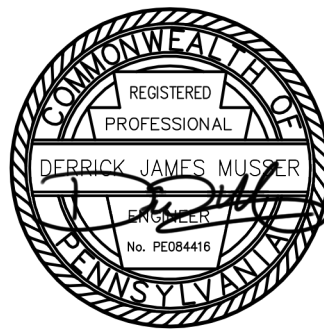


**POST CONSTRUCTION
STORMWATER MANAGEMENT REPORT
FOR
CHIQUES CROSSING**

RAPHO TOWNSHIP
LANCASTER COUNTY

PROJECT NO: 1212-002



December 7, 2023

(CONDITIONAL USE SUBMISSION)

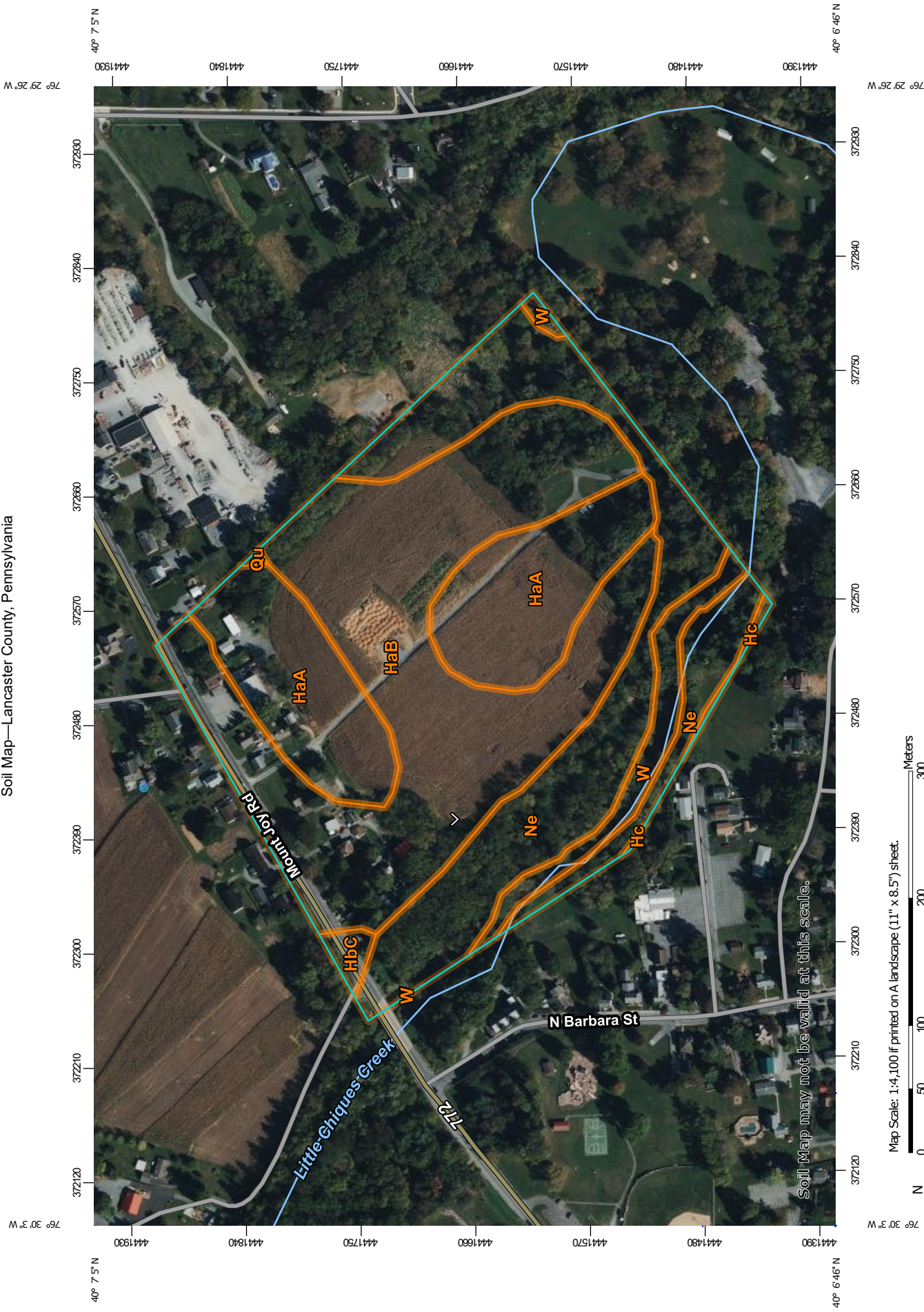
ELA GROUP, INC.

743 S. Broad Street • Lititz, PA 17543
(717) 626-7271 • Fax (717) 626-7040

Website: www.elagroup.com • Email: staff@elagroup.com
Central PA Office • State College, PA

AERIAL SOIL MAP

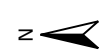
Soil Map—Lancaster County, Pennsylvania



Map Scale: 1:4,100 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84



STORMWATER MANAGEMENT NARRATIVE

PURPOSE

ELA Group, Inc. has prepared post construction stormwater management calculations as part of the supporting documentation for the new Chiques Crossing Conditional Use / Land Development Plan. This report shall be considered an actual part of the Post Construction Stormwater Management Plan which has been prepared to address applicable Municipal, County, and State requirements.

SITE DESCRIPTION

The project site currently consists of an open area of land on the east side of the Little Chiques Creek, south of Manheim / Mount Joy Road.

The site currently consists of an agricultural crop field on the majority of the site, along with some wooded areas near the floodplain and existing impervious/residential units along the roadway.

HYDROLOGY / CHAPTER 93 WATERS AND DESIGNATED USE

The site is tributary to Little Chiques Creek (WWF), which follows the perimeter of the property boundary to the west and south sides of the property.

PAST AND PRESENT LAND USE

Within the past 5 years, the existing land use has been a cultivated field with some wooded and impervious areas.

Within the past 50 years, the existing land use has been an undeveloped cultivated field, with some wooded and impervious areas.

SOIL DESCRIPTIONS, LIMITATIONS AND RESOLUTIONS

As per the USDA NRCS Web Soil Survey, the soils within the project area (Limit of Disturbance) are classified as follows:

- Hagerstown Silt Loam (Hydrologic Soil Group “B”)
- Hagerstown-Urban Land Complex (Hydrologic Soil Group “B”)
- Nolin Silt Loam (Hydrologic Soil Group “B”)

See Geotechnical Report in Appendix B for all information regarding on-site soils. It is recommended that a qualified Geotechnical Engineer be present onsite during all stages/phases of construction to evaluate, make recommendations, and provide solutions for all soil use limitations, construction techniques, and other soils-related items.

GEOTECHNICAL ASSESSMENT AND FEASIBILITY OF INFILTRATION:

ECS Mid Atlantic completed a full site geotechnical evaluation of the project site to evaluate the feasibility of the infiltration of stormwater. Based on their professional recommendation, *infiltration of stormwater is not a feasible design method for the treatment of stormwater volume for this specific site and therefore all stormwater BMPs have been designed as “Managed Release Concept (MRC)” facilities.*

For the full Geotechnical Report prepared by ECS, see Appendix B.

PROPOSED IMPROVEMENTS SUMMARY

The following summarizes the proposed major infrastructure improvements as they relate to stormwater management for the project area:

- Proposed residential buildings and associated improvements including parking lots, access drives, sidewalks, utilities, etc.
- Appropriate storm water management control, collection, and conveyance facilities and appropriate site grading to accommodate flows generated from the proposed improvements as detailed on the plans and documented in this report.

Overall, there is a net impervious area increase of 5.92 acres.

PRE AND POST DEVELOPMENT WATERSHED SUMMARY

The project site has been analyzed with three discharge points (DP):

- DP “001” is an existing PennDOT pipe system located on the south side of Mount Joy Road, just east of Cove Road.
- DP “002” is an existing PennDOT pipe system located at the intersection of Mount Joy Road and Milton Grove Road
- DP “003” is an area on the west side of the site located in the existing floodplain, east of the stream.
- DP “004” is an existing wetland pocket located on the east side of the stream. This DP has been isolated to specifically compare pre and post runoff volumes to the wetlands to ensure hydrology is being preserved to the wetland pocket that currently exists.
- DP “005” is an area in the southwest corner of the site within the floodplain area.
- DP “006” is an area in the southeast corner of the site that drains to another pocket of existing wetlands. This is the primary discharge point for the site. This DP has been isolated to specifically compare pre and post runoff volumes to the

wetlands to ensure hydrology is being preserved to the wetland pocket that currently exists.

For the pre and post development hydrology, the contributory drainage areas have been evaluated and analyzed utilizing existing documented land use and specific characteristics such as hydrological soil group, slope considerations, and vegetative cover. Times of concentration (Tc) paths have been evaluated to be representative of the watershed being analyzed.

See the Pre and Post Watershed Mapping in this report for watershed delineation.

STORMWATER BMP SUMMARY:

STORMTRAP UGDS (BMP-1)

- An underground concrete vault system have been designed to manage site stormwater that drains northwest and out to Manheim / Mount Joy Road (DP001) and have been designed to meet MRC design criteria.
- A SiteSaver water quality unit has been designed to pretreat all roof runoff prior to reaching the UGDS, per MRC design criteria requirements.

Bioretention Basins (BMP-2 and BMP-3)

- Two bioretention basin has been designed to attenuate flows to meet rate control reduction requirements, as well as provide treatment of pollutants.
 - All basins have been designed with their own specific plug planting plan to promote a naturalized look as well as evapotranspiration.
 - The BMPs have been designed as a MRC facilities via treatment through amended soil media. **The BMPs will contain 30” of amended soils, an underdrain with a restricted gate valve opening to promote evapotranspiration, and a 2ft impervious clay liner. The BMP has been designed as an MRC BMP per PADEP’s design criteria for managed release.**
- A Site Saver water quality unit have been designed to treat upstream runoff for the primary MRC basin (BMP-3). BMP-2 does not require pretreatment due to it’s relatively small drainage area and as it only collections roof runoff.

Stormtrap SiteSaver Water Quality Devices (Hydrodynamic Separator)

- SiteSaver is a unique hydrodynamic separator that utilizes trash containment devices, inclined plate technology and baffles to capture and easily remove trash and debris, floatables, hydrocarbons and sediment from waterway
- Two (2) SiteSaver units have been designed as pretreatment BMPs devices to treat runoff coming into the MRC BMPs, as well as treat runoff prior to leaving the

site. The units will filter out sediment, debris, and pollutants. This will increase the longevity of the BMPs and help reduce the amount of yearly maintenance required.

VOLUME SUMMARY CALCULATIONS – SEE PCSM SPREADSHEET APPENDIX A



DEP PCSM Spreadsheet
Version 1.9, October 2021

Volume Management

Project: Chiques Crossing

Structural BMP Volume Credits: No. Structural BMPs: Start BMP Numbering at:

DP No.	BMP No.	BMP Name	MIRC	Discharge	Incremental BMP DA (acres)	Volume Routed to BMP (CF)	Infiltration / Vegetated Area (SF)	Infiltration Rate (in/hr)	Infiltration Period (hrs)	Vegetated?	Media Depth (ft)	Storage Volume (CF)	Infiltration Credit (CF)	ET Credit (CF)
001	1	Dry Extended Detention Basin	Y	Off-Site	1.37	9,570	0	0.00	72	No	3.0	9,570	0	
004	2	Rain Garden / Bioretention	Y	Off-Site	2.40	9,911	11,000	0.00	72	Yes	2.5	9,911	0	7,095
006	3	Rain Garden / Bioretention	Y	Off-Site	10.33	84,472	25,286	0.00	72	Yes	2.5	84,472	0	16,309

Totals: 23,404

INFILTRATION & ET CREDITS (CF):
 MANAGED RELEASE CREDIT (CF):

NET CHANGE IN VOLUME TO MANAGE (CF):
 TOTAL CREDITS (CF):

VOLUME REQUIREMENT SATISFIED

RATE CONTROL SUMMARY (DISCHARGE POINTS DP-001 to DP-006)

Summary of Peak Flows - DP-001					
Target Post Development: 50% of 2yr, 5yr, 10yr, 25yr, 50yr and 100yr storm events					
Storm	Total Pre (CFS)	Target Post (CFS)	Total Post (CFS)	Rate Requirement Met	Flow Reduction Achieved
2 Year	3.38	1.69	1.66	✓	51%
5 Year	4.03	2.02	1.92	✓	52%
10 Year	7.14	3.57	3.13	✓	56%
25 Year	10.06	5.03	4.18	✓	58%
50 Year	12.69	6.35	5.12	✓	60%
100 Year	15.67	7.84	6.16	✓	61%

Summary of Peak Flows - DP-002					
Target Post Development: 50% of 2yr, 5yr, 10yr, 25yr, 50yr and 100yr storm events					
Storm	Total Pre (CFS)	Target Post (CFS)	Total Post (CFS)	Rate Requirement Met	Flow Reduction Achieved
2 Year	1.07	0.54	0.49	✓	54%
5 Year	1.24	0.62	0.53	✓	57%
10 Year	2.02	1.01	0.74	✓	63%
25 Year	2.71	1.36	0.92	✓	66%
50 Year	3.31	1.66	1.07	✓	68%
100 Year	3.98	1.99	1.25	✓	69%

Summary of Peak Flows - DP-003					
Target Post Development: 50% of 2yr, 5yr, 10yr, 25yr, 50yr and 100yr storm events					
Storm	Total Pre (CFS)	Target Post (CFS)	Total Post (CFS)	Rate Requirement Met	Flow Reduction Achieved
2 Year	0.56	0.28	0.09	✓	84%
5 Year	0.81	0.41	0.13	✓	84%
10 Year	2.24	1.12	0.35	✓	84%
25 Year	3.68	1.84	0.57	✓	85%
50 Year	5.06	2.53	0.78	✓	85%
100 Year	6.70	3.35	1.02	✓	85%

Summary of Peak Flows - DP-004					
Target Post Development: 50% of 2yr, 5yr, 10yr, 25yr, 50yr and 100yr storm events					
Storm	Total Pre (CFS)	Target Post (CFS)	Total Post (CFS)	Rate Requirement Met	Flow Reduction Achieved
2 Year	0.82	0.41	0.09	✓	89%
5 Year	1.37	0.69	0.13	✓	91%
10 Year	4.97	2.49	0.35	✓	93%
25 Year	8.88	4.44	0.57	✓	94%
50 Year	12.71	6.36	0.78	✓	94%
100 Year	17.31	8.66	1.57	✓	91%

Summary of Peak Flows - DP-005					
Target Post Development: 50% of 2yr, 5yr, 10yr, 25yr, 50yr and 100yr storm events					
Storm	Total Pre (CFS)	Target Post (CFS)	Total Post (CFS)	Rate Requirement Met	Flow Reduction Achieved
2 Year	0.40	0.20	0.15	✓	63%
5 Year	0.67	0.34	0.21	✓	69%
10 Year	2.43	1.22	0.57	✓	77%
25 Year	4.34	2.17	0.92	✓	79%
50 Year	6.21	3.11	1.26	✓	80%
100 Year	8.45	4.23	1.67	✓	80%

Summary of Peak Flows - DP-006					
Target Post Development: 50% of 2yr, 5yr, 10yr, 25yr, 50yr and 100yr storm events					
Storm	Total Pre (CFS)	Target Post (CFS)	Total Post (CFS)	Rate Requirement Met	% of Pre Devel. Flow Reduction Achieved
2 Year	2.10	1.05	0.66	✓	69%
5 Year	3.53	1.77	1.26	✓	64%
10 Year	12.79	6.40	5.56	✓	57%
25 Year	22.86	11.43	10.60	✓	54%
50 Year	32.73	16.37	15.65	✓	52%
100 Year	44.56	22.28	21.67	✓	51%

STANDARDS

The following criteria was utilized in the preparation of this report:

1. All flow calculations, velocities and related data were calculated using the values and parameters included in the *Commonwealth of PA*, PADOT, Bureau of Design, DESIGN MANUAL PART 2, HIGHWAY DESIGN, Latest Version, and/or Recommended Hydrology Procedures for Computing Runoff from Small Watersheds in Pennsylvania
2. Runoff coefficients ('CN' values) are based on the values listed in the Township Stormwater Ordinance.
3. Rainfall intensities ('I' value) are based on the NOAA data for the site location. See Appendix A.
4. All other storm water management calculations are based on the standards and criteria listed in the Township's Ordinances, Act 167 Plan, or accepted engineering practices.

METHODOLOGY

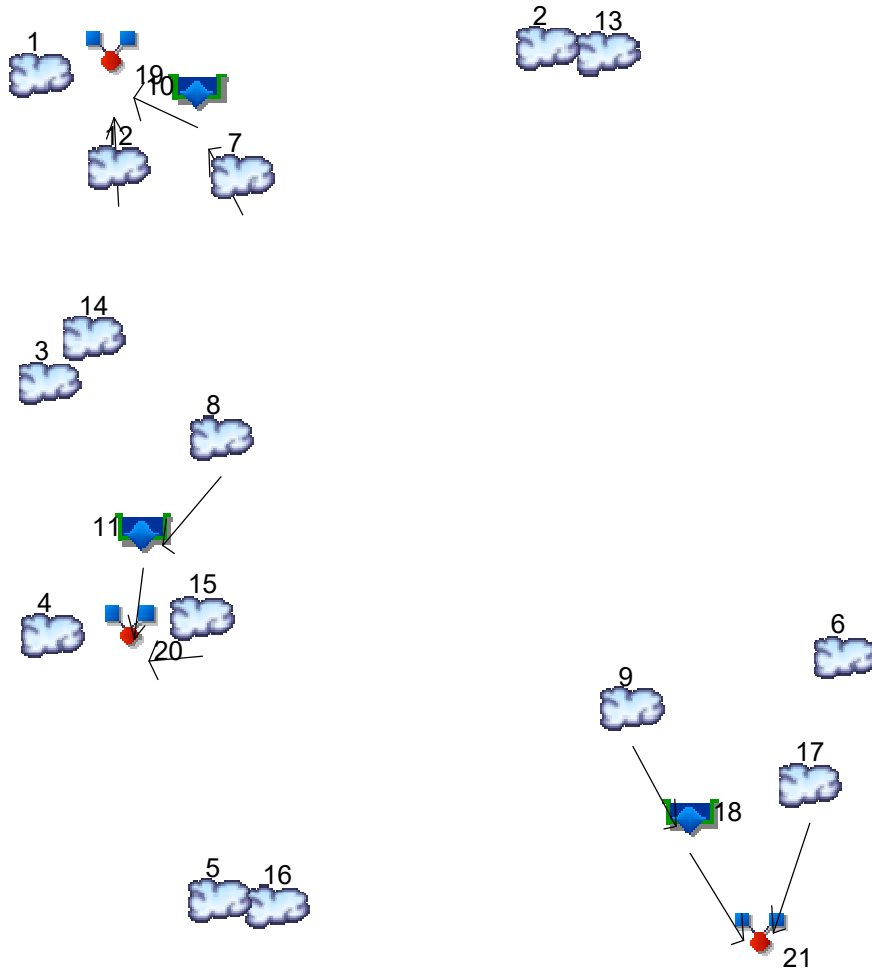
1. All storm water calculations for pipe and inlet sizing are based on the Universal Rational Method of determining peak flow rates of discharge utilizing $Q = CIA$, where
 Q = peak rate of discharge
 C = runoff coefficient
 I = rainfall intensity
 A = watershed area in acres
2. Drainage areas (watersheds) are based upon the topography as mapped on the drawings. Conditions have been field verified for accuracy with the downstream limits of all watersheds terminated at the site property line (when applicable) for comparison purposes when appropriate (see watershed mappings, this report).

3. Runoff coefficients ('c' values) were selected based on soil type, land slope, land cover and/or cover condition, unless otherwise noted. The <http://websoilsurvey.nrcs> website is the source of all soils information.
4. Time of concentration values (T_c) were calculated using Manning's kinematic solution for overland flows. All T_c values for concentrated flow are based upon Figure 3.1 of the *Urban Hydrology for Small Watersheds (TR 55)*. For calculations purposes, the T_c paths are established where they would not be drastically altered in the Post Development Condition to prevent drastically increased times, flow lengths, or other situations that would cause unrealistic comparisons between the Pre and Post Development peak flow rates. Time of concentration paths are established to be representative of the entire watershed.
5. Rainfall intensity values ("I") were determined based upon the calculated times of concentration and the corresponding intensity values for the various storm events.
6. Peak rates of discharge (Q) are calculated for design storm events based on the computed C, A, and I values.
7. Hydraflow Hydrographs software was used in determining the watershed runoff as well as determining the volume of the stormwater management systems
8. Storm sewer piping size was sized, unless otherwise indicated, for at least the 100-year storm event. Pipe sizing is determined, as indicated in the calculations, through either Manning's equation for pipes flowing full or standard-step energy balancing equations using HydraFlow Storm Sewers by Intelisolve.
9. Stormwater Management Volume Calculations as referenced in this Report have been calculated utilizing the Runoff Curve Number Method as referenced in the Soil Conservation Service (SCS) Technical Release Manual (TR-55) and as required by the PADEP NDPES Post Construction Stormwater Permit and as documented within PADEP Spreadsheet (latest edition)

OVERALL HYDROLOGY AND RETURN PERIOD RECAP

Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022



Legend

Hyd. Origin	Description
1 SCS Runoff	Pre 001
2 SCS Runoff	Pre 002
3 SCS Runoff	Pre 003
4 SCS Runoff	Pre 004 (Ex Wetlands)
5 SCS Runoff	Pre 005
6 SCS Runoff	Pre 006
7 SCS Runoff	BMP-1
8 SCS Runoff	BMP-2
9 SCS Runoff	BMP-3 (BASIN)
10 Reservoir	BMP-1 Out
11 Reservoir	BMP-2 Out
12 SCS Runoff	Post Uman 001
13 SCS Runoff	Post Uman 002
14 SCS Runoff	Post Uman 003
15 SCS Runoff	Post Uman 004
16 SCS Runoff	Post Uman 005
17 SCS Runoff	Post Uman 006
18 Reservoir	BMP-3 Out
19 Combine	Post DP 001
20 Combine	Post DP 004
21 Combine	Post DP 006

Hydrograph Return Period Recap

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	----	----	3.382	----	4.029	7.142	10.06	12.69	15.67	Pre 001
2	SCS Runoff	----	----	1.073	----	1.241	2.023	2.707	3.310	3.983	Pre 002
3	SCS Runoff	----	----	0.560	----	0.813	2.235	3.678	5.062	6.696	Pre 003
4	SCS Runoff	----	----	0.815	----	1.370	4.969	8.880	12.71	17.31	Pre 004 (Ex Wetlands)
5	SCS Runoff	----	----	0.398	----	0.669	2.426	4.336	6.208	8.451	Pre 005
6	SCS Runoff	----	----	2.098	----	3.526	12.79	22.86	32.73	44.56	Pre 006
7	SCS Runoff	----	----	3.660	----	4.197	6.664	8.800	10.68	12.77	BMP-1
8	SCS Runoff	----	----	3.468	----	4.210	7.843	11.23	14.38	17.98	BMP-2
9	SCS Runoff	----	----	33.74	----	37.92	56.69	72.68	86.64	102.14	BMP-3 (BASIN)
10	Reservoir	7	----	0.000	----	0.000	0.000	0.000	0.000	0.000	BMP-1 Out
11	Reservoir	8	----	0.004	----	0.005	0.045	0.308	0.429	1.470	BMP-2 Out
12	SCS Runoff	----	----	1.658	----	1.918	3.126	4.183	5.116	6.156	Post Uman 001
13	SCS Runoff	----	----	0.485	----	0.531	0.740	0.918	1.074	1.248	Post Uman 002
14	SCS Runoff	----	----	0.089	----	0.130	0.347	0.565	0.775	1.021	Post Uman 003
15	SCS Runoff	----	----	0.089	----	0.130	0.347	0.565	0.775	1.021	Post Uman 004
16	SCS Runoff	----	----	0.146	----	0.212	0.566	0.923	1.264	1.666	Post Uman 005
17	SCS Runoff	----	----	0.648	----	1.248	5.548	10.51	15.42	21.36	Post Uman 006
18	Reservoir	9	----	0.011	----	0.011	0.239	0.552	1.977	6.269	BMP-3 Out
19	Combine	10, 12,	----	1.658	----	1.918	3.126	4.183	5.116	6.156	Post DP 001
20	Combine	11, 15,	----	0.092	----	0.132	0.350	0.570	0.780	1.565	Post DP 004
21	Combine	17, 18,	----	0.656	----	1.256	5.558	10.60	15.65	21.67	Post DP 006

PRE DEVELOPMENT

**DETAILED ROUTINGS ARE NOT PROVIDED FOR
CONDITIONAL USE SUBMISSION EVEN THOUGH
THEY HAVE BEEN COMPLETED AS REFLECTED
IN THE SUMMARY RATE TABLES AND OVERALL
RETURN PERIOD RECAPS.**

**POST DEVELOPMENT HYDROLOGY
INCLUDES ROUTINGS FOR:**

- **BMP-1, BMP-2, BMP-3**

**DETAILED ROUTINGS ARE NOT PROVIDED FOR
CONDITIONAL USE SUBMISSION EVEN THOUGH
THEY HAVE BEEN COMPLETED AS REFLECTED
IN THE SUMMARY RATE TABLES AND OVERALL
RETURN PERIOD RECAPS.**

**FINAL ROUTINGS AND POND REPORTS WILL BE
PROVIDED AS PART OF FINAL LAND
DEVELOPMENT STORMWATER REPORT**

100 YR STORM SEWER AND HGL CALCULATIONS

**DETAILED STORM SEWER CALCS NOT
PROVIDED FOR CONDITIONAL USE SUBMISSION.
THEY WILL BE PROVIDED AS PART OF FINAL
LAND DEVELOPMENT STORMWATER REPORT**

APPENDIX 'A' – SUPPORTING DOCUMENTS

- **NOAA RAINFALL DATA**
- **RUNOFF CURVE NUMBERS AND “CN” VALUES**
 - **DEP PCSM SPREADSHEET**

**APPENDICES ARE NOT PROVIDED FOR
CONDITIONAL USE SUBMISSION.**

**THEY WILL BE PROVIDED AS PART OF FINAL
LAND DEVELOPMENT STORMWATER REPORT**

APPENDIX 'B' – GEOTECHNICAL REPORT



ECS Mid-Atlantic, LLC

Geotechnical Engineering Report for Stormwater Management

Chiques Crossing

3733 Mount Joy Road
Mount Joy, Lancaster County, Pennsylvania

ECS Project Number 18:5839

February 10, 2023





February 10, 2023

Brandon Conrad, CEO
Vistablock Westmount, LLC
150 Farmington Lane,
Lancaster, PA 17601

ECS Project No. 18:5839

Reference: Geotechnical Engineering Report for Stormwater Management
Chiques Crossing
Mount Joy, Lancaster County, Pennsylvania

Dear Mr. Conrad:

ECS Mid-Atlantic, LLC (ECS) has completed the subsurface exploration and geotechnical engineering analyses for the above-referenced project. Our services were performed in general accordance with our Proposal No. 18:9051-GP, dated December 27, 2022. This report presents our understanding of the geotechnical aspects of the project, results of the field exploration, laboratory testing, and our design and construction recommendations.

It has been our pleasure to be of service to Vistablock Westmount, LLC during this phase of this project. We would appreciate the opportunity to remain involved during the continuation of the design phase and to provide our services during construction phase operations as well to verify the assumptions of subsurface conditions made for this report. Should you have any questions concerning the information contained in this report, or if we can be of further assistance to you, please contact us.

Respectfully submitted,

ECS Mid-Atlantic, LLC



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Principal Engineer
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- Exploration Location Diagram
- Geologic Map
- Soil Survey Map
- Karst Features Map
- Carbonate Assessment Map

Appendix B – Field Operations

- Subsurface Exploration Procedure: Test Pit Excavation
- Test Pits TP-01 through TP-25
- Infiltration Test Results
- Test Pit Photographs
- Carbonate Assessment Photographs

Appendix C – Laboratory Testing

- Laboratory Test Results Summary
- Plasticity Chart
- Grain Size Analyses
- Textural Triangle USDA Test

Appendix D – Supplemental Report Documents

- Sinkhole Repair Details
- French Drain Installation Procedure

EXECUTIVE SUMMARY

The following summarizes the main findings of the exploration, particularly those that may have a cost impact on the planned development. Further, our principal foundation recommendations are summarized. Information gleaned from the Executive Summary should not be utilized in lieu of reading the entire geotechnical report.

- Groundwater depths measured at the time of excavation ranged from approximately 4.5 to 8 feet below the ground surface, corresponding to EL. 316.0 to EL. 317.5 ft. It should be noted that a creek (Little Chiques Creek) is located immediately west and south of the property and the water elevation (ranges from approximately EL. 314 to EL. 320 feet MSL via Google Earth) of this feature will directly influence the groundwater elevation at the site. Variations in the long-term water table may occur as a result of changes in precipitation, evaporation, surface water runoff, construction activities, and other factors.
- Based on the results of the infiltration testing, infiltration characteristics are very limited to negligible at the tested elevations. Therefore, ECS recommends that stormwater management for this property consist of volume and rate control (Managed Release Concept (MRC)) combined with water quality measures using BMP facilities.
- This site is underlain by carbonate geology, which presents a risk of sinkhole development, especially within stormwater management facilities. Careful site preparations and observation in accordance with this report, and proper repair of sinkholes will be key to site development.
- It should also be noted that variable limestone bedrock elevations are likely at this site; therefore, some rock excavation should be expected.

Refer to the text of the report for site specific design and construction recommendations.

1.0 INTRODUCTION

The purpose of this study was to provide geotechnical information for design and construction of a proposed Chiques Crossing Development at the project site. The recommendations developed for this report are based on project information supplied by Vistablock Westmount, LLC, including *Test Pit Plan*, by ELA Group, Inc. dated December 19, 2022.

Our services were provided in accordance with the Proposal No. 9051-GP, dated December 27, 2022, as authorized by Vistablock Westmount, LLC, dated January 5, 2023, which includes our Terms and Conditions of Service.

This report contains the results of our subsurface exploration, site characterization, laboratory testing, engineering analyses, and recommendations for the design and construction of the proposed development.

This report includes the following:

- A brief review and description of our field procedures.
- A review of surface topographical features and site conditions.
- A review of area and site geologic conditions.
- A review of subsurface soil stratigraphy with pertinent available physical properties.
- Final copies of our test pit logs.
- Infiltration testing results and recommendations for stormwater management.
- Evaluation and recommendations relative to groundwater.
- A discussion of potential of karst geology issues.

2.0 PROJECT INFORMATION

2.1 PROJECT LOCATION

The project site is located at the physical address of 3733 Mount Joy Road in Mount Joy, Pennsylvania. Currently, the site consists of several residential properties, agricultural field, and wooded areas. The site is generally bound by Little Chiques Creek to the west and south, by Mount Joy Road to the north and by a commercial property to the east. It should be noted that some of the subject property is located west of Little Chiques Creek. At the time of exploration, the site was sloped downward from Mount Joy Road towards Little Chiques Creek with a total topographic relief on the order of approximately 33 feet.

Refer to Figure 2.1.A and the Site Location Map in Appendix A for a detailed depiction of the project site location.



Figure 2.1.A – Site Location

2.2 PROPOSED CONSTRUCTION

Based on the *Test Pit Plan*, by ELA Group, Inc., dated December 19, 2022, we understand that the proposed development is composed of 6 apartment buildings, 5 garage buildings, stormwater management facilities, site retaining walls, a roundabout, a pump station, and associated parking and access drives. This report addresses only the stormwater management facilities for this development

3.0 FIELD EXPLORATION AND LABORATORY TESTING

Our exploration procedures are explained in greater detail in Appendix B including the insert titled Subsurface Exploration Procedure. Our scope of work included excavating 25 test pits and performing 47 corresponding double ring infiltration tests. Our test pits were located with a handheld GPS unit and their approximate locations are shown on the Exploration Location Plan in Appendix A.

3.1 SUBSURFACE CHARACTERIZATION

The following sections provide generalized characterizations of the soil strata. Please refer to the test pit logs in Appendix B.

SUBSURFACE STRATIGRAPHY	
Stratum	Description
n/a	Surficial Material: Topsoil Thickness 10.0 to 26.0 inches
I	FILL MATERIALS, encountered at isolated locations, LEAN CLAY with Gravel and SAND with Gravel, gray, black, and orangish brown, contains ash, debris, brick, and deleterious materials
II	Lean CLAY (CL) with varying amounts of sand and gravel, orangish brown to brown, moist, stiff to very stiff
III	Clayey GRAVEL with SAND (GC), orangish brown, moist to wet
IV	Weathered LIMESTONE, as GRAVEL with Clay, orangish brown and gray, moist, encountered in TP-02 only.

3.1.1 Stormwater Infiltration Testing

Additionally, our subsurface exploration also consisted of the oversight of twenty-five (25) test pits to explore the subsurface conditions and characterize the site relative to stormwater management. The test pits were conducted on-site under the supervision of ECS and infiltration testing was completed in each.

Infiltration testing was completed using the double ring infiltration in general accordance with Appendix C of the Pennsylvania Stormwater Best Management Practices (PA BMP) Manual. Infiltration test results are provided in the following table.

INFILTRATION TESTING RESULTS						
Test Location	Surface Elevation (Feet, MSL) ¹	Depth to Limiting Zone (Feet)	Limiting Zone Elevation (Feet, MSL)	Infiltration Test Depth (Feet)	Test Elevation (Feet, MSL)	Field Infiltration Rate (inches / hour) (Includes FS=2)
TP-01	337.5	8.5 ²	329.0	6.0	331.5	0.03
TP-02	336.0	5.0 ²	331.0	3.0	333.0	4.79
TP-03	343.0	4.5 ²	338.5	2.5	340.5	0.88
TP-04	338.0	N/E	N/A	4.0	334.0	0.28
				6.0	332.0	0.00
TP-05	338.5	N/E	N/A	4.0	334.5	0.00
				6.0	332.5	0.28
TP-06	334.0	N/E	N/A	4.0	330.0	0.00
				6.0	328.0	0.00
TP-07	333.0	8.5 ²	324.5	4.0	329.0	1.00
				6.0	327.0	0.00
TP-08	334.5	5.5 ²	329.0	1.5	333.0	2.25
				3.5	331.0	0.13
TP-09	335.0	9.0 ²	326.0	4.0	331.0	0.16
				6.0	329.0	0.00
TP-10	332.0	9.0 ²	323.0	4.0	328.0	0.25
				6.0	326.0	0.00
TP-11	332.0	5.5 ²	326.5	1.5	330.5	0.03
				3.5	328.5	0.13
TP-12	332.0	N/E	N/A	4.0	328.0	0.00
				6.0	326.0	0.06
TP-13	333.0	7.5 ²	325.5	3.5	329.5	0.03
				5.5	327.5	0.03
TP-14	334.0	5.5 ²	328.5	1.0	333.0	0.00
				3.0	331.0	0.00
TP-15	332.5	N/E	N/A	4.0	328.5	0.03
				6.0	326.5	0.09
TP-16	324.0	8.0 ³	316.0	4.0	320.0	0.06
				6.0	318.0	0.06
TP-17	324.0	8.0 ³	316.0	4.0	320.0	0.00
				6.0	318.0	0.38
TP-18	324.0	6.5 ³	317.5	2.5	321.5	0.50
				4.5	319.5	0.00
TP-19	321.0	4.5 ³	316.5	1.0	320.0	0.03
				2.5	318.5	0.09
TP-20	321.0	4.5 ³	316.5	1.0	320.0	0.00
				2.5	318.5	0.03
TP-21	321.0	5.0 ³	316.0	1.0	320.0	0.00
				3.0	318.0	0.00
TP-22	332.0	N/E	N/A	4.0	328.0	0.00
				6.0	326.0	0.00

INFILTRATION TESTING RESULTS						
Test Location	Surface Elevation (Feet, MSL) ¹	Depth to Limiting Zone (Feet)	Limiting Zone Elevation (Feet, MSL)	Infiltration Test Depth (Feet)	Test Elevation (Feet, MSL)	Field Infiltration Rate (inches / hour) (Includes FS=2)
TP-23	336.0	5.0 ²	331.0	2.5	333.5	0.00
						0.00
TP-24	349.0	N/E	N/A	4.0	345.0	0.44
				6.0	343.0	0.00
TP-25	349.0	N/E	N/A	4.0	345.0	1.00
				6.0	343.0	1.00

Note¹: Please note that the ground surface was not surveyed by a licensed surveyor; these elevations are approximate based on the provided plans; therefore, elevation ranges are approximate +/- half a foot.

Note²: Limiting zone is bedrock.

Note³: Limiting zone is groundwater.

3.2 CARBONATE ASSESSMENT

3.2.1 Site Geology

According to the Geologic Map of Pennsylvania (1980)¹, the site is underlain by the Epler Formation and the Hershey and Myerstown Formations, undivided. Based on *Engineering Characteristics of the Rocks of Pennsylvania*², the following are the descriptions for each formation.

The Epler formation is a very finely crystalline, medium-gray limestone interbedded with gray dolomite. The joints have a seamy pattern and are poorly to well developed, moderately abundant and moderately spaced. The bedrock formation is moderately resistant to weathering and found to be slightly weathered to a shallow depth. The Epler Formation possesses good subsurface drainage due to secondary porosity provided by joint and solution-channel openings ranging from low to medium in magnitude and a rock permeability that is low in magnitude. Limestone is carbonate based, and therefore, prone to dissolution in water and karst processes including sinkhole formation.

The Hershey formation consists of finely crystalline, dark-gray to black argillaceous limestone with a basal conglomerate that contains angular boulders of dolomite. The weathering is moderately resistant. Joints are well developed, displaying a platy pattern. This formation is generally highly fractured with moderate distance between fractures that are steeply dipping and open. The permeability is low while secondary porosity is provided through jointing and solution openings. Limestone is carbonate based, and therefore, prone to dissolution in water and karst processes including sinkhole formation.

The Myerstown Formation is characterized by a medium to dark gray, medium crystalline limestone. The formation is well bedded, thin to flaggy. The joints have a platy pattern, are well developed, and highly fractured. This formation is moderately resistant and moderately to highly weathered, it can be quickly weathered to a moderate depth. The surface drainage is good with minor subsurface drainage and secondary porosity occurring in the joints and solution openings. Limestone is carbonate based, and therefore, prone to dissolution in water and karst processes including sinkhole formation.

¹ Berg, T. M., Edmunds, W. E., Geyer, A. R., and others, compilers, 1980, Geologic map of Pennsylvania (2nd ed.): Pennsylvania Geological Survey, 4th ser., Map 1, 3 sheets, scale 1:250,000

² Geyer, A. R., and Wilshusen, J. P., (1982), *Engineering Characteristics of the Rocks of Pennsylvania*. Bureau of Topographic and Geologic Survey.

3.2.2 Karst Mapping

The Epler Formation and Hershey and Myerstown Formations, undivided are composed of carbonate bedrock that is prone to karst activity. Karst activity can take the form of soft and loose soils above the bedrock, uneven bedrock surfaces, closed surficial depressions, and sinkholes. The Karst Features Map located in Appendix A depicts a scale of the level of karst activity in the vicinity of the site. The Karst Features Map shows no apparent sinkholes and 80 surface depressions within about ½ mile of the project site; however, the data is incomplete as there is not a requirement within the State to track and document the naturally developing karst activity. Based on our experience in the area and known karst features at nearby sites, the risk of sinkholes and related karst activity near this location is moderate.

3.2.3 Aerial Photograph Review

An aerial photograph study was performed to review the presence of karst features across the project site. Aerial photographs taken in 1940, 1947, 1957, 1971, 1988, 1993, 1994, 1999, 2004, 2005, 2008, 2010, 2012, 2013, 2015, 2016, 2018, 2019, and 2022 were reviewed. The digital aerial photographs used for this study were obtained from publicly available resources (PASDA: <https://maps.psiee.psu.edu/ImageryNavigator> and Google Earth).

The subject property appeared to have been partially-developed at the time the 1940 aerial photograph was taken. Specifically, a few residential properties were visible at the north of the property. The southern portion of the property appears to have been used for agricultural purposes. Given our review of the available aerial photographs, the subject property has remained consistent in the form of a partially-developed parcel of land with agricultural fields to the south, throughout the timeline of the reviewed photographs. It should be noted that the on-site stockpile appeared to have been formed sometime between 2019 and 2022.

Circular tonal features which can be interpreted as possible areas of elevated moisture and/or karst activity associated with potential closed depression/surface depression features were identified in some of the aerial photographs across the property during our review.

No bedrock outcrops or sinkholes were visible within the footprint of the subject property on the reviewed aerial photography. Additionally, no ghost lakes occurring after rainfall events, springs, or surface drainage entering the ground were observed.

Indications of lineaments, caverns, intermittent lakes, and rock outcrops or pinnacles were not noted on the subject property on any of the reviewed aerial photographs. These interpolations were based on judgement and experience of the photo-interpreter.

3.2.4 Site Reconnaissance

A site walk was performed during our fieldwork activities on January 24, 2022 to verify the results of the desktop study and to further evaluate the property for any potential karst features. At the time of our site walk, the project site consisted of a partially-developed parcel of land including several building structures, agricultural fields, and localized wooded areas.

At the time of our fieldwork, no apparent signs of discernible subsurface pinnacles, lineaments, fracture traces, caverns, or intermittent lakes were observed. However, potential karst features in the form of a

potential sinkhole/subsidence feature, surficial rock, and a surficial depression were observed. The locations of these features are presented in the table below.

Observed Karst Feature Locations		
Feature	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)
SD-01	40.11541028	-76.49779922
Sinkhole	40.11493000	-76.49711000
SR-01	40.11528000	-76.49503000
SR-02	40.11506000	-76.49577000
SR-03	40.11700000	-76.49495000
SR-04	40.11492000	-76.49575000
SR-05	40.11462000	-76.49549000
SR-06	40.11452000	-76.49556000
SR-07	40.11449000	-76.49594000

ECS recommends these features be explored with a test pit at each location under the supervision of ECS in the early stages of earthwork in order to determine if potential repairs are necessary.

Additionally, apparent animal burrows were frequently observed during the site walk generally located around the eastern portion of the site, which can potentially be indicative of soft/loose soils associated with karst activity.

Photographs of the observed features are presented on the Carbonate Assessment Photographs and their approximate locations at the site are presented on the Carbonate Assessment Map within Appendix A.

3.3 SOIL SURVEY MAPPING

Based on our review of the Soil Survey (USDA - Natural Resources Conservation Service (websoilsurvey.nrcs.usda.gov), the site soils are mapped Hagerstown silt loam, 0 to 8 percent slopes, Hagerstown silty clay loam, 8 to 15 percent slopes, Hagerstown-Urban land complex, and Nolin Silt Loam. This soil type is described as having the following properties:

SOIL MAPPING SUMMARY						
Mapped Soil Unit	Soil Unit Symbol	Origin/Type	Depth to Restrictive Feature	Depth to Water Table	Hydrologic Soil Group	KSat (in/hr)
Hagerstown silt loam, 0 to 8 percent slopes	HaA / HaB	Residuum weathered from limestone	>80 inches	>80 inches	B	(0.60 – 2.00)
Hagerstown silty clay loam, 8 to 15 percent slopes	HbC	Residuum weathered from limestone	40 to 99 inches to lithic bedrock	>80 inches	B	(0.60 – 2.00)

SOIL MAPPING SUMMARY						
Mapped Soil Unit	Soil Unit Symbol	Origin/Type	Depth to Restrictive Feature	Depth to Water Table	Hydrologic Soil Group	KSat (in/hr)
Hagerstown-Urban land complex	Hc	Residuum weathered from limestone	40 to 99 inches to lithic bedrock	>80 inches	B	(0.60 – 2.00)
Nolin Silt Loam	Ne	Alluvium derived from sedimentary rock over residuum weathered from limestone and shale	60 to 99 inches to lithic bedrock	About 36 to 60 inches	B	(0.60 – 2.00)

3.4 GROUNDWATER OBSERVATIONS

Water levels were measured during the on-site exploration and are included on our test pit logs in Appendix B. Groundwater depths measured at the time of excavation ranged from approximately 4.5 to 8 feet below the ground surface, corresponding to EL. 316.0 to EL. 317.5 ft, in test pits TP-16 through TP-19 in the southeast corner of the site. Our test pits were left open for a period of approximately five (5) hours and the stabilized groundwater readings can be found in the table below. Based on the encountered groundwater depths, the stabilized groundwater table appears to be at an approximate elevation of EL. +316.0 to 317.0 feet, MSL on the southeast portion of the site. Additionally, no apparent signs of the seasonal high ground water table were observed while probing below the infiltration testing depths in other areas of the site explored with test pits.

It should be noted that a creek (Little Chiques Creek) is located immediately west and south of the property and the water elevation (ranges from approximately EL. 314 to EL. 320 feet MSL via Google Earth) of this feature will directly influence the groundwater elevation at the site in nearby proximity. Variations in the long-term water table may occur as a result of changes in precipitation, evaporation, surface water runoff, construction activities, and other factors.

GROUNDWATER READINGS			
Location	Existing Grade (Feet, MSL) ¹	Approximate Groundwater Depth (Feet)	Approximate Groundwater Elevation (Feet, MSL)
TP-16	324.0	8.0	316.0
TP-17	324.0	8.0	316.0
TP-18	324.0	6.5	317.5
TP-19	321.0	4.5	316.5
TP-20	321.0	4.5	316.5
TP-21	321.0	5.0	316.0

Note¹: Please note that the ground surface was not surveyed by a licensed surveyor; these elevations were interpolated by the provided plan; therefore, elevation ranges are approximate +/- half a foot.

3.5 LABORATORY TESTING

The laboratory testing consisted of selected tests performed on samples obtained during our field exploration operations. Classification and index property tests were performed on representative soil samples.

Each sample was visually classified on the basis of texture and plasticity in accordance with ASTM D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedures) and including USCS classification symbols, and ASTM D2487 Standard Practice for Classification for Engineering Purposes (Unified Soil Classification System (USCS)). After classification, the samples were grouped in the major zones noted on the boring logs in Appendix B. The group symbols for each soil type are indicated in parentheses along with the soil descriptions. The stratification lines between strata on the logs are approximate; in situ, the transitions may be gradual.

4.0 DESIGN RECOMMENDATIONS

4.1 STORMWATER MANAGEMENT AREAS

4.1.1 Stormwater Management Facilities

General: The plan provided to ECS displayed proposed locations for the stormwater management facilities. Stormwater management facilities are expected to consist of a combination of at-grade and below-grade facilities. The recommendations presented below should be considered during design and construction.

4.5.1.a Infiltration Characteristics

Based on the results of the infiltration testing, infiltration characteristics are very limited to negligible at the tested elevations. Clay soils were found across the project site and typically lead to low rates of infiltration. In addition, the underlying bedrock is carbonate and would have a higher susceptibility to karst features if infiltration were promoted.

For these reasons, ECS recommends that stormwater management for this property consist of volume and rate control (Managed Release Concept (MRC)) combined with water quality measures using BMP facilities. For design purposes we recommend that stormwater management facilities consist of BMP areas for water quality with underdrains to convey the water offsite.

ECS recommends that specific construction notes appear on the plans requiring full-time observation of the excavation of the basins by the authorized ECS representative to verify suitable conditions are present. ECS can assist in developing these notes once plans become more final.

4.5.1.b Embankment/Outlet Structures/Slopes

Embankment construction or cut slopes to facilitate pond construction should incorporate side slopes of 3(H):1(V) or flatter. If steeper slopes are necessary, ECS should be contacted to review the proposed slope geometry.

Fill materials should be placed to a minimum of 95% of the maximum dry density of the material, as determined by the Standard Proctor method (ASTM D698). The moisture content of the materials should be within $\pm 3\%$ of the optimum.

Storm water management facilities with embankments should include the construction of a clay core having a minimum thickness of 2 feet. Clay suitable for this use should consist of CL or CH materials, having a minimum of 70% fines (passing #200 sieve), a minimum liquid limit (LL) of 40 and minimum plasticity index (PI) of 20. This material should be approved by the Geotechnical Engineer. Clay core materials should be compacted to 95% of the standard proctor maximum dry density at a moisture content that is at or up to 3% above the optimum. Limited laboratory testing of the on-site materials did indicate the presence of soils that meet the criteria listed above.

4.5.1.c Temporary Sediment Basin Fill Embankments

Soils used in temporary sediment basin fill embankments should satisfy the requirements for fill discussed below and should be placed and compacted to the specification requirements for Structural Fill. Care should be taken not to track heavy equipment over the basin bottom during construction.

4.1.2 Stormwater Management Considerations

The property is underlain by carbonate geology which is prone to sinkhole development. The owner should understand that the concentrated influx of stormwater to a select area will increase the potential of sinkhole development. In order to reduce the rate of sinkhole development, and in keeping with the guidelines and recommendations of the PA BMP Manual, we recommend that the following design principles be incorporated.

- Use existing drainage patterns
- Keep stormwater away from known sinkholes or problematic subsidence areas
- Avoid concentrating stormwater
- Reduce runoff volume and velocity
- Use broad shallow basins
- Maintain the facilities post construction
- Provide underdrains or other means for dewatering in stormwater management facilities if needed

4.1.3 Stormwater Management Facilities - Design Notes

It has been our experience that construction of basins may encounter conditions that were not anticipated as a result of the subsurface exploration. As a result, we have developed the following sequence of items for addressing construction related difficulties or discrepancies with the design assumptions. We recommend that these recommendations be included in the stormwater management feature construction notes on the plans.

- A) If redoximorphic features (soil mottling and coloration patterns formed by the reduction of iron and/or manganese from saturated conditions in the soil) are encountered:
- A qualified professional should determine if the features observed are associated with a historic condition (associated with fill, previous site condition, or natural coloration) or are associated with conditions that could presently occur (seasonal variations in the water table).
 - Evaluate the elevation of the features relative to the proposed design elevation of the SWM feature and determine if the size and elevation of the SWM feature can be adjusted to alleviate the conflict.
 - Retain ECS and Civil Engineer to evaluate alternate design concepts. Alternate designs proposed by the Professional should be sealed and submitted to the Township for approval.

If material replacement is required in structural areas (Ex: below-grade SWM facilities in paved areas), material placement specifications, including materials type, mix ratio, compactive effort and required density should be determined by ECS. Suitable soil mixtures can consist of a blend of on-site and/or off-site materials available to the Contractor and approved by ECS.

5.0 SITE CONSTRUCTION RECOMMENDATIONS

5.1 KARST RELATED – GENERAL RISK

Although sinkholes stem from geologic conditions within the underlying rock, they are often triggered by changes in the surface and subsurface drainage patterns. In order to reduce the potential for future sinkhole development which could impact foundation performance, positive surface drainage should be maintained both during and after construction. ECS recommends that the following preventative measures be followed to reduce the potential inducement of sinkhole formation in proposed development areas and to incorporate good construction practices. If subsidence features such as sinkholes, surface depressions, and exposed rock pinnacles are encountered, ECS should be consulted to provide a recommendation for repair on a case-by-case basis.

1. Earthwork operations should be graded to drain away from structures at all times. Upon completion of daily earthwork operations, the ground surface should be sealed by thorough rolling to reduce infiltration of precipitation and facilitate runoff.
2. Sediment control management facilities should be located outside of planned construction areas. Inlets associated with storm drain systems should not be utilized as temporary sediment control devices during construction.
3. During construction, care should be taken to reduce the ponding of surface water in and/or adjacent to the buildings. The foundations should be excavated and poured the same day, if possible, or the founding soils should be provided with a mud mat (lean concrete).
4. Visual observations during all earthwork operations should be carried out in order to detect previous unexposed or recently created collapse features. Such features should be called to ECS's attention for remedial improvement.
5. Final site grading should include sloping grades and piping of downspouts away from the building.
6. Storm piping should be designed such that joints and structure tie-ins remain watertight with allowance for some settlement. Leaking storm pipes promote subsurface seepage and can instigate sinkhole development in the form of surficial dropouts with little or no warning. It may be beneficial to use bentonite clay around all pipe joints to reduce the potential for long-term leaking.

Areas identified to be suspect during the initial earthwork phase should be further explored during construction to determine the extent, both vertically and horizontally, of possible solution activity. We recommend that all available geotechnical data be made available to ECS during earthwork operations.

5.2 STORMWATER CONSTRUCTION RECOMMENDATIONS

It is recommended that verification of the subgrade conditions at the time of construction be conducted by an authorized ECS representative.

During excavation of the basin, the materials at the bottom of basin should be verified to be consistent with those encountered in the exploration. Proper performance of infiltration facilities will be influenced by the variability in the subsurface. It will be important that construction equipment does not traffic on

the materials at the infiltration bed elevation, and that hand probing on an approximately 25 foot grid or isolated test pits be provided to evaluate proper offset distances from bedrock limiting zones.

It should be noted that variable depths to limestone bedrock are very common in this area. Some rock excavation may be required to achieve bottom of basin elevations with the required 2-foot of buffer below the basin subgrade.

We recommend all SWM facilities be located a minimum of 25 feet from all adjacent buildings, taken from edge of SWM facility to outside of footing. The allowable buffer distance is highly dependent on site constraints including but not limited to, foundation type, subgrade soils, geology, structural loading, foundation bearing elevation, invert elevation, and groundwater. If site constraints prohibit this recommendation, the facility may be located closer to a building subject to the review and approval of ECS.

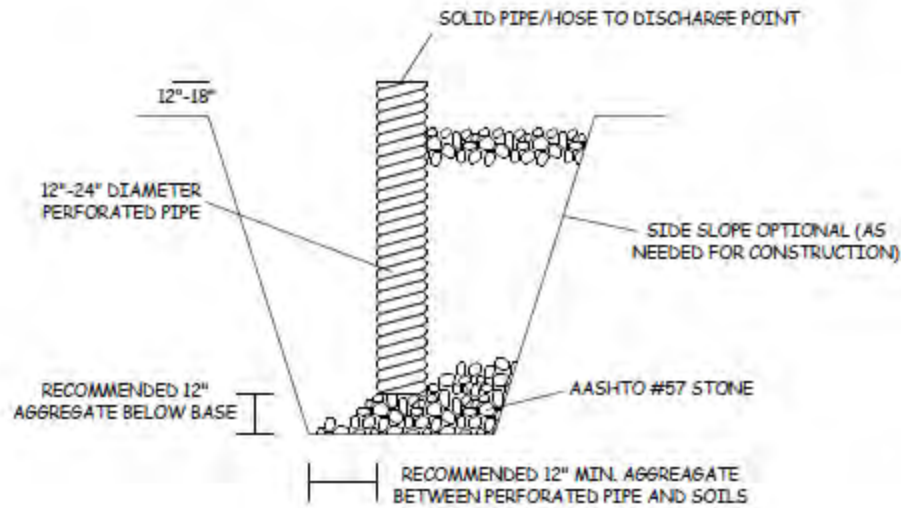
5.3 SITE TEMPORARY DEWATERING

The contractor shall make their own assessment of temporary dewatering needs based upon the limited subsurface groundwater information presented in this report. Soil sampling is not continuous, and thus soil and groundwater conditions may vary between sampling intervals (typically 5 feet). If the contractor believes additional subsurface information is needed to assess dewatering needs, they should obtain such information at their own expense. ECS makes no warranties or guarantees regarding the adequacy of the provided information to determine dewatering requirements; such recommendations are beyond our scope of services.

Dewatering systems are a critical component of many construction projects. Dewatering systems must be selected, designed, and maintained by a qualified and experienced (specialty or other) contractor familiar with the succinct geotechnical and other aspects of the project. The failure to properly design and maintain a dewatering system for a given project can result in delayed construction, unnecessary foundation subgrade undercuts, detrimental phenomena such as ‘running sand’ conditions, internal erosion (i.e., ‘piping’), the migration of ‘fines’ down-gradient towards the dewatering system, localized settlement of nearby infrastructure, foundations, slabs-on-grade and pavements, etc. Water discharged from a site dewatering system shall be discharged in accordance with all local, state and federal requirements.

Strategies for Addressing Perched Groundwater:

The typical primary strategy for addressing perched groundwater seeping into excavations is pumping from trench (or French) and sump pits with sump pumps. A typical sump pump drain (found in a sump pit or along a French drain) is depicted below. The inlet of the sump pump is placed at the bottom of the corrugated pipe and the discharge end of the sump is directed to an appropriate stormwater drain.



Sump Pit/Pump Diagram

Details of a typical French drainage installation are included in Appendix D. A typical French drain consists of an 18 to 24-inch wide by 18 to 24-inch deep bed of AASHTO #57 (or similar open graded aggregate) aggregate wrapped in a medium duty, non-woven geotextile and (sometimes) containing a 6-inch diameter, Schedule 40 PVC perforated or slotted pipe. Actual dimensions should be as determined necessary by ECS during construction. After the installation has been completed, the geotextile should be wrapped over the top of the aggregate and pipe followed by placement of backfill. The top of the drain should be positioned at least 18 inches below the design subgrade elevations. Drains should not be routed within the expanded building limits.

Pumping wells or a vacuum system could also be used to address perched groundwater. These techniques often are only effective during the initial depletion of the perched water quantity and may quickly be ineffective at addressing accumulation of water from rain, snow, etc.

5.4 SINKHOLE REPAIR

If a sinkhole develops at the project site, ECS can provide observation, documentation, and recommendations for repair. Due to the karst nature of the project site, proper repair is imperative. Typical sinkhole repair details are included in Appendix D.

6.0 CLOSING

ECS has prepared this report to guide the geotechnical-related design and construction aspects of the project. We performed these services in accordance with the standard of care expected of professionals in the industry performing similar services on projects of like size and complexity at this time in the region. No other representation, expressed or implied, and no warranty or guarantee is included or intended in this report.

The description of the proposed project is based on information provided to ECS by Vistablock Westmount, LLC. If any of this information is inaccurate, either due to our interpretation of the documents provided or if the site's design changed, ECS should be contacted immediately to review the report in light of the changes and provide additional or alternate recommendations as required to reflect the proposed construction.

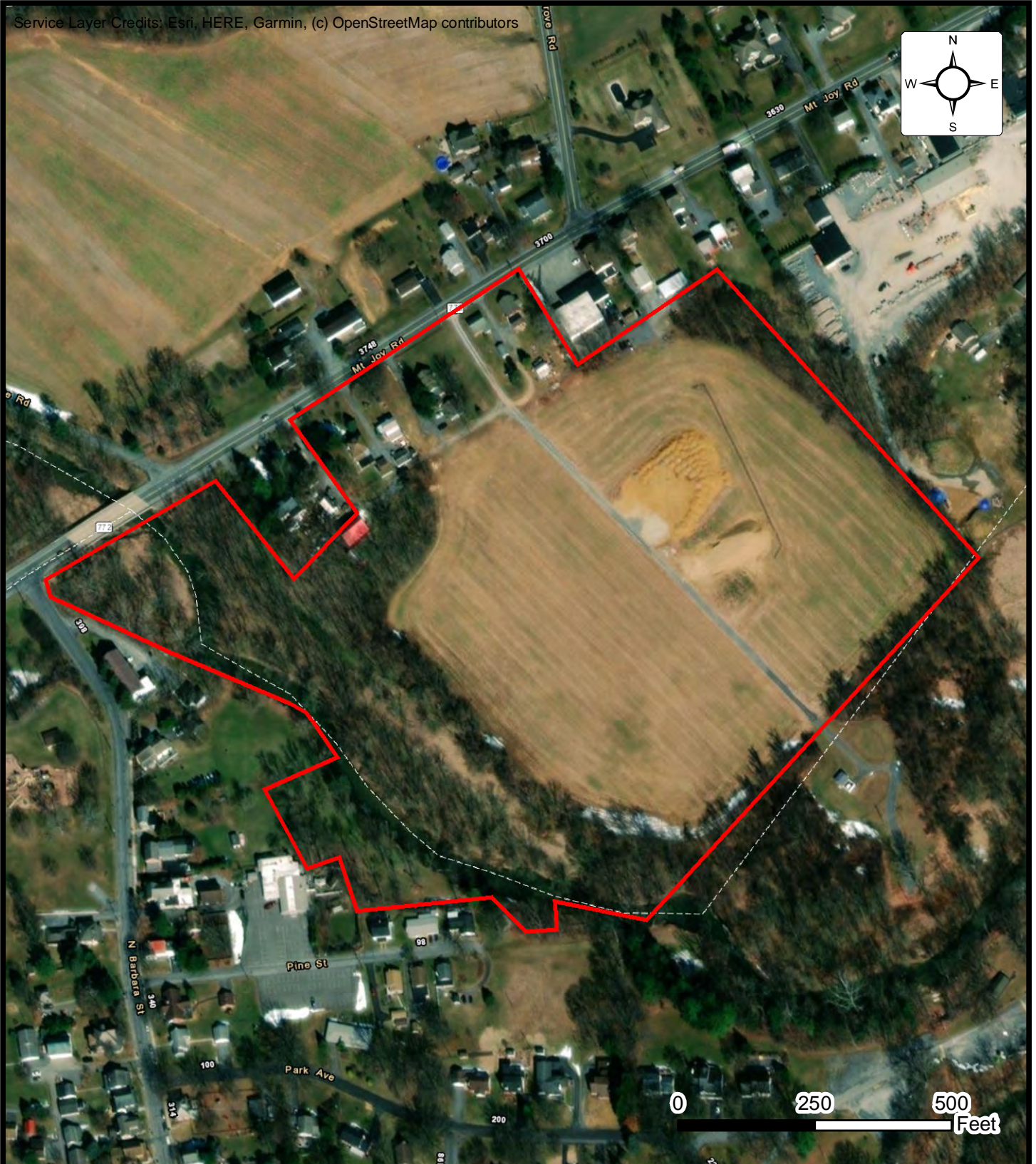
We recommend that ECS review the project plans and specifications so we can confirm that those plans/specifications are in accordance with the recommendations of this geotechnical report.

Field observations, and quality assurance testing during earthwork and foundation installation are an extension of, and integral to, the geotechnical design. We recommend that ECS be retained to apply our expertise throughout the geotechnical phases of construction, and to provide consultation and recommendation should issues arise.

ECS is not responsible for the conclusions, opinions, or recommendations of others based on the data in this report.

APPENDIX A – Drawings & Reports

Site Location Diagram
Exploration Location Diagram
Geologic Map
Soil Survey Map
Karst Features Map
Carbonate Assessment Map



SITE LOCATION DIAGRAM CHIQUES CROSSING

3733 MOUNT JOY ROAD, MOUNT JOY, PA

VISTABLOCK WESTMOUNT, LLC

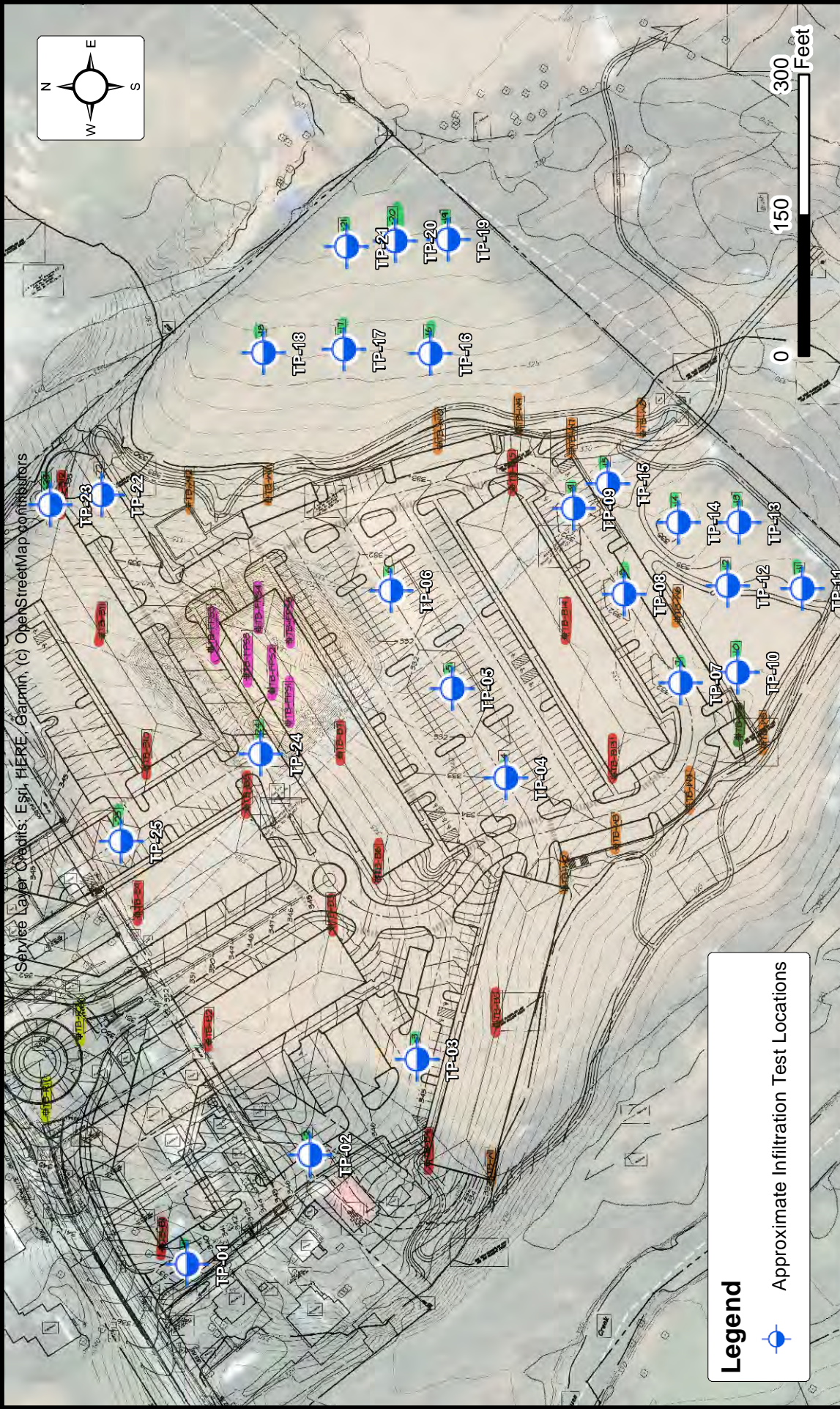
ENGINEER
DGR

SCALE
AS NOTED

PROJECT NO.
18:5839

FIGURE
1 OF 1

DATE
1/9/2023



ENGINEER	DGR
SCALE	AS NOTED
PROJECT NO.	18-5839
FIGURE	1 OF 1
DATE	2/6/2023

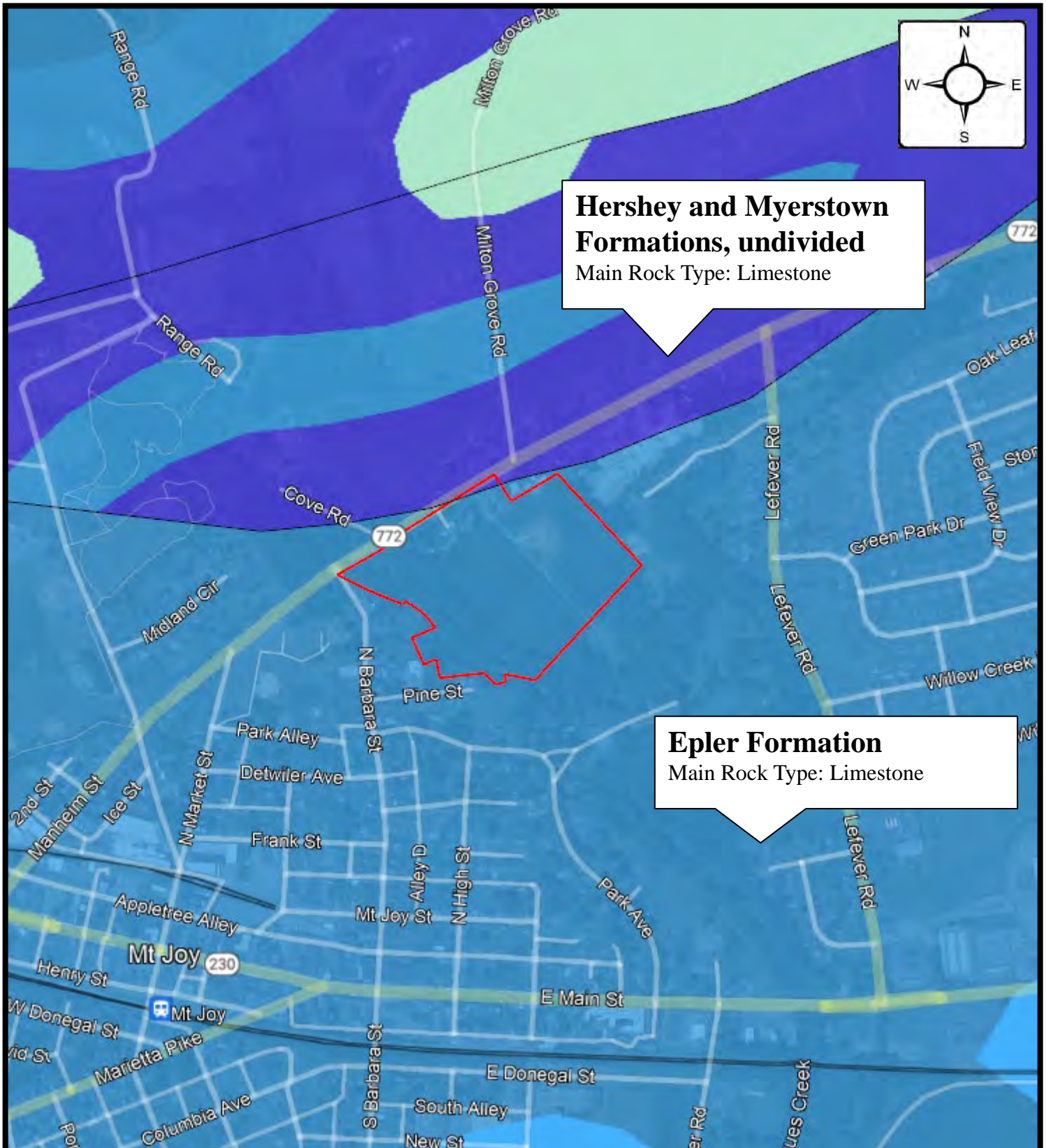
EXPLORATION LOCATION DIAGRAM

CHIQUES CROSSING

3733 MOUNT JOY ROAD, MOUNT JOY, PA
 VISTABLOCK WESTMOUNT, LLC



Legend
 Approximate Infiltration Test Locations



**GEOLOGIC MAP
CHIQUES CROSSING**

3733 MOUNT JOY ROAD, MOUNT JOY, PA

VISTABLOCK WESTMOUNT, LLC

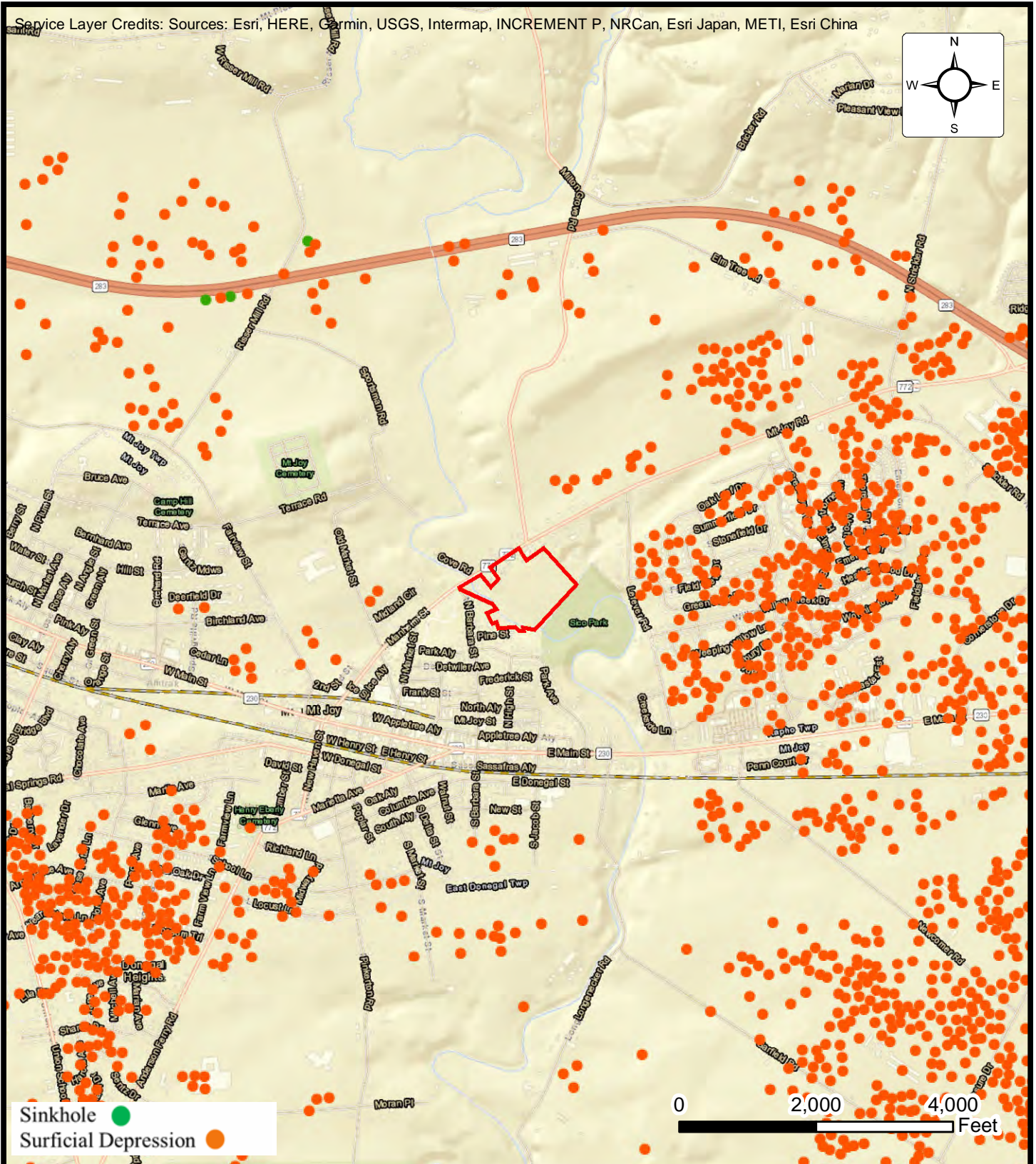
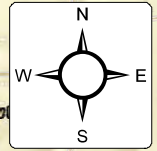
DRAFTER	MDH
SCALE	NTS
PROJECT NO.	18:5839
DATE	2/6/2023
SOURCE	PA DCNR Geologic Map http://www.gis.dcnr.state.pa.us



**SOIL SURVEY MAP
CHIQUES CROSSING**

3733 MOUNT JOY ROAD, MOUNT JOY, PA
VISTABLOCK WESTMOUNT, LLC

DRAFTER	MSD
SCALE	NTS
PROJECT NO.	18:5839
DATE	1/9/2023
SOURCE	Web Soil Survey https://websoilsurvey.nrcs.usda.gov



Sinkhole ●
Surficial Depression ●

0 2,000 4,000 Feet



KARST FEATURES MAP CHIQUES CROSSING

3733 MOUNT JOY ROAD, MOUNT JOY, PA

VISTABLOCK WESTMOUNT, LLC

ENGINEER DGR
SCALE AS NOTED
PROJECT NO. 18:5839
FIGURE 1 OF 1
DATE 1/9/2023



LEGEND

- GH - Animal Burrow
- SD - Surface Depression
- Sinkhole
- △ SR - Surficial Rock



**CARBONATE ASSESSMENT MAP
CHIQUES CROSSING**

3733 MOUNT JOY ROAD, MOUNT JOY, PA
VISTABLOCK WESTMOUNT, LLC

DRAFTER	RWB
SCALE	NTS
PROJECT NO.	18:5839
DATE	2/6/2023
SOURCE	Google Earth

APPENDIX B – Field Operations

Subsurface Exploration Procedure: Test Pit Excavation

Test Pits TP-01 through TP-25

Infiltration Test Results

Test Pit Photographs




SUBSURFACE EXPLORATION PROCEDURE: TEST PIT EXCAVATION

A test pit is an excavation of subsurface materials to characterize the composition and rippability/excavation efforts. Test pit exploration allows observation of the boundary relationships within a soil and rock profile and is useful to identify existing fill composition, disturbed material or the depth of soft sediments. Both track mounted excavators and backhoes are used in a variety of ground conditions allowing for difficult terrain to be accessed. The excavation process also provides access for in-situ and field testing and acquisition of samples for laboratory testing.

TEST PIT Procedure:

- Involves excavation subsurface material to observe composition and physical characteristics
- Recording the approximate depth of subsurface strata
- Excavation is continued as prescribed or to limits of equipment and subsurface conditions
- The exploration is typically carried out with an excavator or backhoe, with the depth dependent on machine size and ground



CLIENT: Vistablock Westmount, LLC	PROJECT NO.: 18:5839	SHEET: 1 of 1	
PROJECT NAME: Chiques Crossing	TEST PIT NO.: TP-01	SURFACE ELEVATION: 337.5	
SITE LOCATION: 3733 Mount Joy Road, Mount Joy, Pennsylvania, 17601		STATION:	
NORTHING: 287792.9		EASTING: 2318673.7	

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
5			Topsoil Thickness[14.00"]					
			(SP FILL) FILL, SAND WITH GRAVEL, gray and black, moist, contains ash, debris, brick, and deleterious materials, strong odor	E				
		333	(CL) LEAN CLAY, reddish brown, moist, stiff, 5YR 5/8	M		1.50	S-1	
			BUCKET REFUSAL AT 8.5 FT					
10		328						
15		323						

REMARKS:


THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL



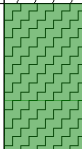
EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

<input type="checkbox"/> WL (First Encountered) N/E	<input type="checkbox"/> WL (Seasonal High)	CONTRACTOR:	OPERATOR:	MAKE/MODEL:
<input type="checkbox"/> WL (Completion)		SA Way & Son Excavating	Tim	Bobcat E32

ECS REP.:	DATE COMPLETED:	UNITS:	CAVE-IN-DEPTH:
MSD	Jan 27 2023	English	

TEST PIT LOG

CLIENT: Vistablock Westmount, LLC	PROJECT NO.: 18:5839	SHEET: 1 of 1	
PROJECT NAME: Chiques Crossing	TEST PIT NO.: TP-02	SURFACE ELEVATION: 336.0	
SITE LOCATION: 3733 Mount Joy Road, Mount Joy, Pennsylvania, 17601		STATION:	
NORTHING: 287661.6		EASTING: 2318789.6	

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
5		331	Topsoil Thickness[12.00"]		M	2.75	S-1	
			(CL) LEAN CLAY, orangish brown, moist, very stiff, 7.5YR 6/8, 7.5YR 5/8					
			(WR) WEATHERED LIMESTONE SAMPLED AS GRAVEL WITH CLAY, orangish brown and gray, moist, 7.5YR 5/8 [Weathered LIMESTONE]					
			BUCKET REFUSAL AT 5.0 FT					
10		326						
15								

REMARKS:


THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

<input type="checkbox"/> WL (First Encountered) N/E	<input type="checkbox"/> WL (Seasonal High)	CONTRACTOR:	OPERATOR:	MAKE/MODEL:
<input type="checkbox"/> WL (Completion)		SA Way & Son Excavating	Tim	Bobcat E32

ECS REP.:	DATE COMPLETED:	UNITS:	CAVE-IN-DEPTH:
MSD	Jan 27 2023	English	

TEST PIT LOG

CLIENT: Vistablock Westmount, LLC	PROJECT NO.: 18:5839	SHEET: 1 of 1	
PROJECT NAME: Chiques Crossing	TEST PIT NO.: TP-03	SURFACE ELEVATION: 343.0	
SITE LOCATION: 3733 Mount Joy Road, Mount Joy, Pennsylvania, 17601		STATION:	
NORTHING: 287547.9		EASTING: 2318891.7	

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
			Topsoil Thickness[10.00"]					
			(CL) LEAN CLAY, orangish brown, moist, very stiff, 10YR 5/8, 5YR 5/8	M		3.25	S-1	
5		338	BUCKET REFUSAL AT 4.5 FT					
10		333						
15								

REMARKS:


THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

<input type="checkbox"/> WL (First Encountered) N/E	<input type="checkbox"/> WL (Seasonal High)	CONTRACTOR:	OPERATOR:	MAKE/MODEL:
<input type="checkbox"/> WL (Completion)		SA Way & Son Excavating	Tim	Bobcat E32

ECS REP.:	DATE COMPLETED:	UNITS:	CAVE-IN-DEPTH:
MSD	Jan 27 2023	English	

TEST PIT LOG

CLIENT: Vistablock Westmount, LLC	PROJECT NO.: 18:5839	SHEET: 1 of 1	
PROJECT NAME: Chiques Crossing	TEST PIT NO.: TP-04	SURFACE ELEVATION: 338.0	
SITE LOCATION: 3733 Mount Joy Road, Mount Joy, Pennsylvania, 17601		STATION:	
NORTHING: 287453.5	EASTING: 2319191.7		

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
5		333	Topsoil Thickness[14.00"]	E		2.25	S-1	27.2
			(CL) LEAN CLAY WITH SAND, orangish brown to reddish brown, moist, stiff to very stiff, 7.5YR 5/8, 10YR 5/8					
10		328	END OF TEST PIT AT 10 FT			1.75	S-2	
15								

REMARKS:


THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

<input type="checkbox"/> WL (First Encountered) N/E	<input type="checkbox"/> WL (Seasonal High)	CONTRACTOR:	OPERATOR:	MAKE/MODEL:
<input checked="" type="checkbox"/> WL (Completion)		SA Way & Son Excavating	Tim	Bobcat E32

ECS REP.:	DATE COMPLETED:	UNITS:	CAVE-IN-DEPTH:
MSD	Jan 27 2023	English	

TEST PIT LOG

CLIENT: Vistablock Westmount, LLC	PROJECT NO.: 18:5839	SHEET: 1 of 1	
PROJECT NAME: Chiques Crossing	TEST PIT NO.: TP-05	SURFACE ELEVATION: 338.5	
SITE LOCATION: 3733 Mount Joy Road, Mount Joy, Pennsylvania, 17601		STATION:	
NORTHING: 287510.2		EASTING: 2319286.9	

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
5		334	Topsoil Thickness[18.00"]	M				
			(CL) LEAN CLAY WITH GRAVEL, orangish brown to reddish brown, moist, stiff, 5YR 5/8, 10YR 6/8				1.25	S-1
10		329				1.50	S-2	
			END OF TEST PIT AT 10 FT					
15		324						

REMARKS:


THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

<input type="checkbox"/> WL (First Encountered) N/E	<input type="checkbox"/> WL (Seasonal High)	CONTRACTOR:	OPERATOR:	MAKE/MODEL:
<input type="checkbox"/> WL (Completion)		SA Way & Son Excavating	Tim	Bobcat E32

ECS REP.:	DATE COMPLETED:	UNITS:	CAVE-IN-DEPTH:
MSD	Jan 27 2023	English	

TEST PIT LOG

CLIENT: Vistablock Westmount, LLC	PROJECT NO.: 18:5839	SHEET: 1 of 1	
PROJECT NAME: Chiques Crossing	TEST PIT NO.: TP-06	SURFACE ELEVATION: 334.0	
SITE LOCATION: 3733 Mount Joy Road, Mount Joy, Pennsylvania, 17601		STATION:	
NORTHING: 287575.9		EASTING: 2319391.0	

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
			Topsoil Thickness[12.00"]	E				
5		329	(CL) SANDY LEAN CLAY WITH GRAVEL, orangish brown, moist, very stiff, 5YR 6/8	M		2.00	S-1	
10		324	END OF TEST PIT AT 10 FT			3.25	S-2	
15								

REMARKS:


THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

<input checked="" type="checkbox"/> WL (First Encountered) N/E	<input checked="" type="checkbox"/> WL (Seasonal High)	CONTRACTOR:	OPERATOR:	MAKE/MODEL:
<input checked="" type="checkbox"/> WL (Completion)		SA Way & Son Excavating	Tim	Bobcat E32

ECS REP.:	DATE COMPLETED:	UNITS:	CAVE-IN-DEPTH:
MSD	Jan 26 2023	English	

TEST PIT LOG

CLIENT: Vistablock Westmount, LLC	PROJECT NO.: 18:5839	SHEET: 1 of 1	
PROJECT NAME: Chiques Crossing	TEST PIT NO.: TP-07	SURFACE ELEVATION: 333.0	
SITE LOCATION: 3733 Mount Joy Road, Mount Joy, Pennsylvania, 17601		STATION:	
NORTHING: 287266.7		EASTING: 2319292.6	

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
			Topsoil Thickness[18.00"]	E				
5		328	(CL) LEAN CLAY WITH GRAVEL, orangish brown, moist, stiff, 5YR 6/8	M		1.50 1.50	S-1	
10		323	BUCKET REFUSAL AT 8.5 FT					
15								

REMARKS:


THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

<input type="checkbox"/> WL (First Encountered) N/E	<input type="checkbox"/> WL (Seasonal High)	CONTRACTOR:	OPERATOR:	MAKE/MODEL:
<input type="checkbox"/> WL (Completion)		SA Way & Son Excavating	Tim	Bobcat E32

ECS REP.:	DATE COMPLETED:	UNITS:	CAVE-IN-DEPTH:
RWB	Jan 24 2023	English	

TEST PIT LOG

CLIENT: Vistablock Westmount, LLC	PROJECT NO.: 18:5839	SHEET: 1 of 1	
PROJECT NAME: Chiques Crossing	TEST PIT NO.: TP-08	SURFACE ELEVATION: 334.5	
SITE LOCATION: 3733 Mount Joy Road, Mount Joy, Pennsylvania, 17601		STATION:	
NORTHING: 287326.3		EASTING: 2319387.0	

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
5		330	Topsoil Thickness[12.00"]	E				
			(CL) LEAN CLAY WITH GRAVEL, orangish brown, moist, very stiff, 5YR 6/8, contains significant boulders and cobbles	D		2.00	S-1	
			BUCKET REFUSAL AT 5.5 FT			2.00		
10		325						
15		320						

REMARKS:


THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

<input checked="" type="checkbox"/> WL (First Encountered) N/E	<input checked="" type="checkbox"/> WL (Seasonal High)	CONTRACTOR:	OPERATOR:	MAKE/MODEL:
<input checked="" type="checkbox"/> WL (Completion)		SA Way & Son Excavating	Tim	Bobcat E32

ECS REP.: RWB	DATE COMPLETED: Jan 24 2023	UNITS: English	CAVE-IN-DEPTH:
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TEST PIT LOG

CLIENT: Vistablock Westmount, LLC	PROJECT NO.: 18:5839	SHEET: 1 of 1	
PROJECT NAME: Chiques Crossing	TEST PIT NO.: TP-09	SURFACE ELEVATION: 335.0	
SITE LOCATION: 3733 Mount Joy Road, Mount Joy, Pennsylvania, 17601		STATION:	
NORTHING: 287380.6		EASTING: 2319478.5	

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
			Topsoil Thickness[12.00"]	E				
5		330	(CL) LEAN CLAY WITH GRAVEL, orangish brown, moist, stiff, 5YR 6/8, contains boulders and cobbles	M		1.50 1.50	S-1	
10		325	BUCKET REFUSAL AT 9 FT					
15								

REMARKS:


THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

<input type="checkbox"/> WL (First Encountered) N/E	<input type="checkbox"/> WL (Seasonal High)	CONTRACTOR:	OPERATOR:	MAKE/MODEL:
<input type="checkbox"/> WL (Completion)		SA Way & Son Excavating	Tim	Bobcat E32

ECS REP.:	DATE COMPLETED:	UNITS:	CAVE-IN-DEPTH:
RWB	Jan 24 2023	English	

TEST PIT LOG

CLIENT: Vistablock Westmount, LLC	PROJECT NO.: 18:5839	SHEET: 1 of 1	
PROJECT NAME: Chiques Crossing	TEST PIT NO.: TP-10	SURFACE ELEVATION: 332.0	
SITE LOCATION: 3733 Mount Joy Road, Mount Joy, Pennsylvania, 17601		STATION:	
NORTHING: 287205.5		EASTING: 2319304.0	

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
			Topsoil Thickness[18.00"]	E				
5		327	(CL) LEAN CLAY WITH GRAVEL, orangish brown, moist, very stiff, 5YR 6/8	M		2.00 2.00	S-1	
10		322	BUCKET REFUSAL AT 9 FT					
15								

REMARKS:


THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

<input type="checkbox"/> WL (First Encountered) N/E	<input type="checkbox"/> WL (Seasonal High)	CONTRACTOR:	OPERATOR:	MAKE/MODEL:
<input type="checkbox"/> WL (Completion)		SA Way & Son Excavating	Tim	Bobcat E32

ECS REP.: RWB	DATE COMPLETED: Jan 24 2023	UNITS: English	CAVE-IN-DEPTH:
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TEST PIT LOG

CLIENT: Vistablock Westmount, LLC	PROJECT NO.: 18:5839	SHEET: 1 of 1	
PROJECT NAME: Chiques Crossing	TEST PIT NO.: TP-11	SURFACE ELEVATION: 332.0	
SITE LOCATION: 3733 Mount Joy Road, Mount Joy, Pennsylvania, 17601		STATION:	
NORTHING: 287136.6		EASTING: 2319393.5	

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
5		327	Topsoil Thickness[12.00"]	E		1.50	S-1	
			(CL) SANDY LEAN CLAY WITH GRAVEL, orangish brown, moist, stiff, 5YR 6/8, contains boulders and cobbles	M				
				D				
			BUCKET REFUSAL AT 5.5 FT			1.50		
10		322						
15								

REMARKS:


THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

<input type="checkbox"/> WL (First Encountered) N/E	<input checked="" type="checkbox"/> WL (Seasonal High)	CONTRACTOR:	OPERATOR:	MAKE/MODEL:
<input checked="" type="checkbox"/> WL (Completion)		SA Way & Son Excavating	Tim	Bobcat E32

ECS REP.: RWB	DATE COMPLETED: Jan 24 2023	UNITS: English	CAVE-IN-DEPTH:
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TEST PIT LOG

CLIENT: Vistablock Westmount, LLC	PROJECT NO.: 18:5839	SHEET: 1 of 1	
PROJECT NAME: Chiques Crossing	TEST PIT NO.: TP-12	SURFACE ELEVATION: 332.0	
SITE LOCATION: 3733 Mount Joy Road, Mount Joy, Pennsylvania, 17601		STATION:	
NORTHING: 287216.6		EASTING: 2319396.1	

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
			Topsoil Thickness[24.00"]	E				
5		327	(CL) LEAN CLAY WITH SAND, orangish brown, moist, stiff, 5YR 6/8, contains boulders and cobbles	M		1.00	S-1	23.7
10		322	END OF TEST PIT AT 10 FT					
15								

REMARKS:


THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

<input type="checkbox"/> WL (First Encountered) N/E	<input type="checkbox"/> WL (Seasonal High)	CONTRACTOR:	OPERATOR:	MAKE/MODEL:
<input type="checkbox"/> WL (Completion)		SA Way & Son Excavating	Tim	Bobcat E32

ECS REP.: RWB	DATE COMPLETED: Jan 24 2023	UNITS: English	CAVE-IN-DEPTH:
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TEST PIT LOG

CLIENT: Vistablock Westmount, LLC	PROJECT NO.: 18:5839	SHEET: 1 of 1	
PROJECT NAME: Chiques Crossing	TEST PIT NO.: TP-13	SURFACE ELEVATION: 333.0	
SITE LOCATION: 3733 Mount Joy Road, Mount Joy, Pennsylvania, 17601		STATION:	
NORTHING: 287204.1	EASTING: 2319463.8		

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
5		328	Topsoil Thickness[10.00"]	E		1.50	S-1	
			(CL) LEAN CLAY WITH SAND, orangish brown, moist, stiff, 5YR 6/8, contains significant boulders and cobbles	M				
			BUCKET REFUSAL AT 7.5 FT			1.50		
10		323						
15								

REMARKS:


THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

<input checked="" type="checkbox"/> WL (First Encountered) N/E	<input checked="" type="checkbox"/> WL (Seasonal High)	CONTRACTOR:	OPERATOR:	MAKE/MODEL:
<input checked="" type="checkbox"/> WL (Completion)		SA Way & Son Excavating	Tim	Bobcat E32

ECS REP.: RWB	DATE COMPLETED: Jan 24 2023	UNITS: English	CAVE-IN-DEPTH:
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TEST PIT LOG

CLIENT: Vistablock Westmount, LLC	PROJECT NO.: 18:5839	SHEET: 1 of 1	
PROJECT NAME: Chiques Crossing	TEST PIT NO.: TP-14	SURFACE ELEVATION: 334.0	
SITE LOCATION: 3733 Mount Joy Road, Mount Joy, Pennsylvania, 17601		STATION:	
NORTHING: 287269.1		EASTING: 2319463.6	

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
5		329	Topsoil Thickness[10.00"]	E				
			(CL) LEAN CLAY WITH GRAVEL, orangish brown, moist, stiff, 5YR 6/8, contains significant boulders and cobbles	D		1.00	S-1	
			BUCKET REFUSAL AT 5.5 FT			1.00		
10		324						
15								

REMARKS:


THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

<input checked="" type="checkbox"/> WL (First Encountered) N/E	<input checked="" type="checkbox"/> WL (Seasonal High)	CONTRACTOR:	OPERATOR:	MAKE/MODEL:
<input checked="" type="checkbox"/> WL (Completion)		SA Way & Son Excavating	Tim	Bobcat E32

ECS REP.: RWB	DATE COMPLETED: Jan 24 2023	UNITS: English	CAVE-IN-DEPTH:
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TEST PIT LOG

CLIENT: Vistablock Westmount, LLC	PROJECT NO.: 18:5839	SHEET: 1 of 1	
PROJECT NAME: Chiques Crossing	TEST PIT NO.: TP-15	SURFACE ELEVATION: 332.5	
SITE LOCATION: 3733 Mount Joy Road, Mount Joy, Pennsylvania, 17601		STATION:	
NORTHING: 287343.7		EASTING: 2319505.3	

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
5		328	Topsoil Thickness[12.00"]	E		2.00	S-1	
			(CL) LEAN CLAY WITH GRAVEL, orangish brown, moist, very stiff, 5YR 6/8, contains boulders and cobbles	M				
10		323	END OF TEST PIT AT 10 FT			2.00		
15		318						

REMARKS:


THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

<input checked="" type="checkbox"/> WL (First Encountered) N/E	<input checked="" type="checkbox"/> WL (Seasonal High)	CONTRACTOR:	OPERATOR:	MAKE/MODEL:
<input checked="" type="checkbox"/> WL (Completion)		SA Way & Son Excavating	Tim	Bobcat E32

ECS REP.: RWB	DATE COMPLETED: Jan 23 2023	UNITS: English	CAVE-IN-DEPTH:
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TEST PIT LOG

CLIENT: Vistablock Westmount, LLC	PROJECT NO.: 18:5839	SHEET: 1 of 1	
PROJECT NAME: Chiques Crossing	TEST PIT NO.: TP-16	SURFACE ELEVATION: 324.0	
SITE LOCATION: 3733 Mount Joy Road, Mount Joy, Pennsylvania, 17601		STATION:	
NORTHING: 287534.0		EASTING: 2319643.7	

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
			Topsoil Thickness[12.00"]	E				
			(CL) LEAN CLAY WITH SAND, brown, moist, stiff, 7.5YR 4/6	M		1.50	S-1	
5		319	(CL) LEAN CLAY WITH GRAVEL, orangish brown, moist, very stiff, 5YR 5/8			2.50	S-2	
10	∇	314	END OF TEST PIT AT 10 FT					
15								

REMARKS:


THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

∇ WL (First Encountered) 10.00	∇ WL (Seasonal High)	CONTRACTOR: SA Way & Son Excavating	OPERATOR: Tim	MAKE/MODEL: Bobcat E32
▼ WL (Completion) 8.00				

ECS REP.: RWB	DATE COMPLETED: Jan 25 2023	UNITS: English	CAVE-IN-DEPTH:
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TEST PIT LOG

CLIENT: Vistablock Westmount, LLC	PROJECT NO.: 18:5839	SHEET: 1 of 1	
PROJECT NAME: Chiques Crossing	TEST PIT NO.: TP-17	SURFACE ELEVATION: 324.0	
SITE LOCATION: 3733 Mount Joy Road, Mount Joy, Pennsylvania, 17601		STATION:	
NORTHING: 287625.9		EASTING: 2319648.4	

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
			Topsoil Thickness[12.00"]	E				
			(CL) LEAN CLAY WITH GRAVEL, brown, moist, stiff, 7.5YR 4/6	M		1.50	S-1	
5		319	(CL) GRAVELLY LEAN CLAY WITH SAND, orangish brown, moist to wet, stiff, 5YR 5/8			1.50	S-2	
10		314	END OF TEST PIT AT 10 FT					
15								

REMARKS:


THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

∇ WL (First Encountered) 9.00	∇ WL (Seasonal High)	CONTRACTOR: SA Way & Son Excavating	OPERATOR: Tim	MAKE/MODEL: Bobcat E32
▼ WL (Completion) 8.00				

ECS REP.: RWB	DATE COMPLETED: Jan 25 2023	UNITS: English	CAVE-IN-DEPTH:
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TEST PIT LOG

CLIENT: Vistablock Westmount, LLC	PROJECT NO.: 18:5839	SHEET: 1 of 1	
PROJECT NAME: Chiques Crossing	TEST PIT NO.: TP-18	SURFACE ELEVATION: 324.0	
SITE LOCATION: 3733 Mount Joy Road, Mount Joy, Pennsylvania, 17601		STATION:	
NORTHING: 287711.1		EASTING: 2319644.9	

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
			Topsoil Thickness[10.00"]	E				
			(CL) LEAN CLAY WITH GRAVEL, brown, moist, stiff, 7.5YR 4/6	M		1.00	S-1	
5	▼	319	(GC) CLAYEY GRAVEL WITH SAND, orangish brown, moist to wet, 5YR 5/8	D			S-2	
	⊗		END OF TEST PIT AT 8.5 FT					
10		314						
15								

REMARKS:


THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

⊗ WL (First Encountered) 7.50	▼ WL (Seasonal High)	CONTRACTOR: SA Way & Son Excavating	OPERATOR: Tim	MAKE/MODEL: Bobcat E32
▼ WL (Completion) 6.50				

ECS REP.: RWB	DATE COMPLETED: Jan 25 2023	UNITS: English	CAVE-IN-DEPTH:
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TEST PIT LOG

CLIENT: Vistablock Westmount, LLC	PROJECT NO.: 18:5839	SHEET: 1 of 1	
PROJECT NAME: Chiques Crossing	TEST PIT NO.: TP-19	SURFACE ELEVATION: 321.0	
SITE LOCATION: 3733 Mount Joy Road, Mount Joy, Pennsylvania, 17601		STATION:	
NORTHING: 287514.8		EASTING: 2319765.5	

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
			Topsoil Thickness[12.00"]	E				
			(CL) SANDY LEAN CLAY WITH GRAVEL, orangish brown, moist, stiff, 5YR 6/8	M		1.00	S-1	
			(GC) CLAYEY GRAVEL WITH SAND, orangish brown, moist to wet, 5YR 5/8			1.00		
5	▼	316						
	⊥		END OF TEST PIT AT 6.5 FT					
10		311						
15								

REMARKS:


THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

∇ WL (First Encountered) 6.00	∇ WL (Seasonal High)	CONTRACTOR: SA Way & Son Excavating	OPERATOR: Tim	MAKE/MODEL: Bobcat E32
▼ WL (Completion) 4.50				

ECS REP.: RWB	DATE COMPLETED: Jan 25 2023	UNITS: English	CAVE-IN-DEPTH:
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TEST PIT LOG

CLIENT: Vistablock Westmount, LLC	PROJECT NO.: 18:5839	SHEET: 1 of 1	
PROJECT NAME: Chiques Crossing	TEST PIT NO.: TP-20	SURFACE ELEVATION: 321.0	
SITE LOCATION: 3733 Mount Joy Road, Mount Joy, Pennsylvania, 17601		STATION:	
NORTHING: 287571.5		EASTING: 2319763.9	

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
			Topsoil Thickness[12.00"]	E				
			(CL) LEAN CLAY WITH GRAVEL, brown, moist, stiff, 7.5YR 4/6			1.00	S-1	
5	▼	316	(GC) CLAYEY GRAVEL WITH SAND, orangish brown, moist to wet, 5YR 5/8	M		1.00		
			END OF TEST PIT AT 8 FT					
10		311						
15								

REMARKS:


THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

▽ WL (First Encountered) 6.00	▽ WL (Seasonal High)	CONTRACTOR: SA Way & Son Excavating	OPERATOR: Tim	MAKE/MODEL: Bobcat E32
▼ WL (Completion) 4.50				

ECS REP.: RWB	DATE COMPLETED: Jan 25 2023	UNITS: English	CAVE-IN-DEPTH:
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TEST PIT LOG

CLIENT: Vistablock Westmount, LLC	PROJECT NO.: 18:5839	SHEET: 1 of 1	
PROJECT NAME: Chiques Crossing	TEST PIT NO.: TP-21	SURFACE ELEVATION: 321.0	
SITE LOCATION: 3733 Mount Joy Road, Mount Joy, Pennsylvania, 17601		STATION:	
NORTHING: 287623.0		EASTING: 2319757.9	

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
			Topsoil Thickness[16.00"]	E		1.00	S-1	
			(CL) LEAN CLAY WITH SAND, brown, moist, stiff, 7.5YR 4/6			1.00		
5	▼	316	(GC) CLAYEY GRAVEL WITH SAND, orangish brown, moist to wet, 5YR 5/8	M				
10		311	END OF TEST PIT AT 10 FT					
15								

REMARKS:


THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

▽ WL (First Encountered) 6.00	▽ WL (Seasonal High)	CONTRACTOR: SA Way & Son Excavating	OPERATOR: Tim	MAKE/MODEL: Bobcat E32
▼ WL (Completion) 5.00				

ECS REP.: RWB	DATE COMPLETED: Jan 25 2023	UNITS: English	CAVE-IN-DEPTH:
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TEST PIT LOG

CLIENT: Vistablock Westmount, LLC	PROJECT NO.: 18:5839	SHEET: 1 of 1	
PROJECT NAME: Chiques Crossing	TEST PIT NO.: TP-22	SURFACE ELEVATION: 332.0	
SITE LOCATION: 3733 Mount Joy Road, Mount Joy, Pennsylvania, 17601		STATION:	
NORTHING: 287883.8	EASTING: 2319493.2		

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
			Topsoil Thickness[24.00"]	E				
5		327	(CL) LEAN CLAY WITH SAND, brown, moist, stiff, 7.5YR 4/6	M		1.25	S-1	
10		322	END OF TEST PIT AT 10 FT					
15								

REMARKS:


THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

<input type="checkbox"/> WL (First Encountered) N/E	<input type="checkbox"/> WL (Seasonal High)	CONTRACTOR:	OPERATOR:	MAKE/MODEL:
<input type="checkbox"/> WL (Completion)		SA Way & Son Excavating	Tim	Bobcat E32

ECS REP.:	DATE COMPLETED:	UNITS:	CAVE-IN-DEPTH:
MSD	Jan 26 2023	English	

TEST PIT LOG

CLIENT: Vistablock Westmount, LLC	PROJECT NO.: 18:5839	SHEET: 1 of 1	
PROJECT NAME: Chiques Crossing	TEST PIT NO.: TP-23	SURFACE ELEVATION: 336.0	
SITE LOCATION: 3733 Mount Joy Road, Mount Joy, Pennsylvania, 17601		STATION:	
NORTHING: 287938.9		EASTING: 2319482.6	

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
5		331	Topsoil Thickness[11.00"]	E		3.00	S-1	
			(CL) LEAN CLAY, orangish brown, moist, very stiff, 5YR 6/8	M				
			BUCKET REFUSAL AT 5 FT					
10		326						
15								

REMARKS:


THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

<input type="checkbox"/> WL (First Encountered) N/E	<input checked="" type="checkbox"/> WL (Seasonal High)	CONTRACTOR: SA Way & Son Excavating	OPERATOR: Tim	MAKE/MODEL: Bobcat E32
<input checked="" type="checkbox"/> WL (Completion)				

ECS REP.: MSD	DATE COMPLETED: Jan 26 2023	UNITS: English	CAVE-IN-DEPTH:
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TEST PIT LOG

CLIENT: Vistablock Westmount, LLC	PROJECT NO.: 18:5839	SHEET: 1 of 1	
PROJECT NAME: Chiques Crossing	TEST PIT NO.: TP-24	SURFACE ELEVATION: 349.0	
SITE LOCATION: 3733 Mount Joy Road, Mount Joy, Pennsylvania, 17601		STATION:	
NORTHING: 287714.7		EASTING: 2319217.2	

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
			Topsoil Thickness[12.00"]	E				
			(CL PROBABLE FILL) PROBABLE FILL, LEAN CLAY WITH GRAVEL, orangish brown, moist, very stiff, 5YR 5/8			3.00	S-1	
5		344	(CL) LEAN CLAY WITH SAND, orangish brown, moist, very stiff, 5YR 6/8	D		2.25	S-2	
10		339	END OF TEST PIT AT 10 FT					
15								

REMARKS:


THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

<input type="checkbox"/> WL (First Encountered) N/E	<input type="checkbox"/> WL (Seasonal High)	CONTRACTOR:	OPERATOR:	MAKE/MODEL:
<input type="checkbox"/> WL (Completion)		SA Way & Son Excavating	Tim	Bobcat E32

ECS REP.:	DATE COMPLETED:	UNITS:	CAVE-IN-DEPTH:
MSD	Jan 26 2023	English	

TEST PIT LOG

CLIENT: Vistablock Westmount, LLC	PROJECT NO.: 18:5839	SHEET: 1 of 1	
PROJECT NAME: Chiques Crossing	TEST PIT NO.: TP-25	SURFACE ELEVATION: 349.0	
SITE LOCATION: 3733 Mount Joy Road, Mount Joy, Pennsylvania, 17601		STATION:	
NORTHING: 287863.6		EASTING: 2319124.3	

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
			Topsoil Thickness[26.00"]	E				
5		344	(CL) LEAN CLAY, orangish brown, moist, very stiff, 5YR 6/8	D		2.25	S-1	21.1
10		339	END OF TEST PIT AT 10 FT					
15								

REMARKS:

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

EXCAVATION EFFORT: E - EASY M - MEDIUM D - DIFFICULT VD - VERY DIFFICULT

<input type="checkbox"/> WL (First Encountered) N/E	<input type="checkbox"/> WL (Seasonal High)	CONTRACTOR:	OPERATOR:	MAKE/MODEL:
<input type="checkbox"/> WL (Completion)		SA Way & Son Excavating	Tim	Bobcat E32

ECS REP.:	DATE COMPLETED:	UNITS:	CAVE-IN-DEPTH:
MSD	Jan 26 2023	English	

TEST PIT LOG

Double Ring Infiltration Test Results
 Chiques Crossing
 ECS Project No. 18:5839

Field Data	1/27/2023		1/27/2023		1/27/2023		1/27/2023		1/27/2023	
	TP-01	TP-02	TP-03	TP-04	TP-04	TP-04	TP-04	TP-05	TP-05	TP-05
Test Depth (ft)	6.0	3.0	2.5	4.0	4.0	6.0	6.0	4.0	6.0	4.0
Presoak Start/Water Depth (in)	Time 11:08 Reading 6.00	Time 11:08 Reading 6.00	Time 11:06 Reading 6.00	Time 11:05 Reading 6.00	Time 11:05 Reading 6.00	Time 11:05 Reading 6.00	Time 11:05 Reading 6.00	Time 11:04 Reading 6.00	Time 11:04 Reading 6.00	Time 11:04 Reading 6.00
Presoak 30 Min (in)	11:38 1.00	11:38 6.00	11:36 1.25	11:35 0.75	11:35 0.75	11:35 0.00	11:35 0.00	11:34 0.00	11:34 0.00	11:34 0.00
Presoak 60 Min (in)	12:08 1.00	12:08 4.00	12:06 1.00	12:05 0.50	12:05 0.50	12:05 0.00	12:05 0.00	12:04 0.00	12:04 0.00	12:04 0.00
START TEST (in)	12:08 6.00	12:08 6.00	12:06 6.00	12:05 6.00	12:05 6.00	12:05 6.00	12:05 6.00	12:04 6.00	12:04 6.00	12:04 6.00
Reading Interval	30 min	10 min	30 min	30 min	30 min	30 min	30 min	30 min	30 min	30 min
Reading # 1 (in)	12:38 0.13	12:18 1.75	12:36 0.75	12:35 0.25	12:35 0.25	12:35 0.00	12:35 0.00	12:34 0.00	12:34 0.00	12:34 0.00
Reading # 2 (in)	13:08 0.00	12:28 1.63	13:06 1.00	13:05 0.25	13:05 0.25	13:05 0.00	13:05 0.00	13:04 0.00	13:04 0.00	13:04 0.00
Reading # 3 (in)	13:38 0.00	12:38 1.50	13:36 0.75	13:35 0.38	13:35 0.38	13:35 0.00	13:35 0.00	13:34 0.00	13:34 0.00	13:34 0.00
Reading # 4 (in)	14:08 0.00	12:48 1.50	14:06 1.00	14:05 0.25	14:05 0.25	14:05 0.00	14:05 0.00	14:04 0.00	14:04 0.00	14:04 0.00
Reading # 5 (in)										
Reading # 6 (in)										
Reading # 7 (in)										
Reading # 8 (in)										
O.D. of Double Ring Infiltrometer (in)	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Initial Water Depth (in)	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Final Water Level Drop (in)	0.00	1.50	1.00	0.25	0.25	0.00	0.00	0.00	0.00	0.00
Average Reading (in)	0.03	1.60	0.88	0.28	0.28	0.00	0.00	0.00	0.00	0.00
Infiltration Rate (in/hr)	0.06	9.57	1.75	0.57	0.57	0.00	0.00	0.00	0.00	0.00
Safety Factor	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Corrected Infiltration Rate (in/hr)	0.03	4.79	0.88	0.28	0.28	0.00	0.00	0.00	0.00	0.00

Notes:
 1. Infiltrometer refilled to water depth of 6 inches (inner and outer ring) after each reading.

Double Ring Infiltration Test Results
Chiques Crossing
ECS Project No. 18:5839

Field Data	1/27/2023		1/26/2023		1/26/2023		1/24/2023		1/24/2023		1/24/2023	
	TP-05	TP-06	TP-06	TP-06	TP-06	TP-07	TP-07	TP-07	TP-07	TP-07	TP-08	
Test Depth (ft)	6.0	4.0	4.0	6.0	6.0	4.0	4.0	6.0	6.0	1.5		
Presoak Start/Water Depth (in)	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00		
Presoak 30 Min (in)	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.50		
Presoak 60 Min (in)	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50		
START TEST (in)	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00		
Reading Interval	30 min	30 min	30 min	30 min	30 min	30 min	30 min	30 min	30 min	10 min		
Reading # 1 (in)	12:34	12:49	12:49	12:49	12:49	12:49	12:49	12:49	12:49	13:26		
Reading # 2 (in)	13:04	13:19	13:19	13:19	13:19	13:19	13:19	13:19	13:19	13:36		
Reading # 3 (in)	13:34	13:49	13:49	13:49	13:49	13:49	13:49	13:49	13:49	13:46		
Reading # 4 (in)	14:04	14:19	14:19	14:19	14:19	14:19	14:19	14:19	14:19	13:56		
Reading # 5 (in)												
Reading # 6 (in)												
Reading # 7 (in)												
Reading # 8 (in)												
O.D. of Double Ring Infiltrometer (in)	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00		
Initial Water Depth (in)	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00		
Final Water Level Drop (in)	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.75		
Average Reading (in)	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.75		
Infiltration Rate (in/hr)	0.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.50		
Safety Factor	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00		
Corrected Infiltration Rate (in/hr)	0.28	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	2.25		

Notes:
1. Infiltrometer refilled to water depth of 6 inches (inner and outer ring) after each reading.

Double Ring Infiltration Test Results
Chiques Crossing
ECS Project No. 18:5839

Field Data	1/24/2023		1/24/2023		1/24/2023		1/24/2023		1/24/2023	
	TP-08	TP-09	TP-09	TP-09	TP-10	TP-10	TP-10	TP-10	TP-11	TP-11
Test Depth (ft)	3.5	4.0	4.0	6.0	4.0	6.0	4.0	6.0	6.0	1.5
Presoak Start/Water Depth (in)										
Presoak 30 Min (in)	12:16	8:30	8:30	6.00	12:20	8:30	6.00	12:20	12:22	6.00
Presoak 60 Min (in)	12:46	9:00	9:00	0.50	12:50	9:00	0.00	12:50	12:52	0.25
START TEST (in)	13:16	9:30	9:30	0.38	13:20	9:30	0.00	13:20	13:22	0.00
Reading Interval	13:16	9:30	9:30	6.00	13:20	9:30	6.00	13:20	13:22	6.00
Reading # 1 (in)	30 min	10:00	10:00	0.25	30 min	10:00	0.00	30 min	30 min	0.13
Reading # 2 (in)	13:46	10:30	10:30	0.13	13:50	10:30	0.00	13:50	13:52	0.13
Reading # 3 (in)	14:16	11:00	11:00	0.13	14:20	11:00	0.00	14:20	14:22	0.00
Reading # 4 (in)	14:46	11:30	11:30	0.13	14:50	11:00	0.00	14:50	14:52	0.00
Reading # 5 (in)	15:16	11:30	11:30	0.13	15:20	11:30	0.00	15:20	15:22	0.00
Reading # 6 (in)										
Reading # 7 (in)										
Reading # 8 (in)										
O.D. of Double Ring Infiltrometer (in)	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Initial Water Depth (in)	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Final Water Level Drop (in)	0.13	0.13	0.13	0.13	0.25	0.00	0.25	0.00	0.00	0.00
Average Reading (in)	0.13	0.16	0.16	0.16	0.25	0.00	0.25	0.00	0.00	0.03
Infiltration Rate (in/hr)	0.25	0.31	0.31	0.31	0.50	0.00	0.50	0.00	0.00	0.06
Safety Factor	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Corrected Infiltration Rate (in/hr)	0.13	0.16	0.16	0.16	0.25	0.00	0.25	0.00	0.00	0.03

Notes:
1. Infiltrometer refilled to water depth of 6 inches (inner and outer ring) after each reading.

Double Ring Infiltration Test Results
Chiques Crossing
ECS Project No. 18:5839

Field Data	1/24/2023		1/24/2023		1/24/2023		1/24/2023		1/24/2023		1/24/2023	
	TP-11	TP-12	TP-12	TP-12	TP-13	TP-13	TP-13	TP-13	TP-13	TP-13	TP-14	TP-14
Test Depth (ft)	3.5		4.0		6.0		3.5		5.5		1.0	
Presoak Start/Water Depth (in)	Time	Reading	Time	Reading	Time	Reading	Time	Reading	Time	Reading	Time	Reading
Presoak 30 Min (in)	12:22	6.00	10:14	6.00	10:14	6.00	10:12	6.00	10:12	6.00	10:10	6.00
Presoak 60 Min (in)	12:52	0.13	10:44	0.00	10:44	0.00	10:42	0.13	10:42	0.00	10:40	0.00
START TEST (in)	13:22	0.00	11:14	0.00	11:14	0.00	11:12	0.00	11:12	0.13	11:10	0.00
Reading Interval	30 min		30 min		30 min		30 min		30 min		30 min	
Reading # 1 (in)	13:52	0.13	11:44	0.00	11:44	0.13	11:42	0.00	11:42	0.00	11:40	0.00
Reading # 2 (in)	14:22	0.13	12:14	0.00	12:14	0.00	12:12	0.13	12:12	0.13	12:10	0.00
Reading # 3 (in)	14:52	0.13	12:44	0.00	12:44	0.13	12:42	0.00	12:42	0.00	12:40	0.00
Reading # 4 (in)	15:22	0.13	13:14	0.00	13:14	0.00	13:12	0.00	13:12	0.00	13:10	0.00
Reading # 5 (in)												
Reading # 6 (in)												
Reading # 7 (in)												
Reading # 8 (in)												
O.D. of Double Ring Infiltrrometer (in)	6.00		6.00		6.00		6.00		6.00		6.00	
Initial Water Depth (in)	6.00		6.00		6.00		6.00		6.00		6.00	
Final Water Level Drop (in)	0.13		0.00		0.00		0.00		0.00		0.00	
Average Reading (in)	0.13		0.00		0.06		0.03		0.03		0.00	
Infiltration Rate (in/hr)	0.25		0.00		0.13		0.06		0.06		0.00	
Safety Factor	2.00		2.00		2.00		2.00		2.00		2.00	
Corrected Infiltration Rate (in/hr)	0.13		0.00		0.06		0.03		0.03		0.00	

Notes:
1. Infiltrrometer refilled to water depth of 6 inches (inner and outer ring) after each reading.

Double Ring Infiltration Test Results
Chiques Crossing
ECS Project No. 18:5839

Field Data	1/24/2023		1/23/2023		1/25/2023		1/25/2023		1/25/2023	
	TP-14	TP-15	TP-15	TP-16	TP-16	TP-16	TP-16	TP-16	TP-17	TP-17
Test Depth (ft)	3.0	4.0	4.0	6.0	4.0	6.0	4.0	6.0	4.0	6.0
Presoak Start/Water Depth (in)	10:10 6.00	10:17 6.00	10:17 6.00	10:17 6.00	11:28 6.00	11:28 6.00	11:28 6.00	11:28 6.00	11:30 6.00	11:30 6.00
Presoak 30 Min (in)	10:40 0.00	10:47 0.00	10:47 0.00	10:47 0.13	11:58 0.00	11:58 0.00	11:58 0.00	11:58 0.00	12:00 0.00	12:00 0.00
Presoak 60 Min (in)	11:10 0.00	11:17 0.13	11:17 0.13	11:17 0.13	12:28 0.00	12:28 0.00	12:28 0.00	12:28 0.00	12:30 0.00	12:30 0.00
START TEST (in)	11:10 6.00	11:17 6.00	11:17 6.00	11:17 6.00	12:28 6.00	12:28 6.00	12:28 6.00	12:28 6.00	12:30 6.00	12:30 6.00
Reading Interval	30 min	30 min	30 min	30 min	30 min	30 min	30 min	30 min	30 min	30 min
Reading # 1 (in)	11:40 0.00	11:47 0.00	11:47 0.00	11:47 0.13	12:58 0.00	12:58 0.00	12:58 0.00	12:58 0.00	13:00 0.00	13:00 0.00
Reading # 2 (in)	12:10 0.00	12:17 0.00	12:17 0.00	12:17 0.13	13:28 0.13	13:28 0.13	13:28 0.13	13:28 0.13	13:30 0.00	13:30 0.00
Reading # 3 (in)	12:40 0.00	12:47 0.00	12:47 0.00	12:47 0.13	13:58 0.00	13:58 0.00	13:58 0.00	13:58 0.00	14:00 0.00	14:00 0.00
Reading # 4 (in)	13:10 0.00	13:17 0.13	13:17 0.13	13:17 0.00	14:28 0.13	14:28 0.13	14:28 0.13	14:28 0.13	14:30 0.00	14:30 0.00
Reading # 5 (in)										
Reading # 6 (in)										
Reading # 7 (in)										
Reading # 8 (in)										
O.D. of Double Ring Infiltrrometer (in)	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Initial Water Depth (in)	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Final Water Level Drop (in)	0.00	0.13	0.13	0.00	0.13	0.13	0.13	0.13	0.00	0.00
Average Reading (in)	0.00	0.03	0.03	0.09	0.06	0.06	0.06	0.06	0.00	0.00
Infiltration Rate (in/hr)	0.00	0.06	0.06	0.19	0.13	0.13	0.13	0.13	0.00	0.00
Safety Factor	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Corrected Infiltration Rate (in/hr)	0.00	0.03	0.03	0.09	0.06	0.06	0.06	0.06	0.00	0.00

Notes:
1. Infiltrrometer refilled to water depth of 6 inches (inner and outer ring) after each reading.

Double Ring Infiltration Test Results
Chiques Crossing
ECS Project No. 18:5839

Field Data	1/25/2023		1/25/2023		1/25/2023		1/25/2023		1/25/2023	
	TP-17	TP-18	TP-18	TP-18	TP-19	TP-19	TP-19	TP-19	TP-20	TP-20
Test Depth (ft)	6.0	2.5	4.5	1.0	2.5	1.0	2.5	1.0	1.0	6.00
Presoak Start/Water Depth (in)	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Presoak 30 Min (in)	0.50	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Presoak 60 Min (in)	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
START TEST (in)	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Reading Interval	30 min	30 min	30 min	30 min	30 min	30 min	30 min	30 min	30 min	30 min
Reading # 1 (in)	0.38	0.50	0.00	0.13	0.13	0.13	0.13	0.13	0.13	0.00
Reading # 2 (in)	0.38	0.50	0.00	0.00	0.00	0.00	0.13	0.13	0.13	0.00
Reading # 3 (in)	0.38	0.50	0.00	0.00	0.00	0.00	0.00	0.13	0.13	0.00
Reading # 4 (in)	0.38	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Reading # 5 (in)										
Reading # 6 (in)										
Reading # 7 (in)										
Reading # 8 (in)										
O.D. of Double Ring Infiltrrometer (in)	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Initial Water Depth (in)	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Final Water Level Drop (in)	0.38	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Average Reading (in)	0.38	0.50	0.00	0.03	0.03	0.03	0.09	0.09	0.00	0.00
Infiltration Rate (in/hr)	0.75	1.00	0.00	0.06	0.06	0.06	0.19	0.19	0.00	0.00
Safety Factor	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Corrected Infiltration Rate (in/hr)	0.38	0.50	0.00	0.03	0.03	0.03	0.09	0.09	0.00	0.00

Notes:
1. Infiltrrometer refilled to water depth of 6 inches (inner and outer ring) after each reading.

Double Ring Infiltration Test Results
Chiques Crossing
ECS Project No. 18:5839

Field Data	1/25/2023		1/25/2023		1/26/2023		1/26/2023		1/26/2023	
	TP-20	TP-21	TP-21	TP-21	TP-22	TP-22	TP-22	TP-22	TP-23	TP-23
Test Depth (ft)	2.5	1.0	3.0	4.0	6.0	6.0	6.0	6.0	2.5	6.0
Time	11:36	11:38	11:38	11:18	11:18	11:18	11:18	11:18	11:17	11:17
Reading	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Presoak Start/Water Depth (in)	0.25	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00
Presoak 30 Min (in)	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Presoak 60 Min (in)	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
START TEST (in)	30 min	30 min	30 min	30 min	30 min	30 min	30 min	30 min	30 min	30 min
Reading Interval	13:06	13:08	13:08	12:48	12:48	12:48	12:48	12:48	12:47	12:47
Reading # 1 (in)	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Reading # 2 (in)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Reading # 3 (in)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Reading # 4 (in)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Reading # 5 (in)										
Reading # 6 (in)										
Reading # 7 (in)										
Reading # 8 (in)										
O.D. of Double Ring Infiltrrometer (in)	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Initial Water Depth (in)	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Final Water Level Drop (in)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Average Reading (in)	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Infiltration Rate (in/hr)	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Safety Factor	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Corrected Infiltration Rate (in/hr)	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes:
1. Infiltrrometer refilled to water depth of 6 inches (inner and outer ring) after each reading.

Double Ring Infiltration Test Results
Chiques Crossing
ECS Project No. 18:5839

Date Tested: 1/26/2023 1/26/2023 1/26/2023 1/26/2023

Field Data	TP-23		TP-24		TP-24		TP-25		TP-25	
	Time	Reading	Time	Reading	Time	Reading	Time	Reading	Time	Reading
Test Depth (ft)	2.5		4.0		6.0		4.0		6.0	
Presoak Start/Water Depth (in)	11:17	6.00	11:21	6.00	11:21	6.00	11:22	6.00	11:22	6.00
Presoak 30 Min (in)	11:47	0.00	11:51	0.75	11:51	0.00	11:52	1.00	11:52	1.00
Presoak 60 Min (in)	12:17	0.00	12:21	0.50	12:21	0.00	12:22	1.00	12:22	1.00
START TEST (in)	12:17	6.00	12:21	6.00	12:21	6.00	12:22	6.00	12:22	6.00
Reading Interval	30 min		30 min		30 min		30 min		30 min	
Reading # 1 (in)	12:47	0.00	12:51	0.50	12:51	0.00	12:52	1.00	12:52	1.00
Reading # 2 (in)	13:17	0.00	13:21	0.50	13:21	0.00	13:22	1.00	13:22	1.00
Reading # 3 (in)	13:47	0.00	13:51	0.38	13:51	0.00	13:52	1.00	13:52	1.00
Reading # 4 (in)	14:17	0.00	14:21	0.38	14:21	0.00	14:22	1.00	14:22	1.00
Reading # 5 (in)										
Reading # 6 (in)										
Reading # 7 (in)										
Reading # 8 (in)										
O.D. of Double Ring Infiltrrometer (in)	6.00		6.00		6.00		6.00		6.00	
Initial Water Depth (in)	6.00		6.00		6.00		6.00		6.00	
Final Water Level Drop (in)	0.00		0.38		0.00		1.00		1.00	
Average Reading (in)	0.00		0.44		0.00		1.00		1.00	
Infiltration Rate (in/hr)	0.00		0.88		0.00		2.00		2.00	
Safety Factor	2.00		2.00		2.00		2.00		2.00	
Corrected Infiltration Rate (in/hr)	0.00		0.44		0.00		1.00		1.00	

Notes:
1. Infiltrrometer refilled to water depth of 6 inches (inner and outer ring) after each reading.



TP-01



TP-02



TP-03



TP-04

CHIQUES CROSSING
ECS PROJECT NO. 18:5839
LANCASTER COUNTY, PENNSYLVANIA



TEST PIT PHOTOGRAPHS
JANUARY 2023



TP-05



TP-06



TP-07



TP-08

CHIQUES CROSSING
ECS PROJECT NO. 18:5839
LANCASTER COUNTY, PENNSYLVANIA



TEST PIT PHOTOGRAPHS
JANUARY 2023



TP-09



TP-10

TP-09

TP-10



TP-11



TP-12

TP-11

TP-12

CHIQUES CROSSING
ECS PROJECT NO. 18:5839
LANCASTER COUNTY, PENNSYLVANIA



TEST PIT PHOTOGRAPHS
JANUARY 2023



TP-13

TP-13



TP-14

TP-14



TP-15

TP-15



TP-16

TP-16

CHIQUES CROSSING
ECS PROJECT NO. 18:5839
LANCASTER COUNTY, PENNSYLVANIA



TEST PIT PHOTOGRAPHS
JANUARY 2023



TP-17

TP-17



TP-18

TP-18



TP-19

TP-19



TP-20

TP-20

CHIQUES CROSSING
ECS PROJECT NO. 18:5839
LANCASTER COUNTY, PENNSYLVANIA



TEST PIT PHOTOGRAPHS
JANUARY 2023



TP-21



TP-22



TP-23



TP-24

CHIQUES CROSSING
ECS PROJECT NO. 18:5839
LANCASTER COUNTY, PENNSYLVANIA



TEST PIT PHOTOGRAPHS
JANUARY 2023



TP-25

CHIQUES CROSSING
ECS PROJECT NO. 18:5839
LANCASTER COUNTY, PENNSYLVANIA



TEST PIT PHOTOGRAPHS
JANUARY 2023



SR-01

Surficial Rock (SR-01)



SR-02

Surficial Rock (SR-02)



SR-03

Surficial Rock (SR-03)



SR-04

Surficial Rock (SR-04)

CHIQUES CROSSING
ECS PROJECT NO. 18:5839
LANCASTER COUNTY, PENNSYLVANIA



CARBONATE ASSESSMENT PHOTOGRAPHS
JANUARY 2023



Surficial Rock (SR-05)



Surficial Rock (SR-06)



Surficial Rock (SR-07)



Sinkhole/Subsidence Feature



Surface Depression (SD-01)



Animal Burrow (GH-01)



Animal Burrow (GH-02)



Animal Burrow (GH-03)



Animal Burrow (GH-04)



Animal Burrow (GH-05)



Animal Burrow (GH-06)



Animal Burrow (GH-07)



Animal Burrow (GH-08)



Animal Burrow (GH-09)



Animal Burrow (GH-10)



Animal Burrow (GH-11)

APPENDIX C – Laboratory Testing

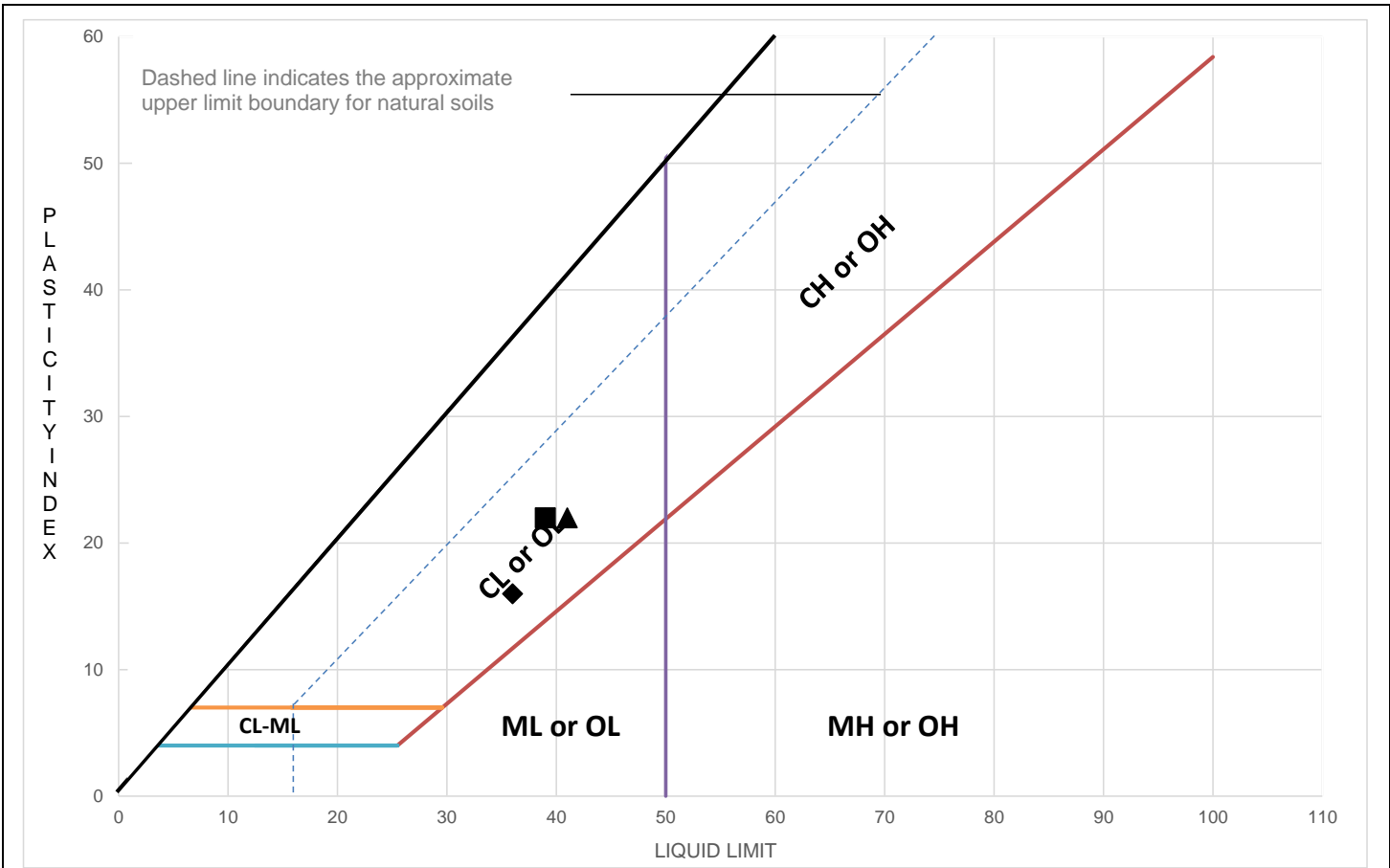
Laboratory Test Results Summary

Plasticity Chart

Grain Size Analyses

Textural Triangle USDA Test

LIQUID AND PLASTIC LIMITS TEST REPORT



TEST RESULTS (ASTM D4318-10 (MULTIPOINT TEST))

	Sample Location	Sample Number	Sample Depth (ft)	LL	PL	PI	%<#40	%<#200	AASHTO	USCS	Material Description
■	TP-04	S-1	4	39	17	22	91.8	77.3	A-6	CL	Lean Clay with Sand
◆	TP-12	S-1	4	36	20	16	93.4	77.4	A-6	CL	Lean Clay with Sand
▲	TP-25	S-1	4	41	19	22	92.5	87.0	A-7-6	CL	Lean Clay

Project: Chiques Crossing
Client: Vistablock Westmount, LLC

Project No.: 18:5839
Date Reported: 2/3/2023



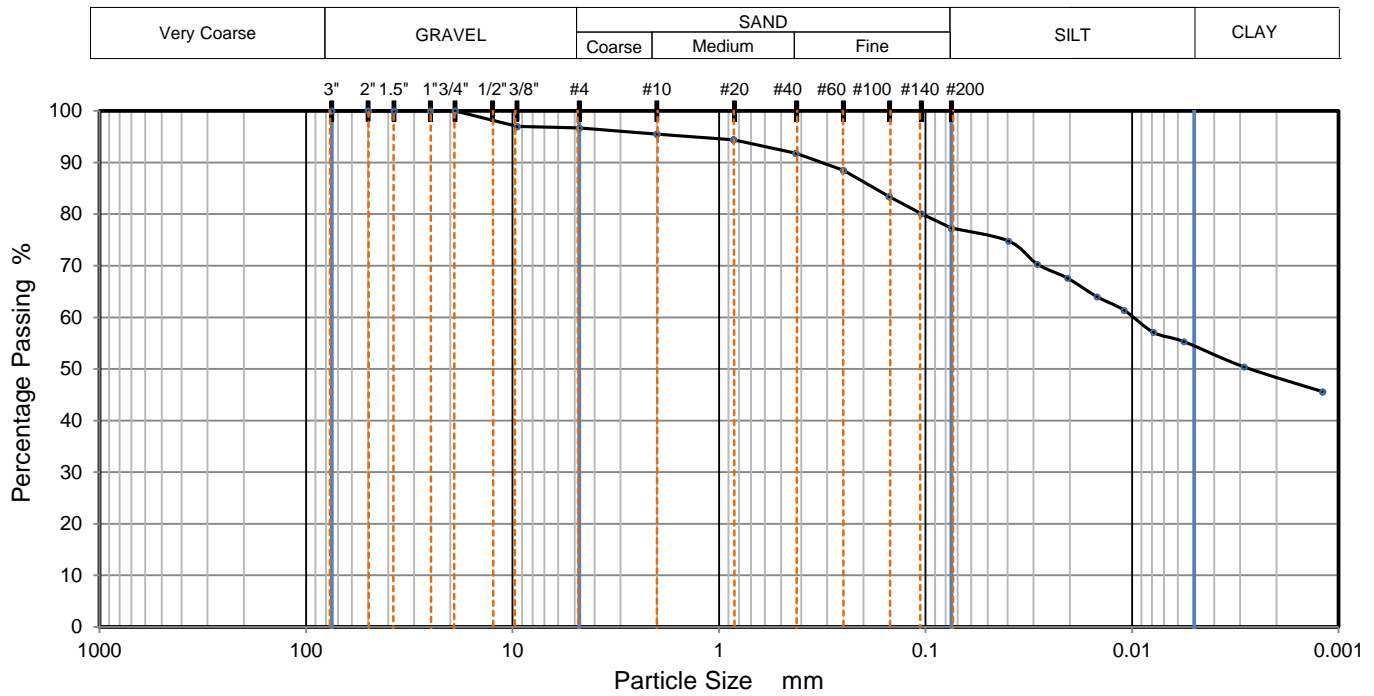
Office / Lab
ECS Mid-Atlantic LLC - York

Address
52-6 Grumbacher Road
York, PA 17406

Office Number / Fax
(717)767-4788
(717)767-5658

Tested by JGates	Checked by	Approved by agolihew	Date Received
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PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D6913M-17-METHOD A)

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100	0.0397	75
2"	100	0.0287	70
1 1/2"	100	0.0206	68
1"	100	0.0148	64
3/4"	100	0.0109	61
3/8"	97	0.0079	57
#4	97	0.0056	55
#10	96	0.0029	50
#20	94	0.0012	46
#40	92		
#60	89		
#100	83		
#140	80		
#200	77		
		Specific Gravity (Historical) 2.65	

Dry Mass of sample, g 145.8

Sample Proportions	% dry mass
Very coarse, >3" sieve	0
Gravel, 3" to # 4 sieve	3
Coarse Sand, #4 to #10 sieve	1
Medium Sand, #10 to #40	4
Fine Sand, #40 to #200	15
Silt, 75µm to 5 µm	23
Clay < 5µm	55

USCS	CL	Liquid Limit	39	D90	0.318	D50	0.003	D10	
AASHTO	A-6	Plastic Limit	17	D85	0.176	D30		Cu	
USCS Group Name	Lean clay with sand	Plasticity Index	22	D60	0.010	D15		Cc	

Project: Chiques Crossing
 Client: Vistablock Westmount, LLC
 Sample Description: Lean Clay with Sand
 Sample Source: TP-04

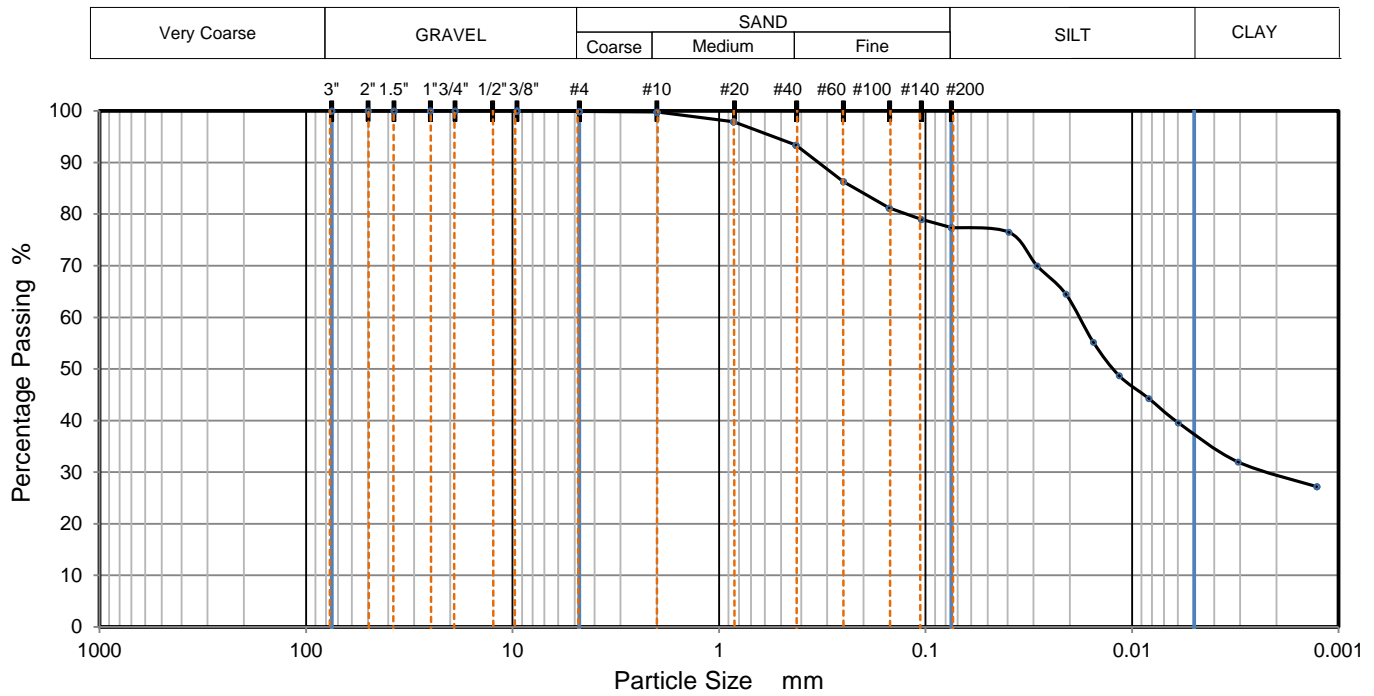
Project No.: 18:5839
 Depth (ft): 4
 Sample No.: S-1
 Date Reported: 2/3/2023



Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - York	52-6 Grumbacher Road York, PA 17406	(717)767-4788 (717)767-5658

Tested by	Checked by	Approved by	Date Received	Remarks
JGates		agolihew		

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D6913M-17-METHOD A)

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100	0.0395	77
2"	100	0.0288	70
1 1/2"	100	0.0209	65
1"	100	0.0154	55
3/4"	100	0.0115	49
3/8"	100	0.0083	44
#4	100	0.0060	40
#10	100	0.0031	32
#20	98	0.0013	27
#40	93		
#60	86		
#100	81		
#140	79		
#200	77		
		Specific Gravity (Historical) 2.65	

Dry Mass of sample, g	111.1	
Sample Proportions		% dry mass
Very coarse, >3" sieve		0
Gravel, 3" to # 4 sieve		0
Coarse Sand, #4 to #10 sieve		0
Medium Sand, #10 to #40		6
Fine Sand, #40 to #200		16
Silt, 75μm to 5 μm		40
Clay < 5μm		38

USCS	CL	Liquid Limit	36	D90	0.330	D50	0.012	D10	
AASHTO	A-6	Plastic Limit	20	D85	0.220	D30	0.002	Cu	
USCS Group Name	Lean clay with sand	Plasticity Index	16	D60	0.018	D15		Cc	

Project: Chiques Crossing
 Client: Vistablock Westmount, LLC
 Sample Description: Lean Clay with Sand
 Sample Source: TP-12

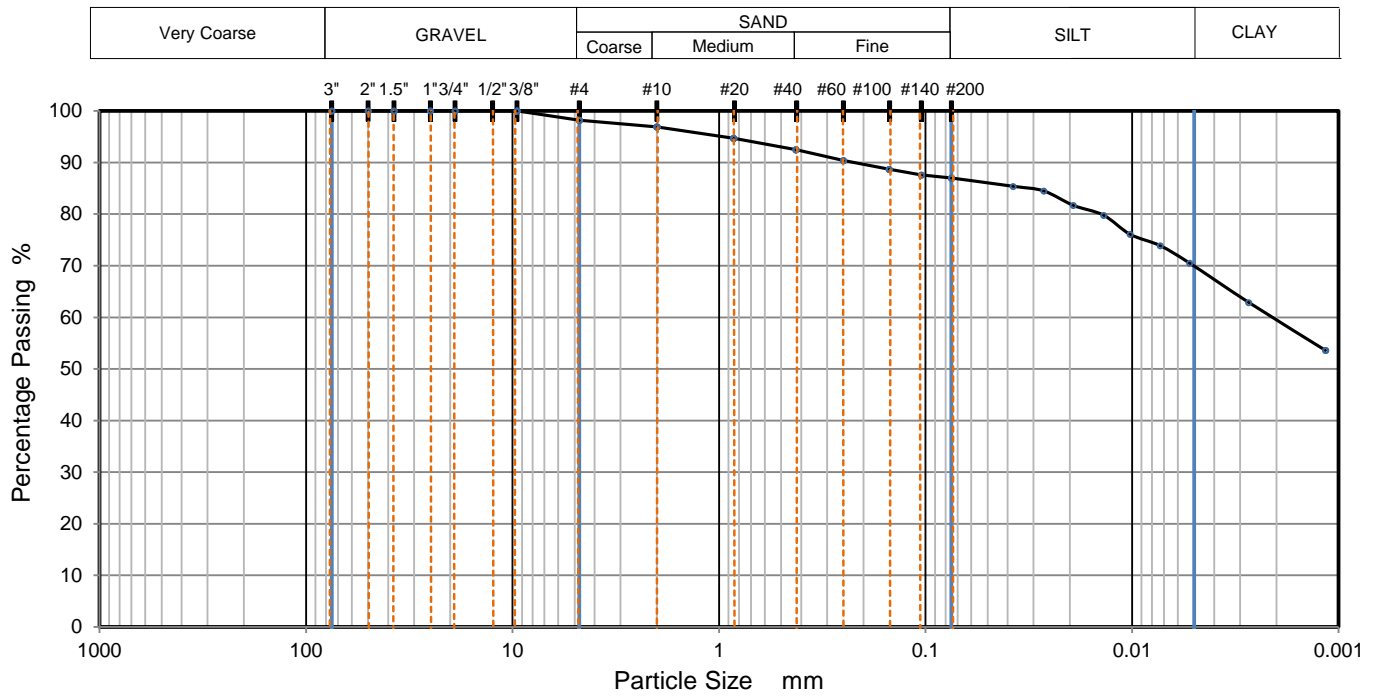
Project No.: 18:5839
 Depth (ft): 4
 Sample No.: S-1
 Date Reported: 2/3/2023



Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - York	52-6 Grumbacher Road York, PA 17406	(717)767-4788 (717)767-5658

Tested by	Checked by	Approved by	Date Received	Remarks
JGates		agolihew		

PARTICLE SIZE DISTRIBUTION



TEST RESULTS (ASTM D6913M-17-METHOD A)

Sieving		Hydrometer Sedimentation	
Particle Size	% Passing	Particle Size mm	% Passing
3"	100	0.0377	85
2"	100	0.0268	85
1 1/2"	100	0.0192	82
1"	100	0.0137	80
3/4"	100	0.0102	76
3/8"	100	0.0073	74
#4	98	0.0053	71
#10	97	0.0027	63
#20	95	0.0012	54
#40	93		
#60	90		
#100	89		
#140	88		
#200	87		
		Specific Gravity (Historical) 2.65	

Dry Mass of sample, g 121.1

Sample Proportions	% dry mass
Very coarse, >3" sieve	0
Gravel, 3" to # 4 sieve	2
Coarse Sand, #4 to #10 sieve	1
Medium Sand, #10 to #40	4
Fine Sand, #40 to #200	6
Silt, 75µm to 5 µm	17
Clay < 5µm	70

USCS	CL	Liquid Limit	41	D90	0.222	D50		D10	
AASHTO	A-7-6	Plastic Limit	19	D85	0.032	D30		Cu	
USCS Group Name	Lean clay	Plasticity Index	22	D60	0.002	D15		Cc	

Project: Chiques Crossing
 Client: Vistablock Westmount, LLC
 Sample Description: Lean Clay
 Sample Source: TP-25

Project No.: 18:5839
 Depth (ft): 4
 Sample No.: S-1
 Date Reported: 2/3/2023



Office / Lab	Address	Office Number / Fax
ECS Mid-Atlantic LLC - York	52-6 Grumbacher Road York, PA 17406	(717)767-4788 (717)767-5658

Tested by	Checked by	Approved by	Date Received	Remarks
JGates		agolihew		

USDA Classification

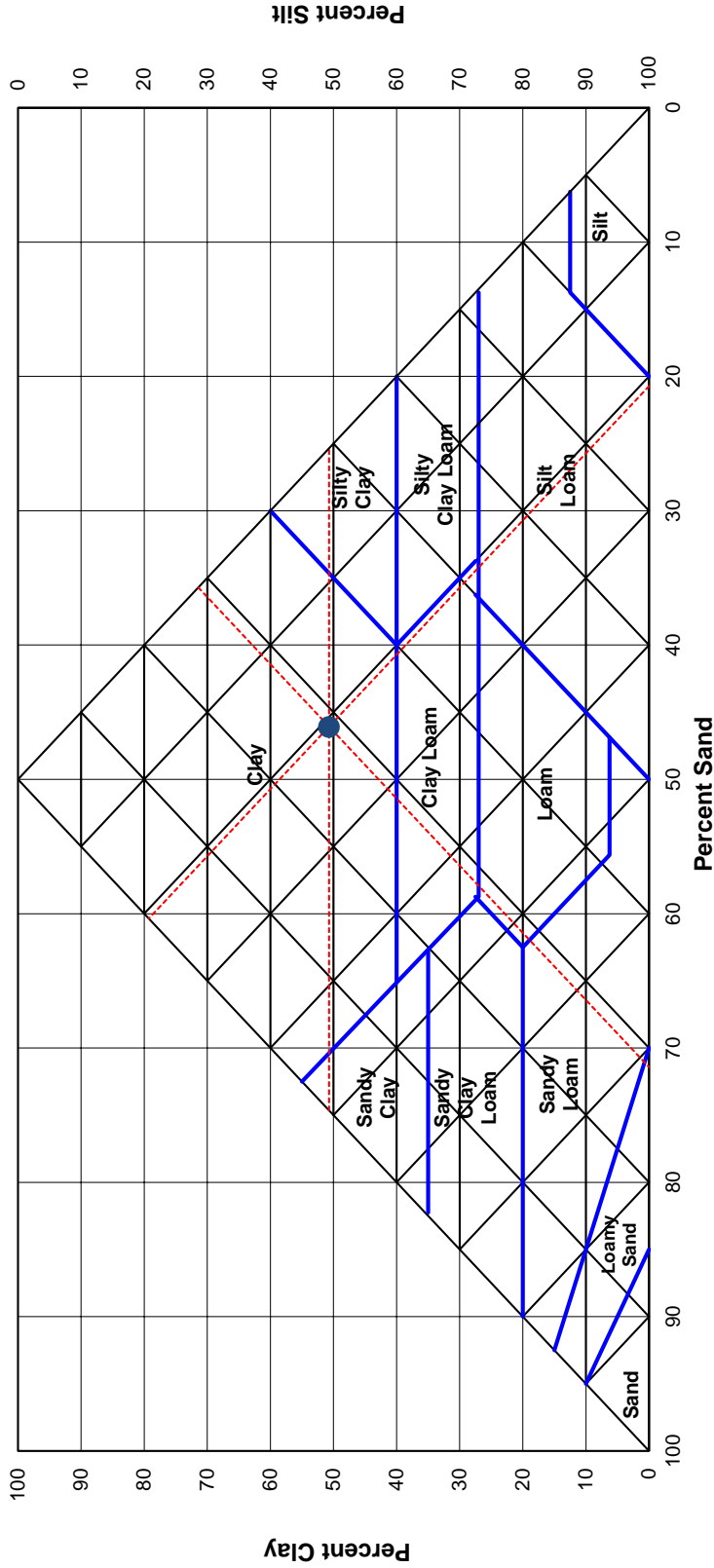
TEST RESULTS (ASTM D6913M-17-METHOD A)

USDA Soil Percentages (Corrected for Gravel):	%Sand	%Silt	%Clay
	20.7	28.6	50.7

Clay

USDA Classification:

Textural Triangle USDA



Project: Chiques Crossing
 Client: Vistablock Westmount, LLC
 Sample Description: Lean Clay with Sand
 Sample Source: TP-04

Project No.: 18:5839
 Depth (ft): 4
 Sample No.: S-1
 Date Reported: 2/3/2023



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 (717)767-4788
 (717)767-5658

Tested by JGates	Checked by	Approved by agolihew	Date Received
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USDA Classification

TEST RESULTS (ASTM D6913M-17-METHOD A)

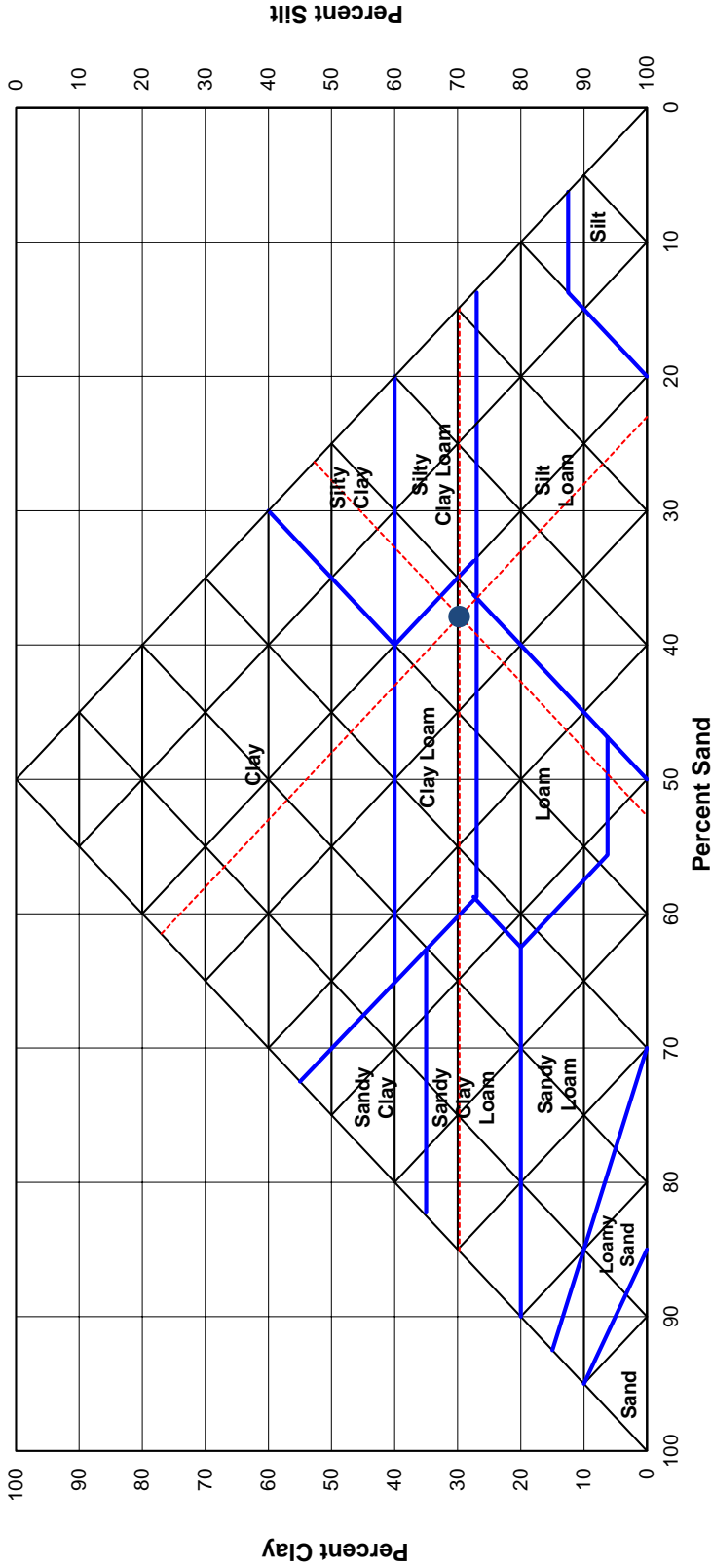
%Sand	%Silt	%Clay
23.0	47.3	29.7

USDA Soil Percentages
(Corrected for Gravel):

Clay Loam

USDA Classification:

Textural Triangle USDA



Project: Chiques Crossing
 Client: Vistablock Westmount, LLC
 Sample Description: Lean Clay with Sand
 Sample Source: TP-12

Project No.: 18:5839
 Depth (ft): 4
 Sample No.: S-1
 Date Reported: 2/3/2023



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Tested by JGates	Checked by	Approved by agolihew	Date Received
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USDA Classification

TEST RESULTS (ASTM D6913M-17-METHOD A)

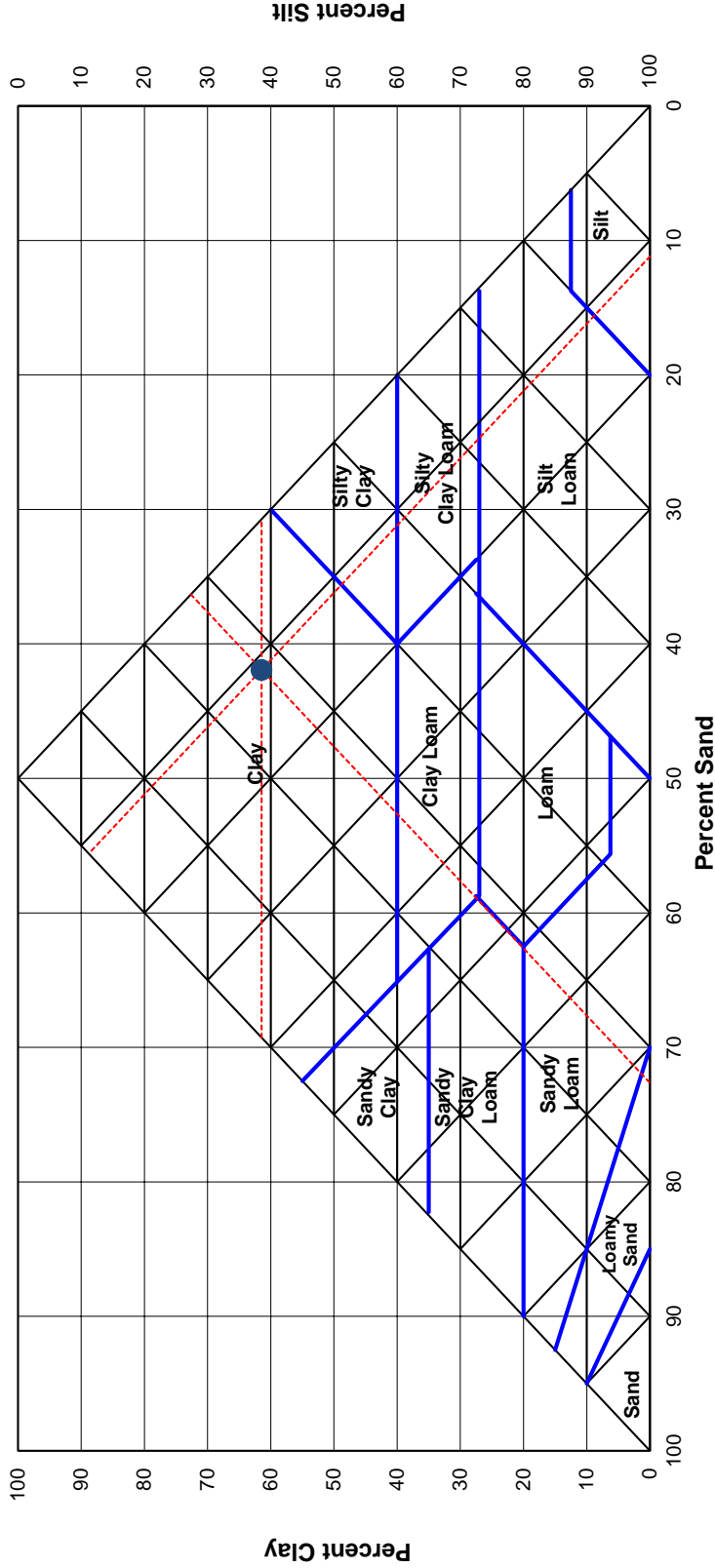
%Sand	%Silt	%Clay
11.2	27.4	61.5

USDA Soil Percentages
(Corrected for Gravel):

Clay

USDA Classification:

Textural Triangle USDA



Project: Chiques Crossing
 Client: Vistablock Westmount, LLC
 Sample Description: Lean Clay
 Sample Source: TP-25

Project No.: 18:5839
 Depth (ft): 4
 Sample No.: S-1
 Date Reported: 2/3/2023



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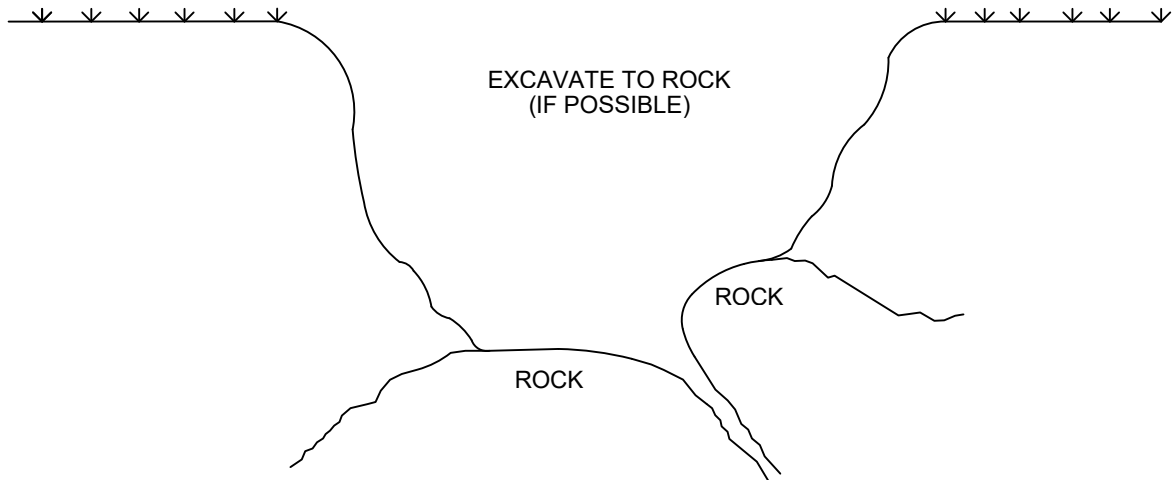
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 (717)767-5658

Tested by JGates	Checked by	Approved by agolihew	Date Received
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APPENDIX D – Supplemental Report Documents

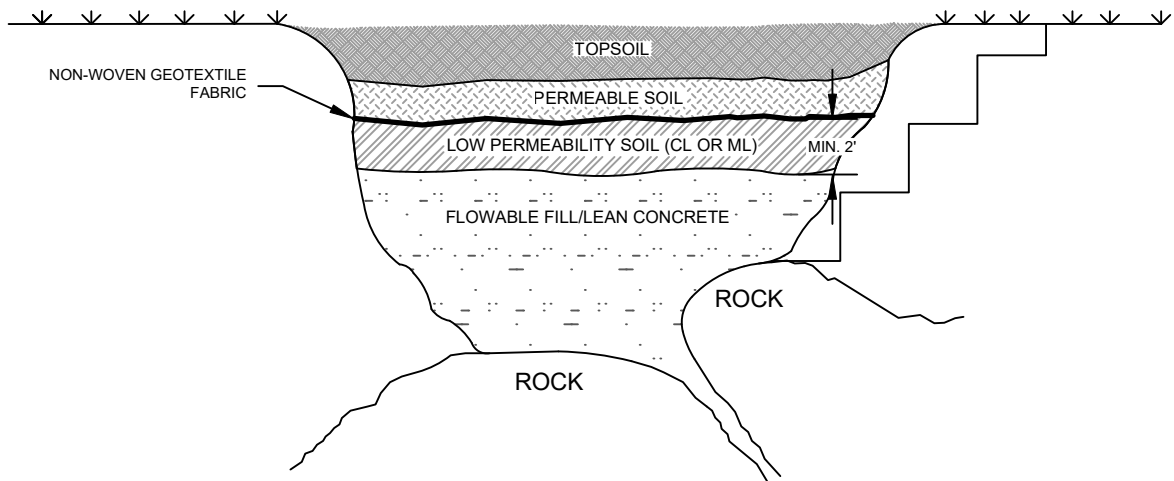
Sinkhole Repair Details

French Drain Installation Procedure



STEP 1: EXCAVATE THE SINKHOLE DOWN TO ROCK, IF POSSIBLE.

STEP 2: CLEAN OUT ALL LOOSE SOIL AND EXPOSE THROAT, IF POSSIBLE.



STEP 3: PLACE APPROXIMATELY 2 TO 3 FEET (OR AS NEEDED) OF FLOWABLE FILL/LEAN CONCRETE.

STEP 4: COMPACT LOW PERMEABILITY SOIL (CL OR ML MATERIALS) OVER FLOWABLE FILL/LEAN CONCRETE TO A MINIMUM THICKNESS OF 2 FEET.

STEP 5: COVER THE SOIL WITH NON-WOVEN GEOTEXTILE FABRIC.

STEP 6: COVER GEOTEXTILE WITH PERMEABLE SOIL, COMPATIBLE WITH THE ON-SITE SOILS. COMPACT TO A MINIMUM OF 95% OF THE MAXIMUM DRY DENSITY (MDD) AS OBTAINED BY ASTM D698 (OR 92% OF THE MDD AS OBTAINED BY ASTM D1557.)

STEP 7: FILL THE REMAINDER OF THE HOLE WITH SOIL TO MATCH GRADE. THIS CAN BE LAYERED TO MATCH THE EXISTING SOIL PROFILE.

NOTE: ALL SINKHOLE REPAIRS SHOULD BE PERFORMED UNDER THE SUPERVISION OF A GEOTECHNICAL ENGINEER EXPERIENCED WITH CARBONATE GEOLOGY AND SINKHOLE REPAIR PROCEDURES. DETAILS CAN BE MODIFIED AT THE DESCRETION OF THE GEOTECHNICAL ENGINEER BASED ON THE ENCOUNTERED CONDITIONS. POSITIVE DRAINAGE AWAY FROM THE OPEN EXCAVATION SHOULD BE MAINTAINED.

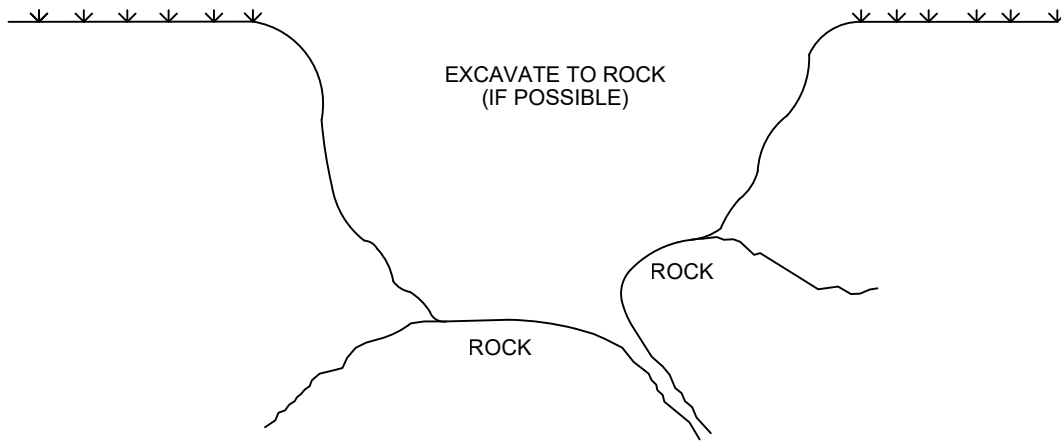


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TYPICAL SINKHOLE REPAIR DETAIL

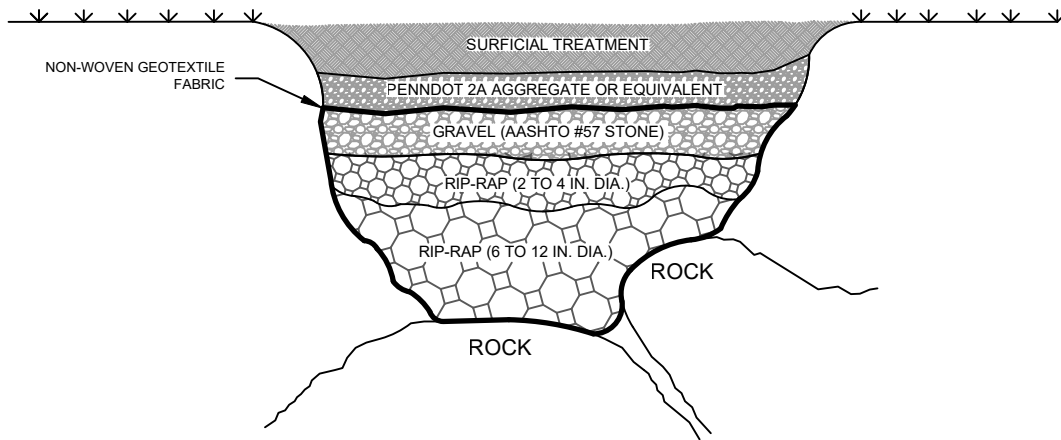
GROUTED REPAIR

NOT TO SCALE



STEP 1: EXCAVATE THE SINKHOLE DOWN TO ROCK, IF POSSIBLE.

STEP 2: CLEAN OUT ALL LOOSE SOIL AND EXPOSE THROAT, IF POSSIBLE.



STEP 3: LINE THE EXCAVATION WITH NON-WOVEN GEOTEXTILE FABRIC (MIRAFI 140N OR EQUIVALENT).

STEP 4: PLACE A LAYER OF LARGE STONE IN THE EXCAVATION. STONE SHOULD BE APPROXIMATELY 6 TO 12 INCHES IN DIAMETER.

STEP 5: PLACE A LAYER OF SMALLER STONE ON TOP. THIS LAYER SHOULD CONSIST OF STONES APPROXIMATELY 2 TO 4 INCHES IN DIAMETER.

STEP 6: PLACE A LAYER OF GRAVEL ON TOP OF THE SMALLER STONES. THE GRAVEL SHOULD BE AASHTO #57 STONE OR EQUIVALENT.

STEP 7: COVER THE GRAVEL WITH THE GEOTEXTILE FABRIC. THIS WILL PREVENT THE FINES FROM THE NEXT LAYER FROM BEING LOST IN THE VOID SPACE OF THE GRAVEL/STONE.

STEP 8: PLACE A LAYER OF PENNDOT 2A AGGREGATE OR EQUIVALENT ON TOP OF THE GEOTEXTILE FABRIC. COMPACT TO A MINIMUM OF 95% OF THE MAXIMUM DRY DENSITY (MDD) AS OBTAINED BY ASTM D698 (OR 92% OF THE MDD AS OBTAINED BY ASTM D1557.)

STEP 9: FILL THE REMAINDER OF THE HOLE WITH SOIL TO MATCH GRADE. THIS CAN BE LAYERED TO MATCH THE EXISTING SOIL PROFILE.

NOTE: IDEALLY EACH LAYER IS APPROXIMATELY 6 INCHES TO 2 FEET THICK; HOWEVER, THICKER LAYERS ARE SOMETIMES WARRANTED DEPENDING ON THE DEPTH OF THE FEATURE. ALL SINKHOLE REPAIRS SHOULD BE PERFORMED UNDER THE SUPERVISION OF A GEOTECHNICAL ENGINEER EXPERIENCED WITH CARBONATE GEOLOGY AND SINKHOLE REPAIR PROCEDURES. DETAILS CAN BE MODIFIED AT THE DISCRETION OF THE GEOTECHNICAL ENGINEER BASED ON THE ENCOUNTERED CONDITIONS. POSITIVE DRAINAGE AWAY FROM THE OPEN EXCAVATION SHOULD BE MAINTAINED.



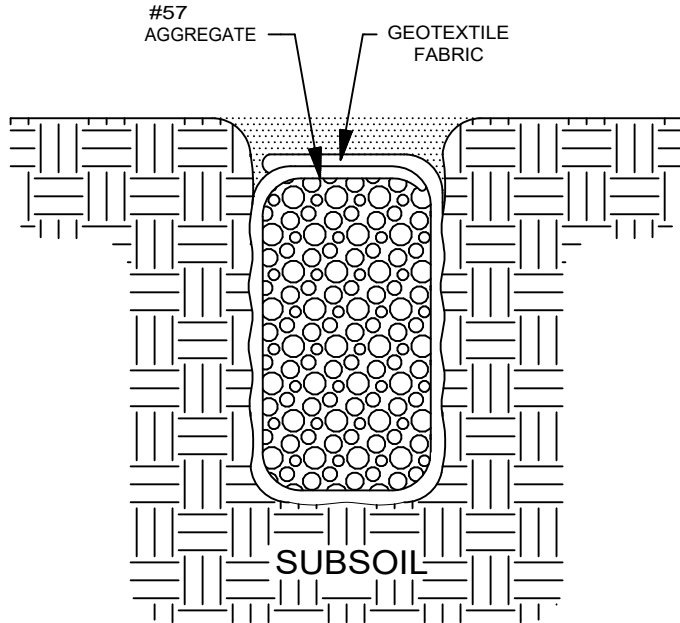
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TYPICAL SINKHOLE REPAIR DETAIL

STONE TYPE REPAIR

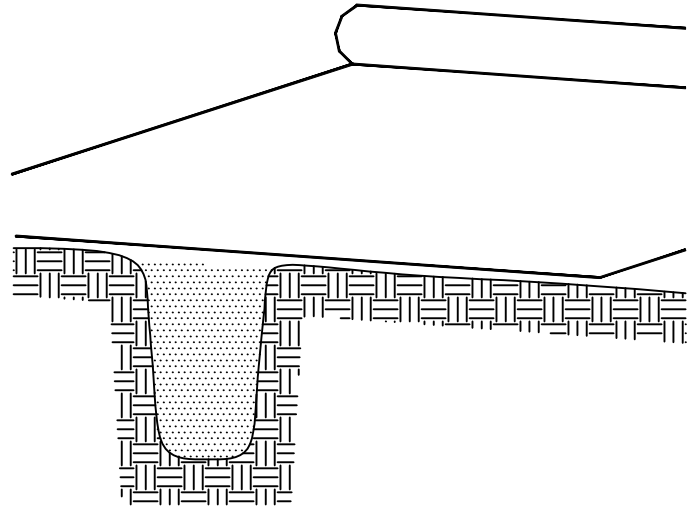
NOT TO SCALE

FINAL CONFIGURATION



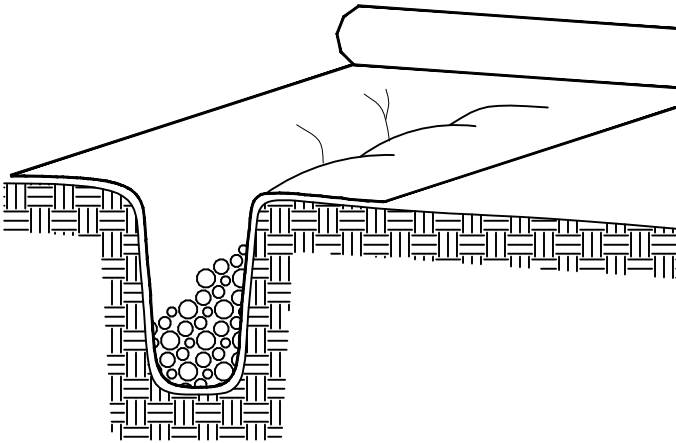
SUBDRAIN USING FILTER FABRIC

STEP 1



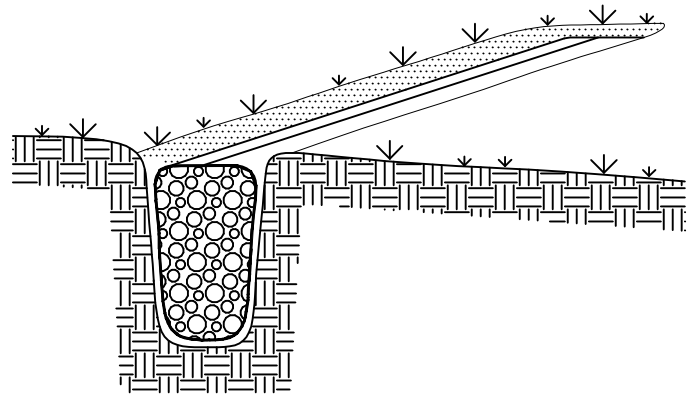
FABRIC IS UNROLLED DIRECTLY OVER TRENCH

STEP 2



THE TRENCH IS FILLED WITH AGGREGATE

STEP 3



THE FABRIC IS LAPPED CLOSED AND COVERED WITH BASE STONE



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FRENCH DRAIN TYPICAL DETAIL

INSTALLATION PROCEDURE

NOT TO SCALE