction of fill materials required to achieve building pad or site subgrades, including an assessment of the suitability of the on-site soil for re-use as structural fill.
- Provided a *seismic site class definition*. The *seismic site class definition* was assigned based on the test boring Standard Penetration Test data and correlations provided in the 2012 IBC;
- Preparation of this geotechnical report by professional engineers.

Our scope of services did not include a survey of the boring locations, quantity estimates, preparation of plans or specifications, or the identification and evaluation of wetland or other environmental aspects of the project site.

2.0 PROJECT INFORMATION

2.1 Site Description

The project site is located off of Beery Road and is currently occupied by the existing solid waste management facility. The existing facility is encompassed by gravel filled lots with existing building surrounding proposed new construction. The existing solid waste transfer building, which will be demolished for this project, consists of a 2-story steel framed building with concrete slabs and stone gravel surrounding the facility. A concrete ramp is located south of the building that services the transportation of solid waste into and out of the existing facility. The project site is located east of Blacks Run Creek. Topographically, the area slopes from El 1260 in the east direction down to El 1250 in the west towards Blacks Run Creek.

2.2 Proposed Construction

Project information was provided in email correspondence with you, which included the "Site Plan" by Valley Engineering dated 3/22/16. It is understood that a metal building with a footprint of approximately 17,000 square feet, is planned for the project site. The building will included some concrete "push walls", up to 8 feet tall. We understand that materials will be piled against these walls, which will be subjected to lateral loading from the material piles, as well as equipment "pushing" against these walls (i.e. a loader bucket) to process these materials. Considering the existing topography, relatively minor grading, with cuts and fills of 5 feet or less, is expected to be needed for this project. Although structural loads were not provided, based on experience with similar projects we anticipate column loads less than 50 kips and wall loads less than 6 kips per linear foot.

3.0 EXPLORATION PROCEDURES

3.1 Soil Borings

The exploration program was performed on June 17 and June 23, 2016, and consisted of four borings designated B-1 through B-4 (and two offset borings designated B-4A and B-4B). The borings were drilled to the planned termination depth of 15 feet, or auger refusal, whichever occurred first. The locations of the borings are shown on the attached Boring Location Plan (Drawing No. 2). The planned boring locations were staked in the field by representatives of the client. Surface elevations at the boring locations were estimated to the nearest foot from the topography indicated on the provided site plans. In consideration of the methods used in their determination, the test boring locations shown on the attached boring location plan and the elevations shown on the boring logs should be considered approximate.

The soil test borings were performed in accordance with generally accepted practice using a truck-mounted CME-55 rotary drill rig equipped with an automatic safety hammer. Hollow-stem augers were advanced to pre-selected depths, the center plug was removed, and representative soil samples were recovered with a standard split-spoon sampler (1 3/8 in. ID, 2 in. OD) in general accordance with ASTM D 1586, the Standard Penetration Test. For these tests, a weight of 140 pounds was freely dropped from a height of 30 inches to drive the split-spoon sampler into the soil. The number of blows required to drive the split-spoon sampler three consecutive 6-inch increments was recorded, and the blows of the last two increments were summed to obtain the Standard Penetration Resistance (N-value). The N-value provides a general indication of in-situ soil conditions and has been correlated with certain engineering properties of soils.

Research has shown that the Standard Penetration Resistance (N-value) determined by automatic hammer is different than the N-value determined by the safety hammer method. Most corrections that are published in the technical literature are based on the N-value determined by the safety hammer method. This is commonly termed N_{60} as the rope and cathead with a safety hammer delivers about 60 percent of the theoretical energy delivered by a 140-pound hammer falling 30 inches. Several researchers have proposed correction factors for the use of hammers other than the safety hammer. The correction is made by the following equation:

$$N_{60} = N_{field} \times C_E$$

where N_{field} is the value recorded in the field, and C_E is the drill rod energy ratio for the hammer used. A correction factor (C_E) of 1.3 was utilized for the automatic hammer used during the drilling of borings for this site, based on previous energy measurements made for the automatic hammer system. Plotted N-values reported on Boring Logs are the actual, field-derived blow counts (N_{field}). Drilling notes on each Boring Log indicates whether penetration resistances presented on the Boring Log were determined using automatic hammer or conventional hammer systems. Corrected N_{60} values were used for all analyses.

In some soils it is not always practical to drive a split-spoon sampler the full three consecutive 6-inch increments. Whenever more than 50 blows are required to drive the sampler over a 6-inch increment, or the sampler is observed not to penetrate after 10 blows, the condition is called split-spoon refusal. Split-spoon refusal conditions may occur because of obstructions or because the earth materials being tested are very dense or very hard. When split-spoon refusal occurs, often little or no sample is recovered. The SPT N-value for split-spoon refusal conditions is typically estimated as > 100 blows per foot (bpf). Where the sampler is observed not to penetrate after 10 blows, the N-value is reported as 10/0. Otherwise, the depth of penetration after 50 blows is reported in inches, i.e. 50/5, 50/2, etc.

The test borings were advanced through the soil overburden by soil drilling procedures until the termination depth or auger refusal was reached. Subsurface water level readings were taken in each of the borings during the drilling process. Upon completion of drilling, the boreholes were backfilled with auger cuttings (soil). Periodic observation of the boreholes should be performed to monitor subsidence at the ground surface, as the borehole backfill could settle over time.

Representative portions of the split-spoon soil samples obtained throughout the exploration program were placed in glass jars and transported to our laboratory. In the laboratory, the soil samples were evaluated by a member of our engineering staff in general accordance with techniques outlined in the visual-manual identification procedure (ASTM D 2488). The soil descriptions and classifications discussed in this report and shown on the attached Boring Logs are based on visual observation and should be considered approximate. A copy of the boring logs are provided and classification procedures are further explained in Appendix II.

Split-spoon soil samples recovered on this project will be stored at F&R's office for a period of 60 days. After 60 days, the samples will be discarded unless prior notification is provided to us in writing.

3.2 Laboratory Testing

Representative soil samples were subjected to Water Content (ASTM D 2216), #200 Sieve Wash (ASTM D 1140), and Atterberg Limits (ASTM D 4318) to substantiate the visual classifications and assist with the estimation of the soils' pertinent engineering properties. The results are shown in Section 4.4.

4.0 REGIONAL GEOLOGY & SUBSURFACE CONDITIONS

4.1 Regional Geology

The project site is located in Virginia's Valley and Ridge Geologic Province which is underlain by ancient faulted and folded limestones, dolomites, shales and sandstones of Paleozoic age. Information obtained from publication entitled Geology of Harrisonburg and Bridgewater, Quadrangles, Virginia (Commonwealth Division of Mineral Resources Publication 60, 1986) indicates that this area is located over the Beekmantown Formation which is composed of interbedded layers of Dolomite and Limestone. The Dolomite in the lower section of this formation is also found to contain considerable amounts of Chert layers. The virgin soils encountered in this area are the residual product of in-place chemical and mechanical weathering of the parent bedrock formation that underlies the site. These materials consist of clayey soils near the surface where soil weathering is more advanced, underlain by silty material.

Often, these rocks weather to form a highly variable bedrock surface consisting of troughs and pinnacles that may greatly fluctuate in elevation within short lateral distances. Sometimes, the interbedded layers after weathering will result in alternating rock and soil seam layers that can be oriented near vertical. The varying susceptibility to weathering creates seams of soil sandwiched between weather-resistant rock pinnacles.

From an excavation and support point of view, this near vertical orientation can result in very hard layers that may require blasting to excavate, interbedded with soft clay seams that may require undercutting to some depth to provide adequate structural support. Where soil test borings encountered a vertical bed of auger refusal material, direct interpretation of the field data might lead one to envision a rock surface between the auger refusal points. Likewise, where vertical soil seams are encountered, a deep soft soil profile might be anticipated. However, in the Valley and Ridge physiographic province our experience is that a combination of both conditions may exist. Therefore, the boring data should be viewed as a specific example of the subsurface condition at each explored location rather than a broad interpretation of conditions across the site area.

Limestone and dolomite are composed of calcium carbonate and calcium magnesium carbonate, respectively, with the relative proportion of magnesium to calcium being used to distinguish the two types of rock. Impurities (i.e., silicates, sulfides, and other mineral groups) within these rock formations occur either as distinct beds of shale or siltstone, or may be widely dispersed throughout the rock. Carbonate rocks are susceptible to dissolution in the presence of subsurface water. The mineral residues remaining after the carbonates are eroded are known as residual soils, and typically consist of medium to highly plastic silts and clays.

Continued subsurface dissolution of the carbonate bedrock may lead to development of a highly irregular rock profile that may include underground voids. Over time, the soils overlying a void may subside, in a continual process of subsurface chemical erosion of bedrock and infilling by overburden soils. The resulting ground surface depression is known as a sinkhole. Terrain characterized by sinkholes and other solutional features is known as karst. See attached conceptual model of carbonate geology provided by ATS International in Appendix II.

There are numerous other variations on sinkhole development. Regardless of the mode of development, it is important to note that changes in soil stress and water regime can greatly accelerate sinkhole development. Natural geologic processes that might otherwise occur over thousands of years can occur within several years or even months. Construction activities such as site grading, building construction, change in water flow and water impoundment have reportedly caused sinkholes to develop rapidly or to collapse suddenly. This site lies within a

geologic formation known to contain solutional features; however, the potential for development of sinkholes, along with the rate at which a sinkhole will develop, are not easily determined or accurately predicted.

The transitional term "Hard or Soft Weathered Rock" is normally found overlying the parent bedrock. For engineering purposes, SWR is described as broken and partially weathered rock with Standard Penetration Resistance N-values between 50 blows per 6 inches and 50 blows per inch. HWR is described as broken and partially weathered rock with N values in excess of 50 blows per inch.

Weathering is facilitated by fractures, joints and the presence of less resistant rock types. Consequently, the profile of the SWR or HWR is often quite irregular, even over very short horizontal distances. Also, it is not unusual to find lenses, layers, or zones of less resistant SWR and more resistant HWR, and boulders of hard rock within the soil mantle well above the general bedrock level.

4.2 Subsurface Conditions

4.2.1 General

The subsurface conditions discussed in the following paragraphs and those shown on the attached Boring Logs represent an estimate of the subsurface conditions based on interpretation of the boring data using normally accepted geotechnical engineering judgments. The transitions between different soil strata are usually less distinct than those shown on the boring logs. Sometimes the relatively small sample obtained in the field is insufficient to definitively describe the origin of the subsurface material. In these cases, we qualify our origin descriptions with "possible" before the word describing the material's origin (i.e. possible fill, etc.). Although individual soil test borings are representative of the subsurface conditions at the boring locations on the dates shown, they are not necessarily indicative of subsurface conditions at other locations or at other times. Data from the specific soil test borings is shown on the attached Boring Logs in Appendix II.

A Subsurface Profile has been prepared from the boring data to graphically illustrate the subsurface conditions encountered at the site. The Subsurface Profile can be found after the boring logs in Appendix II. Strata breaks designated on the Boring Logs and Subsurface Profile represent approximate boundaries between soil types. The transition from one soil type to another may be gradual or occur between soil samples. This section of the report provides a general discussion of subsurface conditions encountered within areas of proposed construction at the project site.

Below the existing ground surface, the borings generally encountered gravel, existing fill materials, alluvial soils, residual soils, and auger refusal materials. These materials are generally discussed in the following paragraphs.

4.2.2 Surficial Gravel

Surficial gravel materials were encountered in each boring, with thicknesses of 3 inches to 24 inches. Actual surficial gravel depths should be expected to vary. Although not encountered in the borings, any surficial organics (topsoil) should be removed from the site.

4.2.3 Existing Fill

Existing fill includes any materials deposited by man, and were encountered in each boring, extending to depths of up to 8.5 feet below existing grades. The sampled fill materials were classified as lean CLAY (CL) and fat CLAY (CH) soils, with varying amounts of gravel and asphalt fragments. The fill materials were dark brown, dark gray, and orange in color, with moisture contents visually characterized as moist to very moist. The Standard Penetration Test values (N-Values) in the fill ranged from 9 bpf to 50/1.

4.2.4 Alluvial Soils

Alluvial soils, deposited by flowing water, were encountered in each boring except B-4 and extended to the residual soils. The alluvial soils consisted of lean CLAY (CL) and fat CLAY (CH), with varying amounts of sand and gravel. The alluvial soils were brown, dark brown, and gray in color, with moisture contents visually characterized as moist to wet. The Standard Penetration Test values (N-Values) in the alluvium ranged from 7 bpf to 15 bpf.

4.2.5 Residual Soils

Residual soil, formed by the in-place weathering of the parent rock, was encountered below the fill or alluvium, at each boring location except B-4, and extended to the boring termination depth or auger refusal. The residual soil was generally described as orange brown, moist to wet, fat CLAY (CH), little sand. The Standard Penetration Test values (N-Values) in the residuum ranged from 6 bpf to 16 bpf.

4.2.6 Auger Refusal Materials

Auger refusal occurs when materials are encountered that cannot be penetrated by the soil auger and is normally indicative of a very hard or very dense material, such as boulders, rock lenses, rock pinnacles, or the upper surface of rock. Auger refusal was encountered in boring B-3, B-4, B-4A, and B-4B at depths of 2 feet to 12.5 feet below existing grades. Auger refusal conditions with a CME 55 do not necessarily indicate conditions impenetrable to other equipment. Auger refusal conditions will likely vary in unexplored areas of the site. A summary of the auger refusal conditions can be found in the table below.

Boring No.	Existing Grade	Existing Fill Depth (ft)	Auger Refusal Depth (ft)
B-1	1254	6	--
B-2	1250	8.5	--
B-3	1250	6	12.5
B-4	1254	2	2
B-4A	1254	2	2
B-4B	1254	4.6	4.6

Note- borings B-4, B-4A, and B-4B encountered auger refusal within existing fill.

4.3 Subsurface Water

The test borings were monitored during and after drilling operations to obtain short-term subsurface water information. Subsurface water was not encountered during drilling or upon removal of the augers in any of the borings. It should be noted that the location of the subsurface water table could vary by several feet because of seasonal fluctuations in precipitation, evaporation, surface water runoff, local topography, and other factors not immediately apparent at the time of this exploration. Normally, the highest subsurface water levels occur in the late winter and spring and lowest levels occur in the late summer and fall.

4.4 Laboratory Test Results

As discussed in Section 3.2, laboratory testing was performed on selected soil samples collected during our subsurface exploration. The results from the laboratory testing are included in the table below.

Boring No.	Sample Depth (Feet)	Natural Water Content (%)	Liquid Limit/ Plasticity Index	% Passing No. 200 Sieve	USCS Class.
B-1	1.5-3	22.1	--	--	--
B-1	6-7.5	26.4	48/29	87.9	CL
B-2	4-5.5	28.4	--	--	--
B-3	4-5.5	17.1	41/23	60.8	CL
B-3	8.5-10	36.8	--	--	--
B-4	1-2.5	16.6	--	--	--

5.0 GEOTECHNICAL DESIGN RECOMMENDATIONS

5.1 General

The following evaluations and recommendations are based on our observations at the site, interpretation of the field obtained during this exploration, and our experience with similar subsurface conditions and projects. Soil penetration data has been used to evaluate relative consistency and compressibility of the underlying soil stratum using established correlations. Subsurface conditions in unexplored locations may vary from those encountered. If the structure locations, loadings, or elevations are changed, we should be notified and requested to confirm and, if necessary, re-evaluate our recommendations.

Determination of an appropriate foundation system for a given structure is dependent on the proposed structural loads, soil conditions, and construction constraints such as proximity to other structures, etc. The subsurface exploration aids the geotechnical engineer in determining the soil stratum appropriate for structural support. This determination includes considerations with regard to both allowable bearing capacity and compressibility of the soil strata. In addition, since the method of construction greatly affects the soils intended for structural support, consideration must be given to the implementation of suitable methods of site preparation, fill compaction, and other aspects of construction, where applicable.

5.2 Foundation Design

Based on the boring data, we envision that the proposed building can be supported by shallow foundations bearing on firm natural soils, newly placed controlled and compacted fill, or approved existing fill materials. We recommend that foundations be designed for a net allowable bearing pressure not to exceed 2,000 pounds per square feet (psf).

Based on F&R's soil boring data and site observation it appears that the existing fill materials may have been placed in a controlled method; however, records of compaction testing were not provided. Considering the proposed structure and the anticipated loads, and the composition of the fill materials, we envision that the proposed structure can be supported on a shallow foundation system bearing on approved existing fill materials, provided that the risks regarding construction on existing fill materials, as described in Section 5.3 are understood and accepted by the owner and project team.

If soft soils or poor quality existing fill materials are encountered at the footing subgrade level, the materials should be undercut to reach firm bearing soils and replaced with controlled compacted fill, flowable fill, or concrete. If soil backfill is used the excavation should be oversized on each side by an amount equal to the depth of undercut.

In addition, due to the pinnacled nature of the site's underlying geology, it is possible that foundations could bear directly on bedrock materials. At locations where footing support transitions from soil to rock, we recommend that a "rock cushion", consisting of at least 12 inches of compacted soil be placed between the rock and the footing (refer to Rock Sub Excavation Detail, Appendix II). This should reduce the potential for a point loading on the footing.

To reduce the possibility of localized shear failures, column and wall footings should be a minimum of 3 feet and 2 feet wide, respectively. The soils encountered in the borings were classified as lean CLAY (CL) and fat CLAY (CH). It should be understood that clayey soils are considered to be moderately expansive. We recommend that all exterior footings be placed a minimum of 3 feet below finished exterior grades to satisfy shrink-swell considerations, which should be below the zone of seasonal moisture fluctuation, and should also be adequate to protect exterior footings against the effects of frost.

5.3 Support on Existing Fill

In order to eliminate risk associated with foundation support on existing fill materials, the existing materials could be completely removed and replaced with new controlled structural fill or deep foundations could be utilized. Based on boring data and given the relatively light structural loading, structural support on existing fill is possible, provided that the recommended engineering evaluations are performed during construction and the owner is willing to accept some risk. The risks associated with structural support in the short term include additional support related costs (i.e. undercutting) should unforeseen conditions be encountered during construction. Long-term risks (i.e. excessive settlement) can be reduced by requesting an F&R engineer to perform the recommended subgrade evaluations during construction.

5.4 Ground Floor Slabs

Ground floor slabs may be designed as a slab-on-grade supported by controlled compacted fill or approved existing fill materials. Any loose/soft or otherwise unsuitable materials should be remediated as judged necessary by the Geotechnical Engineer. We recommend that the slab-on-grade be underlain by 4-inches of well-compacted granular materials, which should conform to an open graded aggregate (such as VDOT No. 57 Stone). This granular material provides a capillary break between the subgrade and slab-on-grade; while also providing a uniform bearing surface. A vapor retarder should be used beneath ground floor slabs that will be covered by tile, wood, carpet, impermeable floor coatings, and/or if other moisture-sensitive equipment or materials will be in contact with the floor. However, the use of vapor retarders may result in excessive curling of floor slabs during curing. We refer the floor slab designer to ACI 302.1R-96, Sections 4.1.5 and 11.11, for further discussion on vapor retarders, curling, and the means to minimize concrete shrinkage and curling.

Proper jointing of the ground floor slab is also essential to minimize cracking. ACI suggests that unreinforced, plain concrete slabs may be jointed at spacings of 24 to 36 times the slab thickness, up to a maximum spacing of 18 feet. Floor slab construction should incorporate isolation joints along bearing walls and around column locations to allow minor movements to occur without damage. Utility or other construction excavations in the prepared floor subgrade should be backfilled to a controlled fill criteria to provide uniform floor support.

Structural analyses and design of floor slab foundation may require the use of a vertical modulus of subgrade reaction (k). We note that typical practice for slab-on-grade and pavement design is to provide a "k" value based on published correlation with soil types and California Bearing Ratio (CBR) test values. Such correlations are based on empirical data from plate load tests. The plate load test sufficiently models typical floor and wheel loads that exert stresses on the order of 3 to 5 feet. Based on published correlations, we estimate that a design modulus of subgrade reaction (k) = 150 pci is appropriate for floor slab design calculations, provided that the recommended 4-inch subbase is utilized.

5.5 Lateral Earth Pressures

We understand that the structure could have some loading dock walls or retaining walls. We also understand that there will be a series of "push walls". All below-grade walls should be designed to resist the lateral earth pressure. The at-rest and active earth pressure coefficients given herein are not applicable to the push walls, since the types of materials to be piled against these walls was not provided, and these walls will also have additional lateral loading from equipment. However, we expect that these lateral loads will be resisted by passive earth pressure and base friction, and those coefficients listed below can be used in this analysis.

Earth pressures on walls below grade are influenced by structural design of the walls, conditions of wall restraint, methods of construction and/or compaction, and the strength of the materials being restrained. The most common conditions assumed for earth retaining wall design are the active and at-rest conditions. Active conditions apply to relatively flexible earth retention structures, such as freestanding walls, where some movement and rotation may occur to mobilize soil shear strength. Walls that are rigidly restrained, such as basement, pit, pool and tunnel walls, should be designed for the structure requiring the use of at-rest earth pressures.

A third condition, the passive state, represents the maximum possible pressure when a structure is pushed against the soil, and is used in wall foundation design to help resist active or at-rest pressures. Because significant wall movements are required to develop the passive pressure, the total calculated passive pressure should be reduced by one-half to two-thirds for design purposes.

The fat CLAY (CH) and lean CLAY (CL) soils that were encountered in each of the borings are not considered suitable for use as below grade wall backfill due to the relatively high earth pressures they exhibit, poor drainage properties, and potential excess pressures due to swelling. We recommend that VDOT No. 21B Stone be used as below grade wall backfill. The recommended lateral earth pressure coefficients and equivalent fluid pressure parameters for design of retaining or below grade walls using these soils are provided in the following table.

Soil Type	**Base Friction Coefficient**	**Lateral Earth Pressure Coefficient (k)**		**Equivalent Fluid Unit Weight (γ_{eq}, pcf)**		
		At-rest	Active	At-rest	Active	Passive
VDOT No. 21B Stone	0.34	0.36	0.22	51.8	31.5	200

A moist unit weight of 145 pcf for soil should be used for design calculations using the No. 21B Stone. The backfill material should be extended a minimum distance of 0.5 times the wall height laterally from the back face of the wall, or for a cantilevered wall, from the heel of the wall footing.

Our recommendations were given assuming that the ground surface above the wall is level. The recommended equivalent fluid pressures were provided assuming that constantly functioning drainage systems, consisting of slotted 4 inch diameter PVC pipe, are installed between walls and crushed stone backfill to prevent the accidental buildup of hydrostatic pressures and lateral stresses in excess of those stated. If a functioning drainage system is not installed, then lateral earth pressures should be determined using the buoyant weight of the soil. Hydrostatic pressures calculated with the unit weight of water (62.4 pcf) should be added to these earth pressures to obtain the total stresses for design.

Heavy equipment should not operate within 5 feet of below grade walls to prevent lateral pressures in excess of those cited. Adjacent footings or other surcharge loads located a short distance outside below grade walls will also exert appreciable additional lateral pressures. Surcharge loads should be evaluated using the appropriate active or at-rest pressure coefficients provided above. The effect of surcharge loads should be added to the recommended earth pressures to determine total lateral stresses.

5.6 Seismic Considerations

The following Seismic Site Class Definition was established per Section 1613.3.2 of the 2012 International Building Code (IBC) and Chapter 20 of ASCE 7. Our scope of services did not include a seismic conditions survey to determine site-specific shear wave velocity information. This method requires averaging N-values over the top 100 feet of the subsurface profile. Based on our experience in this area and the data from our testing and subsurface exploration and in general accordance with Section 1613.3.2 of the 2012 International Building Code (IBC) and Chapter 20 of ASCE 7, a **Site Classification "D"** should be used for further evaluations relative to earthquake load design.

6.0 GEOTECHNICAL CONSTRUCTION RECOMMENDATIONS

6.1 Site Preparation

Before proceeding with construction, existing structures, utilities, surficial organic soils, asphalt, concrete and crushed stone, and other deleterious non-soil materials (if any) should be stripped or removed from the proposed construction area. Attention should be given to these areas to ensure all unsuitable material is removed prior to continuing with construction. During the site preparation operations, positive surface drainage should be maintained to prevent the accumulation of water. Existing underground utilities should be re-routed to locations a minimum of 10 feet outside of any proposed structures or abandoned in place with flowable fill.

After stripping, areas intended to support ground floor slabs or new fill should be carefully evaluated by a geotechnical engineer. At that time the engineer may require proofrolling of the subgrades with a 20 to 30-ton loaded truck or other pneumatic-tired vehicle of similar size and weight. Proofrolling should be performed during a time of good weather and not while the site is wet, frozen, or severely desiccated. The purpose of the proofrolling is to locate soft, weak, or excessively wet soils present at the time of construction.

The proofrolling observation is an opportunity for the geotechnical engineer to locate inconsistencies intermediate of our boring locations and evaluate the stability of the existing subgrade materials. Any unsuitable materials observed during the evaluation and proofrolling operations should be undercut and replaced with compacted or flowable fill, or stabilized in-place. The existing fill materials may be left in place, as outlined in sections 5.2 and 5.3, for support of structural fill or foundation support, provided they are evaluated by the geotechnical engineer and found to be stable during proofrolling and do not include an excessive amount of organics or debris. The possible need for, and extent of, undercutting and/or in-place stabilization required can best be determined by the geotechnical engineer at the time of construction. Once the site has been properly prepared, at-grade construction may proceed.

6.2 Excavation Conditions

Auger refusal materials were encountered in borings B-3 and B-4, B-4A, and B-4B at depths of 2 feet to 12.5 feet. The relatively shallow refusals at borings B-4, B-4A, and B-4B were recorded in existing fill materials, and it is not known whether the refusal was the result of a large obstruction within the fill or bedrock. In addition, F&R notes that the profile of the bedrock surface will be highly irregular, and that bedrock could be encountered at higher elevations between test boring locations. Therefore, it is possible that difficult excavation conditions could be encountered at this site.

In mass excavations for general sitework, hard or dense soils (soils with standard penetration resistances of 30 or more blows per foot) can usually be removed by ripping with a single-tooth ripper attached to a large crawler tractor or by breaking it out with a tracked excavator or large front-end loader. Blasting is not anticipated to be necessary at this site, based on the borings, and is not recommended due to the proximity of existing structures. In confined excavations such as foundations, utility trenches, etc., removal of partially weathered rock typically requires use of large backhoes, pneumatic spades, or hoe rams. The gradation of the material removed by ripping or hoe ramming is typically erratic, making it unsuitable for use as structural fill.

The definition of rock can be a source of conflict during construction. The following definitions have been incorporated into specifications on other projects and are provided for your general guidance:

GENERAL EXCAVATION:

Rip Rock - Any material that cannot be removed by scrapers, loaders, pans, dozers, or graders; and requires the use of a single-tooth ripper mounted on a crawler tractor having a minimum draw bar pull rated at not less than 56,000 pounds.

Blast Rock - Any material which cannot be excavated with a single-tooth ripper mounted on a crawler tractor having a minimum draw bar pull rated at not less than 56,000 pounds (Caterpillar D-8K or equivalent) or by a Caterpillar 977 front-end loader or equivalent; and occupying an original volume of at least one (1) cubic yard.

TRENCH EXCAVATION:

Blast Rock - Any material which cannot be excavated with a backhoe having a bucket curling force rated at not less than 25,700 pounds (Caterpillar Model 225 or equivalent), and occupying an original volume of at least one-half (1/2) cubic yard.

6.3 Foundation Construction

All foundation subgrades should be observed, evaluated, and verified for the design bearing pressure by the geotechnical engineer after excavation and prior to reinforcement steel placement. If low consistency soils are encountered during foundation construction, localized undercutting and/or in-place stabilization of foundation subgrades will be required. Existing fill materials were encountered in the borings and will require careful evaluation by the geotechnical engineer. Considering these existing fill materials and the variability associated with existing fills, it is possible that some undercutting could be needed. The actual need for, and extent of, undercutting should be based on field observations made by the geotechnical engineer at the time of construction.

Excavations for footings should be made in such a way as to provide bearing surfaces that are firm and free of loose, soft, wet, or otherwise disturbed soils. Foundation concrete should not be placed on frozen or saturated subgrades. If such materials are allowed to remain below foundations, settlements will increase. Foundation excavations should be concreted as soon as practical after they are excavated. If an excavation is left open for an extended period, a thin mat of lean concrete should be placed over the bottom to minimize damage to the bearing surface from weather or construction activities. Water should not be allowed to pond in any excavation.

6.4 Structural Fill Placement and Compaction

Fill materials may consist of the non-organic on-site soils, or an off-site borrow having a classification of CL or more granular, as defined by the Unified Soil Classification System. Controlled structural fill should have a maximum particle size of 4 inches, should be free of organics or other deleterious materials, and should have a minimum standard Proctor (ASTM D 698) maximum dry density of 90 pounds per cubic foot. Recommendations and additional restrictions for backfilling the below grade walls were provided in Section 5.5 of this report.

Based on our visual classifications and the laboratory testing, we anticipate that the on-site soils should serve satisfactorily as fill provided that the moisture contents can be maintained within acceptable limits. In addition, although not encountered in the borings, it is possible that the existing fill materials could contain organics or other debris, making them unsuitable for re-use as controlled, compacted fill. The on-site soils are considered moisture sensitive and may be difficult to work with when they are wet of the optimum moisture content. The laboratory tests indicate that some of the samples were above their optimum water contents, while others were below the optimum water content. Therefore, some wetting or drying of the on-site soils should be anticipated.

Predicated on the boring and laboratory results, and the recommendations provided above, the best time for construction of the structural fills and compacted subgrades would be during the warmer, drier months of the year, such as from late April through early October. During this

time frame, on-site soils that are wet of optimum can usually be dried to near optimum levels with relatively little effort. If grading is performed during the colder, wetter months of the year, such as late October through early April, and suitable dry materials are not available on site, then off-site drier borrow sources will likely be necessary.

The fill should be placed in horizontal lifts, 8 inches in loose thickness, and compacted to at least 95 percent of the maximum dry density as determined by the Standard Proctor compaction test (ASTM D 698). Where portable compaction equipment is used, such as utility trenches, the lift thickness may need to be reduced to 4 inches to achieve the required degree of compaction. Excessively wet or dry soils should not be used as fill materials without proper drying or wetting. A moisture content range of plus or minus 3 percentage points from the optimum moisture of the fill material is recommended. We recommend that the contractor have equipment on site during earthwork for both drying and wetting of fill soils.

Where construction traffic or weather has disturbed the subgrade, the upper 8 inches of soils intended for structural support should be scarified and re-compacted. Field density tests to determine the degree of compaction should be performed, with a minimum of two tests per lift.

6.5 Surface Water/Groundwater Control

Subsurface water for the purposes of this report is defined as water encountered below the existing ground surface. Based on the subsurface water data obtained during our exploration program, we do not generally anticipate that subsurface water will be encountered during anticipated earthwork or shallow foundation excavations at the site. However, considering the proximity of Blacks Run, it is possible that water could be encountered in deeper excavations on the site. The contractor should be prepared to dewater should water levels vary from those encountered during the drilling program. Fluctuations in subsurface water levels and soil moisture can be anticipated with changes in precipitation, runoff, and season.

An important aspect to consider during development of this site is surface water control. During the construction, we recommend that steps be taken to enhance surface flow away from any excavations and promote rapid clearing of rainfall and runoff water following rain events. It should be incumbent on the contractor to maintain favorable site drainage during construction to reduce deterioration of otherwise stable subgrades.

6.6 Temporary Excavation Recommendations

Mass excavations and other excavations required for construction of this project must be performed in accordance with the United States Department of Labor, Occupational Safety and Health Administration (OSHA) guidelines (29 CFR 1926, Subpart P, Excavations) or other applicable jurisdictional codes for permissible temporary side-slope ratios and/or shoring requirements. The OSHA guidelines require daily inspections of excavations, adjacent areas

and protective systems by a "competent person" for evidence of situations that could result in cave-ins, indications of failure of a protective system, or other hazardous conditions. All excavated soils, equipment, building supplies, etc., should be placed away from the edges of the excavation at a distance equaling or exceeding the depth of the excavation. F&R cautions that the actual excavation slopes will need to be evaluated frequently each day by the "competent person" and flatter slopes or the use of shoring may be required to maintain a safe excavation depending upon excavation specific circumstances. The contractor is responsible for providing the "competent person" and all aspects of site excavation safety. F&R can evaluate specific excavation slope situations if we are informed and requested by the owner, designer or contractor's "competent person".

6.7 Seepage Erosion

Our subsurface exploration did not find indication of existing karst features such as sinkholes or extensive zones of soft compressible soils. However, karst features are common in this formation. As a result there is some concern for development of a sinkhole at this site. Man-made changes in soil stress and water regime can cause formation of sinkholes by loss of erodible soils that are exposed to ponded or flowing water during grading and other construction activities. We recommend that karst features that become evident during construction and are located outside the proposed building, be remediated as described in the paragraph below.

If stiff overburden soils are removed during site grading, it is possible that sinkholes or solution features may be discovered or that highly erodible soils adjacent to pinnacle rock will be exposed to stormwater runoff. These soils can then be washed into solution cavities in the rock. Consideration must then be given to methods for arresting continued growth of the sinkhole. Support of a structure may require significant redesign where karst features are uncovered in the vicinity of a structure's location. At locations away from structures, we recommend that the raveling over-burden be excavated to expose throats (i.e. solution channels) in the underlying bedrock. Once the contributing throats are exposed by excavation, a concrete or flowable fill plug can be constructed to inhibit future drainage of groundwater and/or overburden into the solution channel. The excavation should then be backfilled to the line and grade of the project plans with acceptable structural fill and properly compacted to reduce the permeability of the backfill soils. Geosynthetics and compacted structural fill may also be required above the plug of the sinkhole.

7.0 CONTINUATION OF SERVICES

We recommend that we be given the opportunity to review the foundation plan, grading plan, and project specifications when construction documents approach completion. This review evaluates whether the recommendations and comments provided herein have been understood and properly implemented. We also recommend that Froehling & Robertson, Inc. be retained for professional and construction materials testing services during construction of the project. Our continued involvement on the project helps provide continuity for proper implementation of the recommendations discussed herein.

The Geotechnical Engineer of Record should be retained to monitor and test earthwork activities, and subgrade preparations for foundations, excavations and floor slabs. It should be noted that the actual soil conditions at the various subgrade levels and footing bearing grades will vary across this site and thus the presence of the Geotechnical Engineer and/or his representative during construction will serve to validate the subsurface conditions and recommendations presented in this report. We recommend that F&R be employed to monitor the earthwork and foundation construction, and to report that the recommendations contained in this report are completed in a satisfactory manner. Our involvement on the project will aid in the proper implementation of the recommendations discussed herein. The following is a recommended scope of services:

- Review of project plans and construction specifications to verify that the recommendations presented in this report have been properly interpreted and implemented;
- Observe all foundation excavations and footing bearing grades for compliance with the geotechnical recommendations.

These services are not included in our current scope of services and can be rendered for an additional cost.

8.0 LIMITATIONS

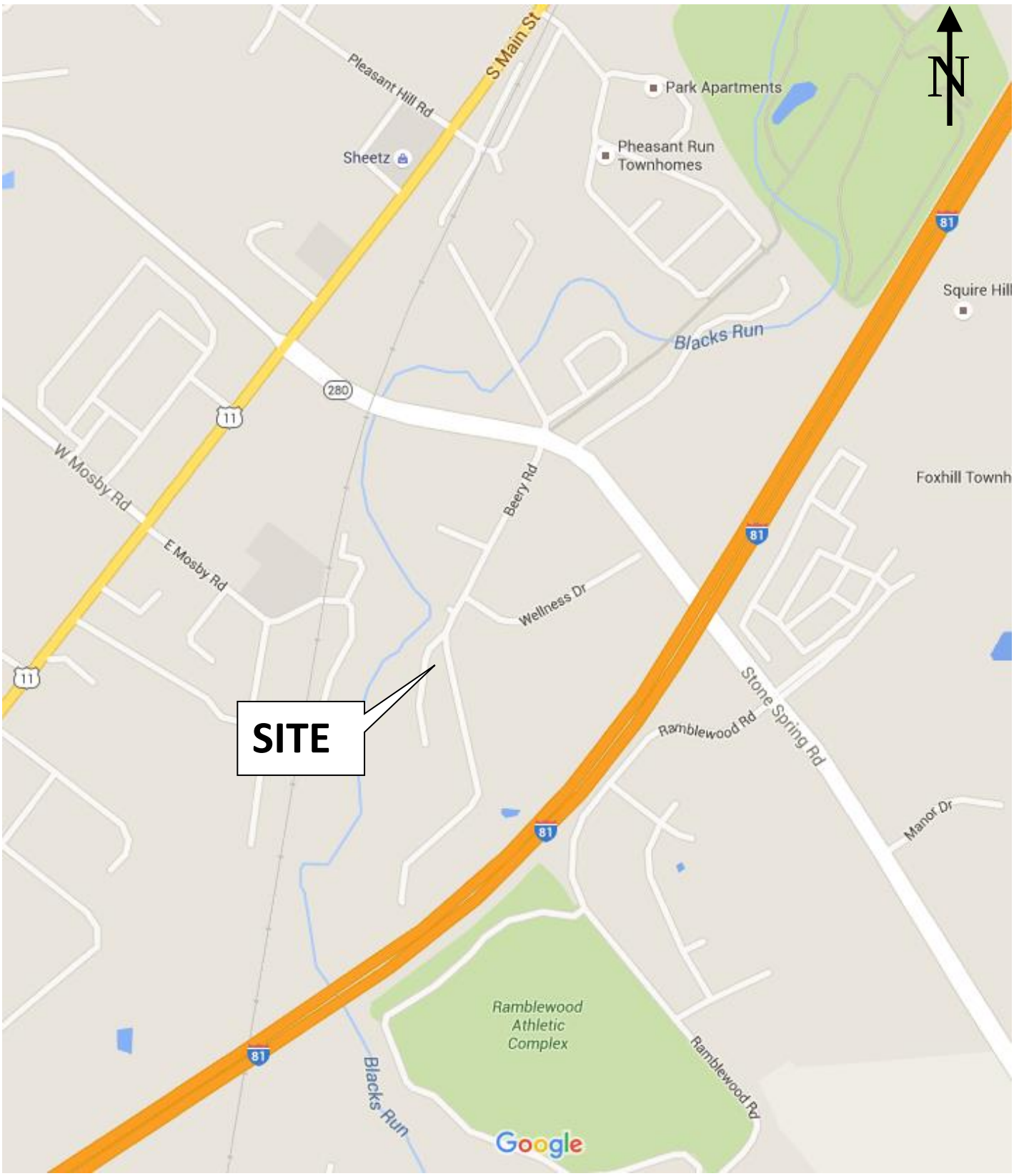
This report has been prepared for the exclusive use of the City of Harrisonburg, or their agent, for specific application to the Harrisonburg Solid Waste Transfer Station project, in accordance with generally accepted soil and foundation engineering practices. No other warranty, express or implied, is made. Our evaluations and recommendations are based on design information furnished to us; the data obtained from the previously described subsurface exploration program, and generally accepted geotechnical engineering practice. The evaluations and recommendations do not reflect variations in subsurface conditions which could exist intermediate of the boring locations or in unexplored areas of the site. Should such variations become apparent during construction, it will be necessary to re-evaluate our recommendations based upon on-site observations of the conditions.

There are important limitations to this and all geotechnical studies. Some of these limitations are discussed in the information prepared by ASFE, which is included in Appendix III. We ask that you please review this ASFE information.

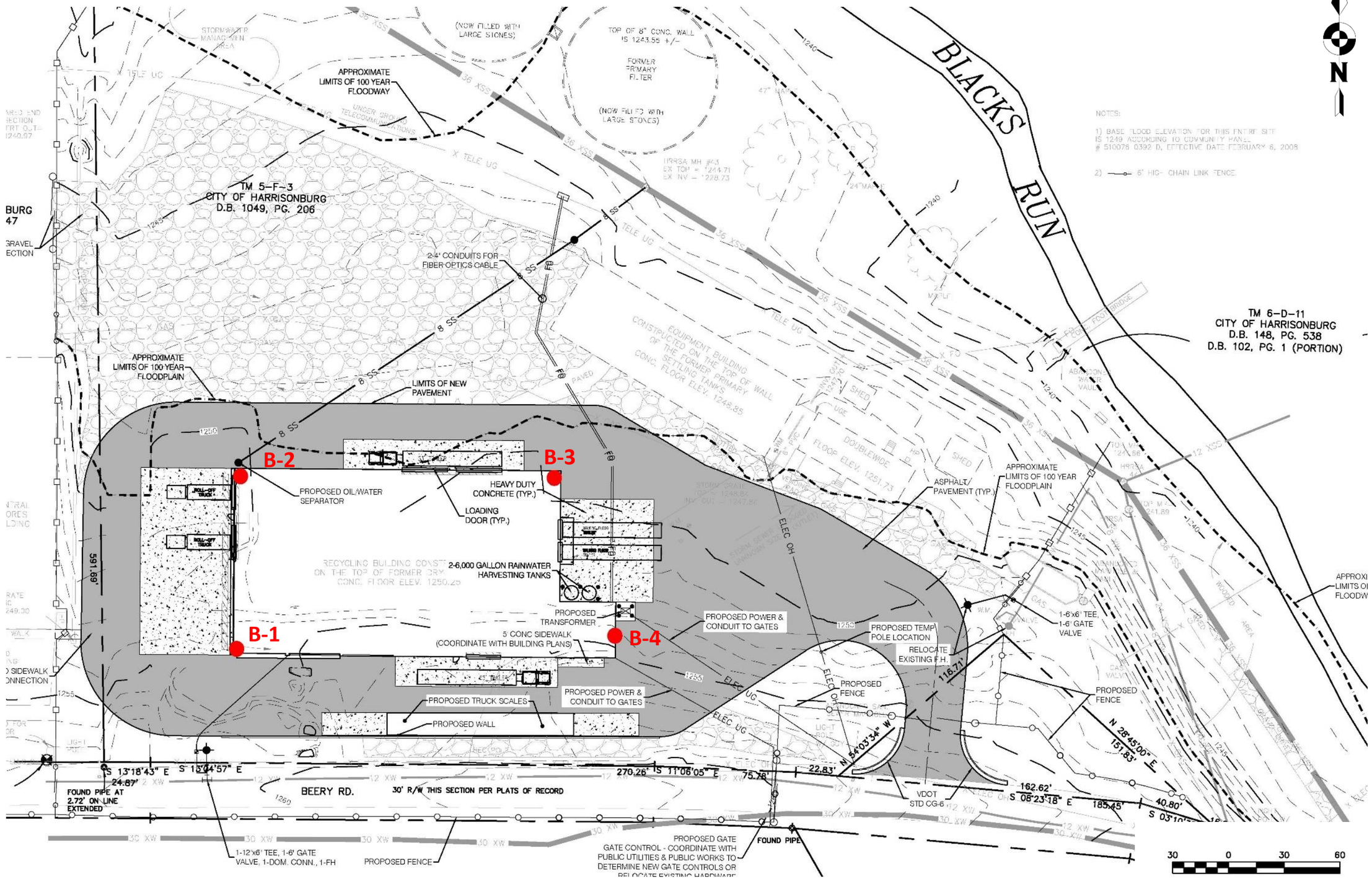
Regardless of the thoroughness of a subsurface exploration, there is the possibility that conditions between borings will differ from those at the boring locations, that conditions are not as anticipated by the designers, or that the construction process has altered the soil conditions. Therefore, experienced geotechnical engineers should evaluate earthwork, pavement, and foundation construction to verify that the conditions anticipated in design actually exist. Otherwise, we assume no responsibility for construction compliance with the design concepts, specifications, or recommendations.

In the event that changes are made in the design or location of the proposed structure, the recommendations presented in the report shall not be considered valid unless the changes are reviewed by our firm and conclusions of this report modified and/or verified in writing. If this report is copied or transmitted to a third party, it must be copied or transmitted in its entirety, including text, attachments, and enclosures. Interpretations based on only a part of this report may not be valid.

APPENDIX I



FROEHLING & ROBERTSON, INC. *Engineering Stability Since 1881* 6181 Rockfish Gap Turnpike Crozet, Virginia 22932-3330 T 434.823.5154 I F 434.823.4764	Site Location Plan		
	Client: City of Harrisonburg		
	Project: Harrisonburg Solid Waste Transfer Station		
	F&R Project No. 71U0078		
	Date: July, 2016	Scale: No Scale	Drawing No.: 1



FROEHLING & ROBERTSON, INC

Engineering Stability Since 1881

6181 Rockfish Gap Turnpike, Crozet, VA 22932
T 434.823.5154 | F 434.823.4764

Boring Location Plan

Client: City of Harrisonburg

Project: Harrisonburg Solid Waste Transfer Station

F&R Project No.: 71U0078

Date: July, 2016

Scale: 1" = 50' (approx.)

Drawing No.

2

APPENDIX II

KEY TO BORING LOG SOIL CLASSIFICATION

Particle Size and Proportion

Verbal descriptions are assigned to each soil sample or stratum based on estimates of the particle size of each component of the soil and the percentage of each component of the soil.

Particle Size Descriptive Terms		Proportion Descriptive Terms		
Soil Component	Particle Size	Component	Term	Percentage
Boulder	> 12 inch	Major	Uppercase Letters	>50%
Cobble	3 – 12 inch		(e.g., SAND, CLAY)	
Gravel-Coarse	¾ - 3 inch			
-Fine	#4 – ¾ inch	Secondary	Adjective	20%-50%
Sand-Coarse	#10 - #4		(e.g. sandy, clayey)	
-Medium	#40 - #10			
-Fine	#200 - #40	Minor	Some	15%-25%
Silt (non-cohesive)	< #200		Little	5%-15%
Clay (cohesive)	< #200		Trace	0%-5%

Notes:
1. Particle size is designated by U.S. Standard Sieve Sizes
2. Because of the small size of the split spoon sampler relative to the size of gravel, the true percentage of gravel may not be accurately estimated.

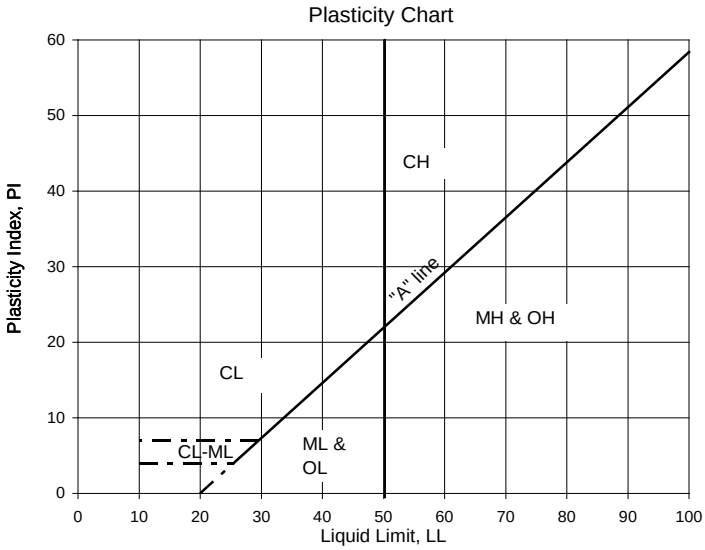
Density or Consistency

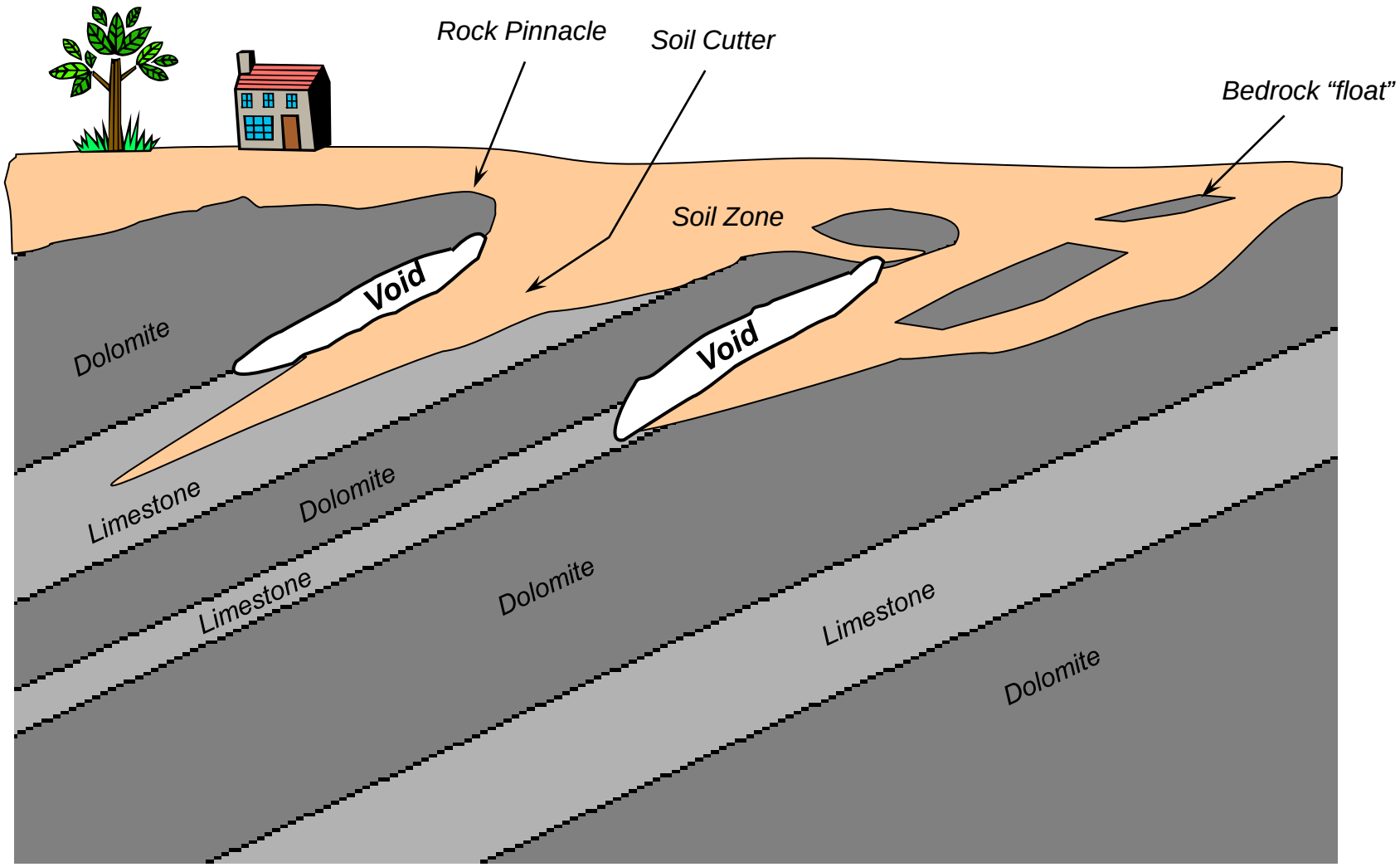
The standard penetration resistance values (N-values are used to describe the density of coarse-grained soils (GRAVEL, SAND) or the consistency of fine-grained soils (SILT, CLAY). Sandy silts of very low plasticity may be assigned a density instead of a consistency.

DENSITY		CONSISTENCY	
Term	N-Value	Term	N-Value
Very Loose	0 – 4	Very Soft	0 – 1
Loose	5 – 10	Soft	2 – 4
Medium-Dense	11 – 30	Medium Stiff	5 – 8
Dense	31 – 50	Stiff	9 – 15
Very Dense	> 50	Very Stiff	16 – 30
		Hard	>30

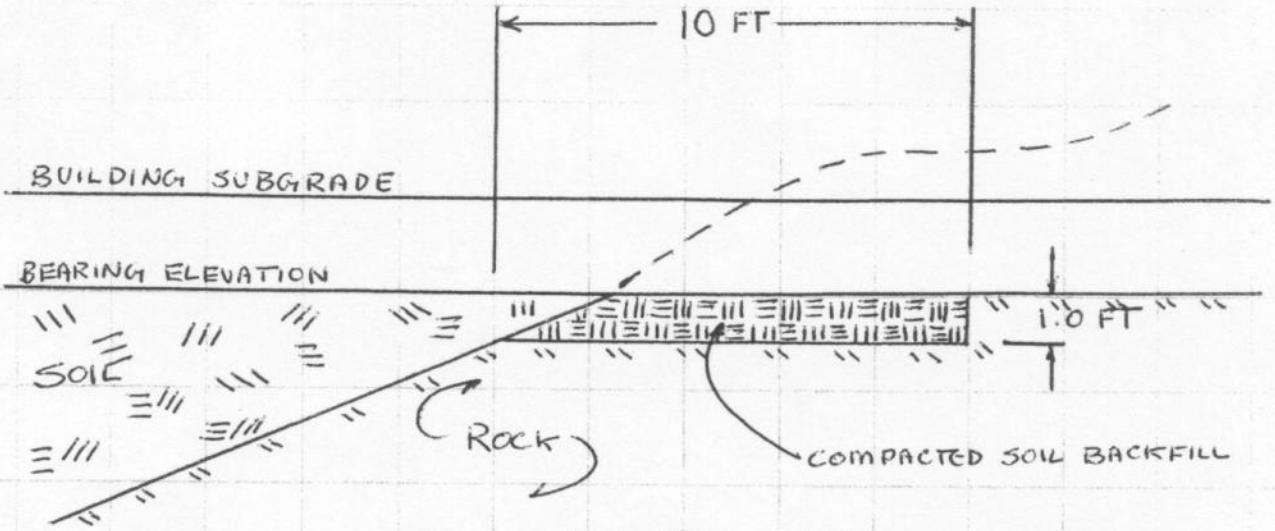
Notes:
1. The N-value is the number of blows of a 140 lb. hammer freely falling 30 inches required to drive a standard split-spoon sampler (2.0 in. O.D., 1-3/8 in. I.D.) 12 inches into the soil after properly seating the sampler 6 inches.
2. When encountered, gravel may increase the N-value of the standard penetration test and may not accurately represent the in-situ density or consistency of the soil sampled.

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D-2487)

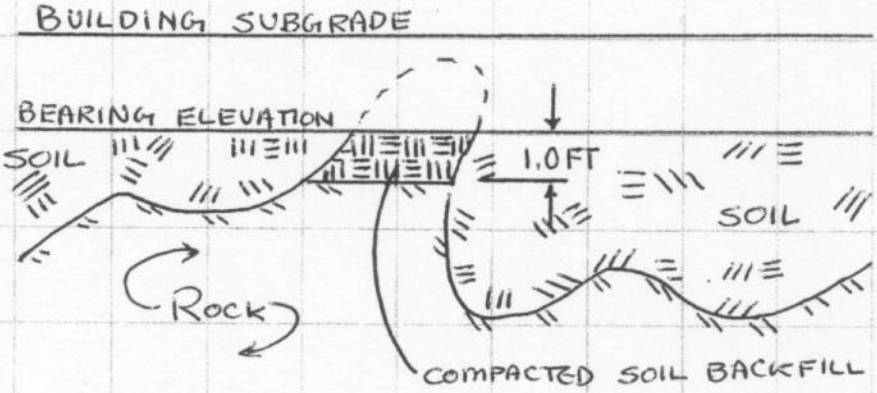
Major Divisions			Group Symbols	Typical Names	Laboratory Classification Criteria		
Coarse-grained soils (More than half of material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than No. 4 sieve size)	Clean gravels (little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 Sieve), coarse-grained soils are classified as follows: Less than 5 per cent GW, GP, SW, SP; More than 12 per cent GM, GC, SM, SC; 5 to 12 per cent Borderline cases requiring dual symbols	$C_u=D_{60}/D_{10}$ greater than 4; $C_c=(D_{30})^2/(D_{10} x D_{60})$ between 1 and 3	
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW	
		Gravels with fines (Appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below "A" line or PI less than 4	Above "A" line with PI between 4 and 7 are border-line cases requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits below "A" line or PI greater than 7	
	Sands (More than half of coarse fraction is smaller than No.4 sieve size)	Clean sands (little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines		$C_u=D_{60}/D_{10}$ greater than 6; $C_c=(D_{30})^2/(D_{10} x D_{60})$ between 1 and 3	
			SP	Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM	Silty sands, sand-silt mixtures		Atterberg limits above "A" line or PI less than 4	Above "A" line with PI between 4 and 7 are border-line cases requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures		Atterberg limits above "A" line or PI greater than 7	
Fine-grained soils (More than half material is smaller than No. 200 sieve	Silts and clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity			
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
			OL	Organic silts and organic silty clays of low plasticity			
	Silts and clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts			
			CH	Inorganic clays of high plasticity, fat clays			
			OH	Organic clays of medium to high plasticity			
	Highly organic soils		Pt	Peat and other highly organic soils			



Conceptual model of the site geology including alternating limestone and dolomite beds undergoing differential weathering. The weathering results in deep soil cutters in the limestone, tabular pinnacles of dolomite, and detached rock fragments often called "float". Voids form primarily in the limestone beds at the interface with the dolomite beds.
(Adapted from report by ATS International)



SOIL TO ROCK TRANSITION



ISOLATED ROCK PINNACLE

SINCE F&R 1881

FROEHLING & ROBERTSON, INC.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS
ENGINEERS • LABORATORIES
"OVER ONE HUNDRED YEARS OF SERVICE"

DATE:
SCALE: NOT TO SCALE
DRWN:

ROCK SUB-EXCAVATION DETAIL

DWG. NO.

Froehling & Robertson, Inc.

BORING LOG

Boring: B-1 (1 of 1)

Project No: 71U0078
Client: City of Harrisonburg
Project: Harrisonburg Solid Waste Transfer Station
City/State: Harrisonburg, VA

Elevation: 1254 ±
Total Depth: 15.0'
Boring Location: See Boring Location Plan

Drilling Method: HSA
Hammer Type: Automatic
Date Drilled: 6/17/16
Driller: S. Sequist

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
1253.5	0.5	6-INCHES, CRUSHED STONE	5-5-7	0.0		Subsurface water was not encountered during drilling or upon removal of augers.
		Dark Brown, Moist, Stiff, Sandy Lean CLAY (CL), Little Gravel **FILL**		1.5	12	
1252.0	2.0		4-7-7			
				3.0	14	
		Dark Gray and Orange Brown to Dark Brown, Moist, Stiff, Fat CLAY (CH), Little Gravel **FILL**		4.0		
			3-4-6			
				5.5	10	
1248.0	6.0	Dark Brown, Moist, Stiff, Lean CLAY (CL), Little Sand **ALLUVIUM**	2-6-9	6.0		
				7.5	15	
1245.5	8.5	Dark Orange Brown, Moist, Stiff, Fat CLAY (CH), Little Sand **RESIDUUM**	3-6-8	8.5		
				10.0	14	
			3-6-7	13.5		
1239.0	15.0	Terminated Test Boring at 15 Feet		15.0	13	

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.

BORING_LOG 71U-0078 BORING LOGS.GPJ F&R.GDT 7/22/16

Froehling & Robertson, Inc.

BORING LOG

Boring: B-2 (1 of 1)

Project No: 71U0078
Client: City of Harrisonburg
Project: Harrisonburg Solid Waste Transfer Station
City/State: Harrisonburg, VA

Elevation: 1250 ±
Total Depth: 15.0'
Boring Location: See Boring Location Plan

Drilling Method: HSA
Hammer Type: Automatic
Date Drilled: 6/17/16
Driller: S. Sequist

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
		24-INCHES, CRUSHED STONE	18-14-20	0.0	34	Subsurface water was not encountered during drilling or upon removal of augers.
1248.0	2.0	Dark Brown and Gray, Moist, Very Stiff to Stiff, Fat CLAY (CH), Little Sand, Contains Rock Fragments, Quartz Fragments, and Asphalt Fragments **FILL**	17-15-11	1.5	26	
				3.0		
			3-4-5	4.0	9	
			4-5-5	5.5	10	
				6.0		
				7.5		
1241.5	8.5	Dark Gray and Brown, Moist to Wet, Medium Stiff, Sandy Lean CLAY (CL), Trace Gravel, Organic Odor **ALLUVIUM**	2-3-4	8.5	7	
				10.0		
1236.5	13.5	Orange Brown, Moist to Wet, Medium Stiff, Fat CLAY (CH), Little Sand **RESIDUUM**	3-3-3	13.5	6	
1235.0	15.0			15.0		

Terminated Test Boring at 15 Feet

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.

BORING_LOG 71U-0078 BORING LOGS.GPJ F&R.GDT 7/22/16

Froehling & Robertson, Inc.

BORING LOG

Boring: B-3 (1 of 1)

Project No: 71U0078
Client: City of Harrisonburg
Project: Harrisonburg Solid Waste Transfer Station
City/State: Harrisonburg, VA

Elevation: 1250 ±
Total Depth: 12.5'
Boring Location: See Boring Location Plan

Drilling Method: HSA
Hammer Type: Automatic
Date Drilled: 6/17/16
Driller: S. Sequist

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
		24-INCHES, CRUSHED STONE	14-15-31	0.0	46	Subsurface water was not encountered during drilling or upon removal of augers.
1248.0	2.0	Dark Brown and Orange Brown, Moist, Very Stiff, Sandy Lean CLAY (CL), Little Gravel, Contains Rock Fragments and Asphalt Fragments **FILL**	6-11-12	1.5	23	
1246.0	4.0		6-5-6	3.0	11	
1244.0	6.0	Dark Brown, Moist, Stiff, Sandy Lean CLAY (CL), Little Sand and Gravel **FILL**	3-4-5	4.0	9	
1241.5	8.5	Dark Brown, Moist, Stiff, Sandy Fat CLAY (CH), Trace Rounded Gravel **ALLUVIUM**	2-4-5	5.5	9	
		Orange Brown, Moist to Wet, Stiff to Very Stiff, Fat CLAY (CH), Little Sand **RESIDUUM**	4-8-8	6.0	16	
		orange brown and gray		7.5		
				8.5		
				10.0		
				11.0		
1237.5	12.5	Auger Refusal at 12.5 Feet		12.5		Sampler Spoon bent.

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.

BORING_LOG 71U-0078 BORING LOGS.GPJ F&R.GDT 7/22/16

Froehling & Robertson, Inc.

BORING LOG

Boring: B-4 (1 of 1)

Project No: 71U0078
Client: City of Harrisonburg
Project: Harrisonburg Solid Waste Transfer Station
City/State: Harrisonburg, VA

Elevation: 1254 ±
Total Depth: 1.6'
Boring Location: See Boring Location Plan

Drilling Method: HSA
Hammer Type: Automatic
Date Drilled: 6/17/16
Driller: S. Sequist

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
1253.5	0.5	6-INCH, CRUSHED STONE		0.0		
1252.0	2.0	Dark Brown, Moist, Sandy Fat CLAY (CH), Little Gravel **POSSIBLE FILL**		1.5		
		Auger Refusal at 2 Feet				Subsurface water was not encountered during drilling or upon removal of augers.

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.

BORING_LOG 71U-0078 BORING LOGS.GPJ F&R.GDT 7/22/16

Froehling & Robertson, Inc.

BORING LOG

Boring: B-4A (1 of 1)

Project No: 71U0078
Client: City of Harrisonburg
Project: Harrisonburg Solid Waste Transfer Station
City/State: Harrisonburg, VA

Elevation: 1254 ±
Total Depth: 2.0'
Boring Location: 14 ft east of B-4

Drilling Method: HSA
Hammer Type: Automatic
Date Drilled: 6/17/16
Driller: S. Sequist

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
		Auger probed to 2 Feet.				
1252.0	2.0	Auger Refusal at 2 Feet				Subsurface water was not encountered during drilling or upon removal of augers.

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.

BORING_LOG 71U-0078 BORING LOGS.GPJ F&R.GDT 7/22/16

Froehling & Robertson, Inc.

BORING LOG

Boring: B-4B (1 of 1)

Project No: 71U0078
Client: City of Harrisonburg
Project: Harrisonburg Solid Waste Transfer Station
City/State: Harrisonburg, VA

Elevation: 1254 ±
Total Depth: 4.6'
Boring Location: 10 ft east of B-4A

Drilling Method: HSA
Hammer Type: Automatic
Date Drilled: 6/23/16
Driller: S. Sequist

Elevation	Depth	Description of Materials (Classification)	* Sample Blows	Sample Depth (feet)	N-Value (blows/ft)	Remarks
1253.8	0.3	3-INCHES, CRUSHED STONE	5-7-9	0.0	16	Subsurface water was not encountered during drilling or upon removal of augers.
		Dark Brown, Moist, Very Stiff to Medium Stiff, Fat CLAY (CH), Contains Rock Fragments, Trace Gravel and Sand **POSSIBLE FILL**	4-4-5	1.5	9	
				3.0		
			48-50/1"	4.0		
1249.4	4.6	Auger Refusal at 4.6 Feet			100+	Sampler Spoon bent

*Number of blows required for a 140 lb hammer dropping 30" to drive 2" O.D., 1.375" I.D. sampler a total of 18 inches in three 6" increments. The sum of the second and third increments of penetration is termed the standard penetration resistance, N-Value.

BORING_LOG 71U-0078 BORING LOGS.GPJ F&R.GDT 7/22/16

Froehling & Robertson, Inc.

SUBSURFACE PROFILE

Plot Based on Elevation

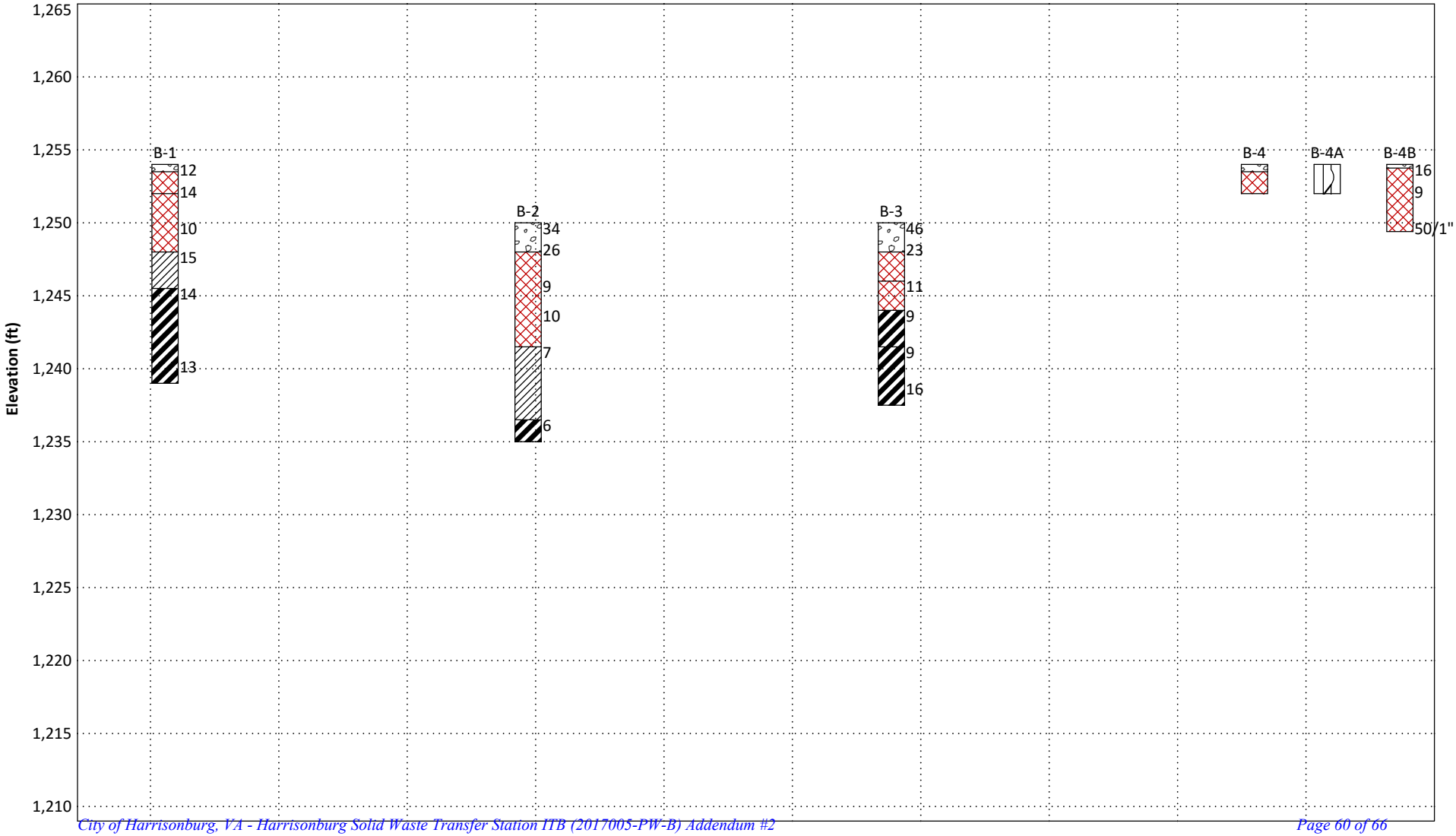
Profile Name: 1

Project No: 71U0078

Client: City of Harrisonburg

Project: Harrisonburg Solid Waste Transfer Station

City/State: Harrisonburg, VA



ELEV_LANDSCAPE_8.5X11 71U-0078 BORING LOGS.GPJ F&R.GDT 7/22/16

APPENDIX III

Important Information about Your

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical-Engineering Report Is Based on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical-engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical-engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold-prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical-engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold-prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your GBA-Member Geotechncial Engineer for Additional Assistance

Membership in the GEOPROFESSIONAL BUSINESS ASSOCIATION exposes geotechnical engineers to a wide array of risk confrontaton techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your GBA-member geotechnical engineer for more information.

GEOPROFESSIONAL BUSINESS ASSOCIATION

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@geoprofessional.org www.geoprofessional.org

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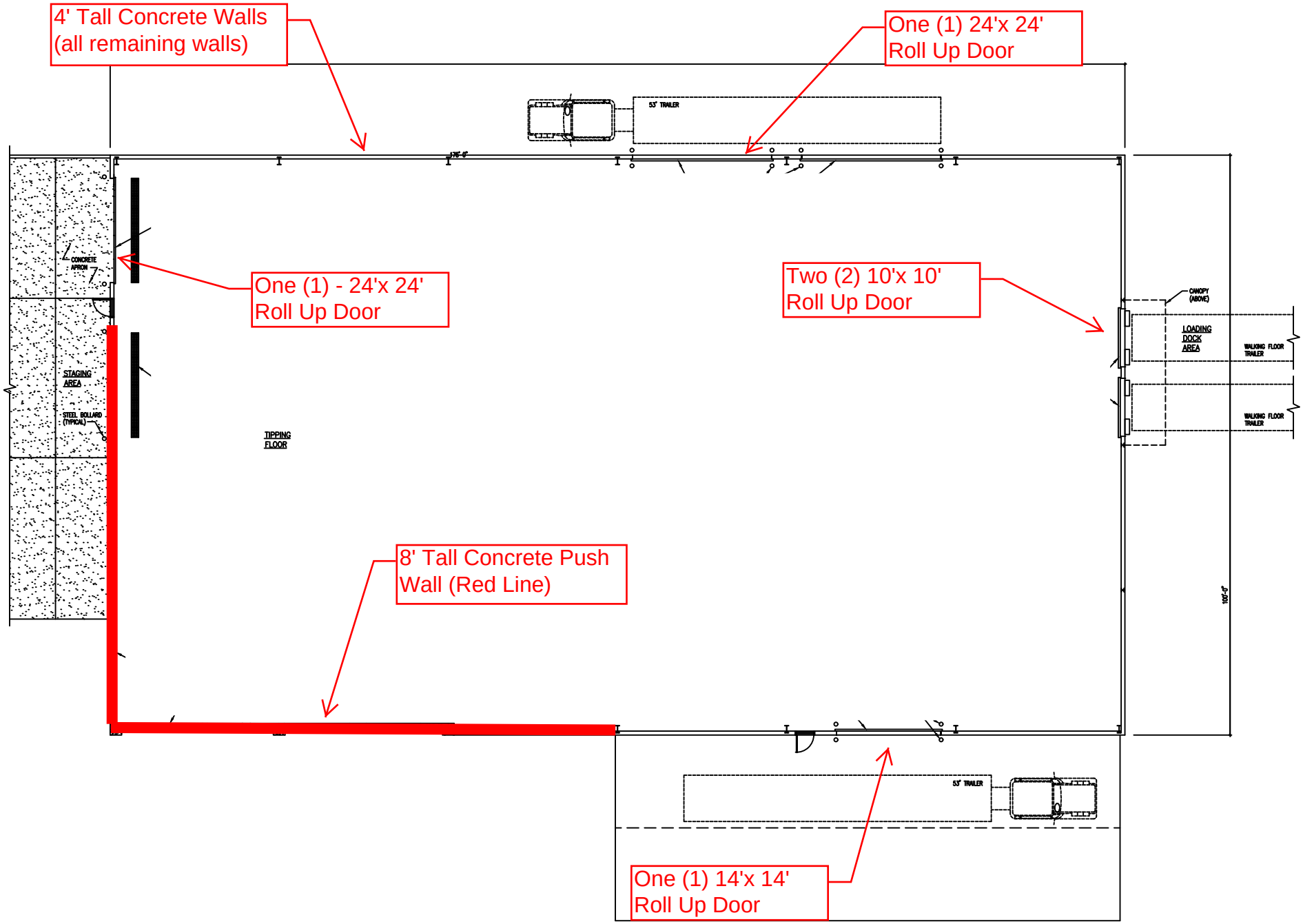
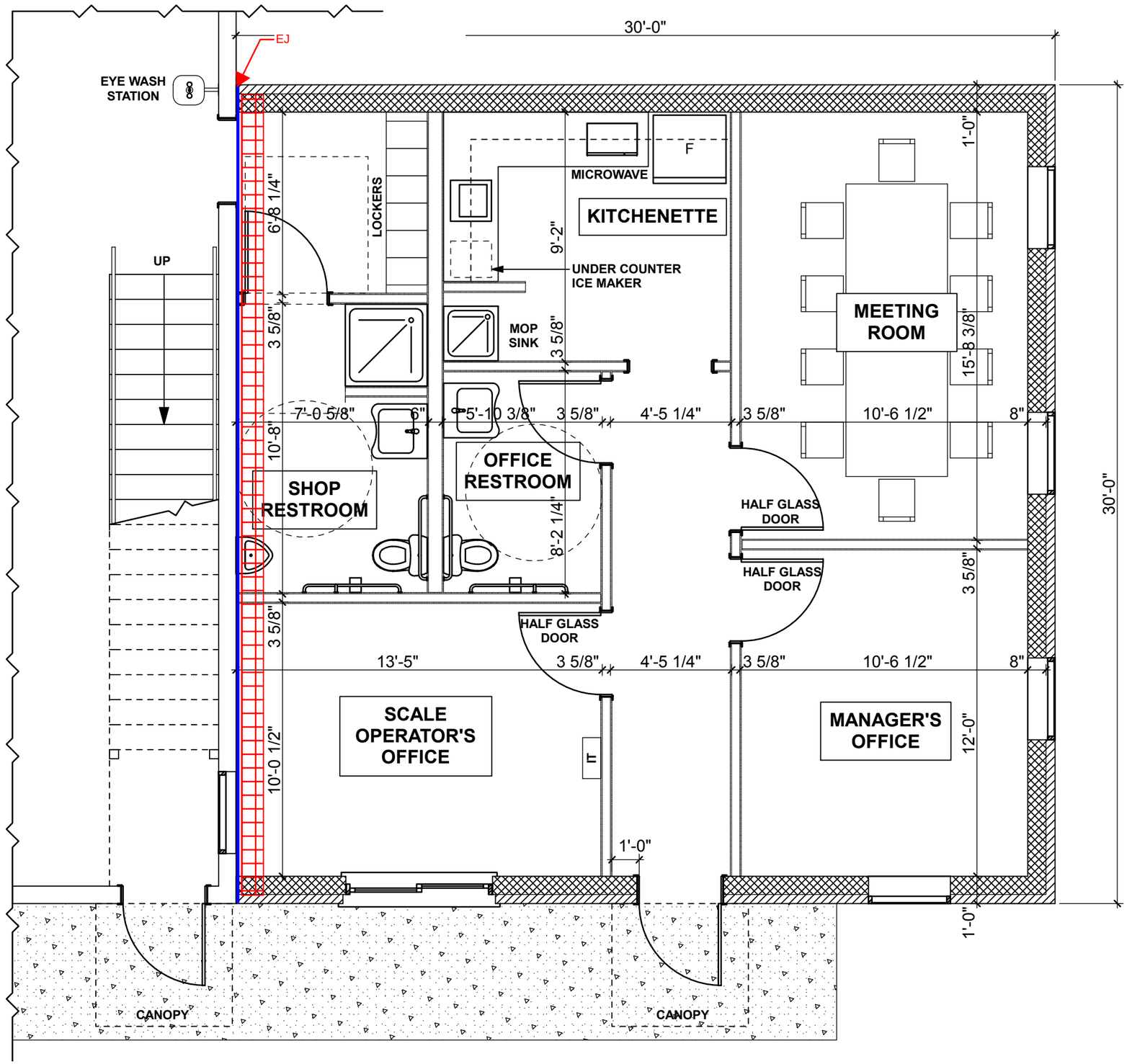


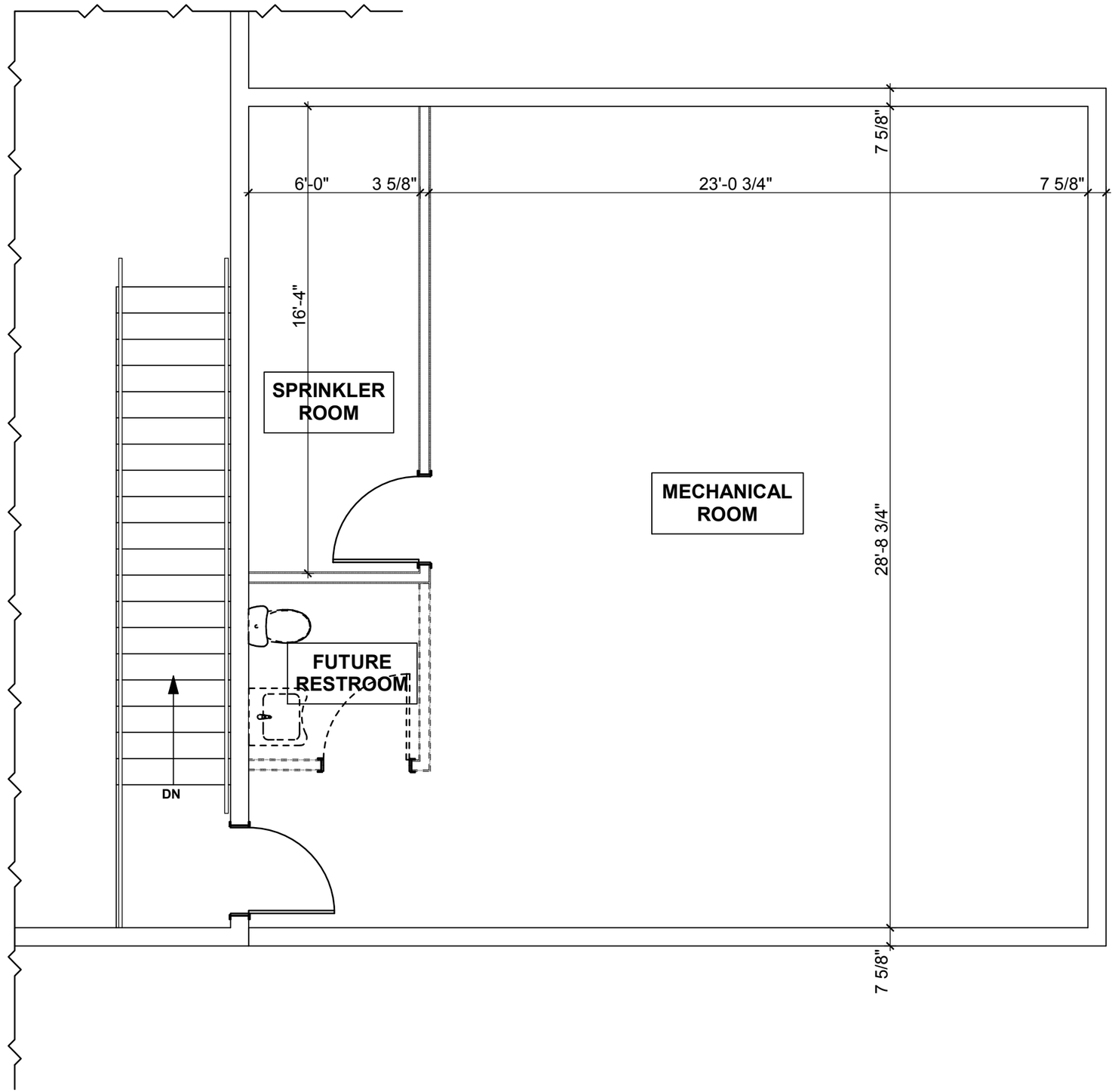
Solid Waste Transfer Building Door and Wall Configuration Layout

BLUE RIDGE
ARCHITECTS
126 W. Bruce Street, Suite 102
Harrisonburg, VA 22801



SCALE: 1/4" = 1'-0"
6/29/16

BLUE RIDGE
ARCHITECTS
126 W. Bruce Street, Suite 102
Harrisonburg, VA 22801



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6/29/16