



ECS Mid-Atlantic, LLC

Geotechnical Engineering Report for Stormwater Management

Greiner Warehouse

2861 Mount Pleasant Road
Mount Joy Township, Lancaster County, Pennsylvania

ECS Project Number 18:5665

August 22, 2022





August 22, 2022

Mr. Joshua C. George, P.E.
Landworkds Civil Design, LLC
1195 Virginia Avenue
York, PA 17403

ECS Project No. 18:5665

Reference: Geotechnical Engineering Report for Stormwater Management
Greiner Warehouse
Mount Joy Township, Lancaster County, Pennsylvania

Dear Mr. George:

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. 18:8445-GP-REV, dated July 18, 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 Landworkds Civil Design, 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

Jesse B. Derick
Geotechnical Staff Project Manager
jderick@ecslimited.com



Derek G. Ridinger, P.E.
Associate Principal
driding@ecslimited.com

TABLE OF CONTENTS

EXECUTIVE SUMMARY1

1.0 INTRODUCTION2

2.0 PROJECT INFORMATION.....3

 2.1 Project Location..... 3

 2.2 Proposed Construction..... 3

3.0 FIELD EXPLORATION AND LABORATORY TESTING4

 3.1 Subsurface Characterization..... 4

 3.1.1 Stormwater Infiltration Testing..... 4

 3.2 Site Geology..... 5

 3.3 Groundwater Observations 6

 3.4 Laboratory Testing..... 6

4.0 DESIGN RECOMMENDATIONS7

 4.1 Stormwater Management Areas 7

 4.1.1 Stormwater Management Facilities 7

 4.1.2 Stormwater Management Considerations..... 8

 4.1.3 Stormwater Management Facilities - Design Notes..... 8

5.0 SITE CONSTRUCTION RECOMMENDATIONS9

 5.1 Construction Recommendations..... 9

6.0 CLOSING10

APPENDICES

Appendix A – Diagrams & Reports

- Site Location Diagram
- Exploration Location Plan
- Geology Map
- Soil Survey Map
- Soils Mapping Descriptions

Appendix B – Field Operations

- Subsurface Exploration Procedure: Test Pit Excavation
- Test Pit Logs IT-01 through IT-12
- Infiltration Test Results
- Test Pit Photographs

Appendix C – Laboratory Testing

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

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 recommendations are summarized. Information gleaned from the Executive Summary should not be utilized in lieu of reading the entire geotechnical report.

- Groundwater seepage into our test pits was not observed during our exploration at the depths explored. Additionally, no apparent signs of the seasonal high water table were observed within the test pits completed.
- Infiltration rates ranged between 0.00 in/hr to 0.35 in/hr, including a factor of safety of 2 or 3, depending on the infiltration method and the soil type. Based on guidance from the Pennsylvania Department of Protection (DEP), a Managed Release Concept (MRC) can be utilized when infiltration rates are negligible (0.20 in/hr or less), which is the case on this property.
- Based on the data obtained, rock excavation is not anticipated during construction. However, difficult excavation efforts through highly weathered bedrock with a Bobcat E32 excavator was required to advanced select test pits to the required basin bottom and limiting zone check.

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 the stormwater management facilities associated with a proposed warehouse at the project site.

Our services were provided in accordance with the Proposal No. 8445-GP-REV, dated July 18, 2022, as authorized by Landworks Civil Design, LLC under the corresponding Subconsultant Agreement between ECS Mid-Atlantic, LLC and Landworks Civil Design August 3, 2022.

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.

The report includes the following items:

- 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.

2.0 PROJECT INFORMATION

2.1 PROJECT LOCATION

The project site is located at the physical address of 2861 Mount Pleasant Road in Mount Joy Township, Lancaster County, Pennsylvania. The site is located north of Mount Pleasant Road and currently consists of undeveloped agricultural fields and woodlands. The topographic relief of the site is on the order of approximately 115 feet. The site generally slopes downgradient in all directions from a high point of the property situated in the central-eastern portion of the property.

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 provided *Infiltration Testing Exhibit Plan* by Landworks Civil Design, provided on July 22, 2022, we understand that the proposed development consists of two (2) warehouses. Development of this project will also include constructing parking areas, truck aprons/docks, drive lanes and stormwater management facilities. The proposed SWM facilities are anticipated to be comprised of four (4) at-grade basins situated along the south and west ends of the site. Based on the provided plan, cuts up to approximately 10 feet will be required to reach proposed basin bottom elevations. This report addresses only the stormwater management structures of this development.

3.0 FIELD EXPLORATION AND LABORATORY TESTING

Our scope of work included excavating twelve (12) test pits and performing corresponding infiltration tests in each. 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 subsurface conditions. Please refer to the test pit logs in Appendix B for more detailed information.

SUBSURFACE STRATIGRAPHY	
Stratum	Description
n/a	Topsoil Thickness: Approximately 12 inches
I	Generally, SILT (ML), SAND (SC), and GRAVEL (GP-GM) - Reddish Brown, Light Brown, Orange Brown - Moist - 2.5YR 4/8, 2.5YR 7/6, 2.5YR 6/8

3.1.1 Stormwater Infiltration Testing

The infiltration testing was completed using the double ring infiltration and percolation methods 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 and include a factor of safety.

INFILTRATION TESTING RESULTS						
Test Location	Surface Elevation (Feet)	Limiting Zone Depth (Feet)	Limiting Zone Elevation (Feet)	Infiltration Test Depth (Feet)	Test Elevation (Feet)	Field Infiltration Rate (inches / hour)
Basin #1 (Proposed Basin Bottom = 440.0 feet)						
IT-01	444.8	>7.5	<437.3	4.8	440.0	0.00 ²
				4.8		0.13 ⁴
IT-02	442.5	>4.5	<438.0	2.5	440.0	0.00 ²
				2.5		0.35 ³
IT-03	446.5	>8.5	<438.0	6.5	440.0	0.00 ²
				6.5		0.23 ⁴
IT-04	442.0	>4.0	<438.0	2.0	440.0	0.00 ²
				2.0		0.16 ⁴
Basin #2 (Proposed Basin Bottom = 432.0 feet)						
IT-05	437.9	>8.0	<429.9	5.9	432.0	0.00 ²
				5.9		0.15 ⁴

INFILTRATION TESTING RESULTS						
Test Location	Surface Elevation (Feet)	Limiting Zone Depth (Feet)	Limiting Zone Elevation (Feet)	Infiltration Test Depth (Feet)	Test Elevation (Feet)	Field Infiltration Rate (inches / hour)
IT-06	435.5	>5.5	<430.0	3.5	432.0	0.00 ²
				3.5		0.08 ⁴
IT-07	433.5	>4.0	<429.5	1.5	432.0	0.00 ²
				1.5		0.10 ⁴
Basin #3 (Proposed Basin Bottom = 460.0 feet)						
IT-08	460.0	>3.0	<457.0	1.0	459.0	0.00 ²
				1.0		0.12 ⁴
IT-09	467.5	>10.0	<457.5	7.5	460.0	0.00 ²
				7.5		0.08 ⁴
IT-10	467.6	>10.0	<457.6	7.6	460.0	0.00 ²
				7.6		0.09 ⁴
Basin #4 (Proposed Basin Bottom = 477.0 feet)						
IT-11	479.5	>5.0	<474.5	2.5	477.0	0.00 ²
				2.5		0.24 ⁴
IT-12	480.5	>6.0	<474.5	3.5	477.0	0.00 ²
				3.5		0.08 ⁴

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.

Note²: Infiltration rate achieved utilizing double ring methodology and includes a factor of safety of 2.0

Note³: Infiltration rate achieved utilizing percolation methodology and includes a factor of safety of 2.0

Note⁴: Infiltration rate achieved utilizing percolation methodology and includes a factor of safety of 3.0

3.2 SITE GEOLOGY

According to the Geologic Map of Pennsylvania (1980)¹, the site is underlain by the New Oxford Formation and Cocalico Formation. In many cases, when a site is near the meeting of two or more formations, the bedrock encountered displays characteristics of both formations.

Based on *Engineering Characteristics of the Rocks of Pennsylvania*², the New Oxford Formation consists of light colored arkosic sandstone and conglomerate sandstone. The formation is well bedded, thin. The joints have a seamy to platy pattern, are moderately developed, and highly fractured. This formation is slightly resistant to weathering and can be quickly weathered to a moderate depth. The surface drainage is good with primary porosity occurring in the weathered portion of the bedrock with secondary porosity occurring in the joints and bedding planes.

The Cocalico Formation consists of gray phyllitic shale, siltstone, siliceous shale, some interbedded argillaceous and quartzose sandstone. Bedding is moderately well developed and thin. Joints have a seamy to platy pattern, are well developed, highly abundant, and are open and steeply dipping. The

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.

formation is slightly resistant to weathering is thus moderately to highly weathered in thin, pencil-like fragments. Surface drainage is good due to jointing, faulting, and bedding-plane openings providing secondary porosity of low magnitude

3.3 GROUNDWATER OBSERVATIONS

Groundwater seepage into our test pits was not observed during our exploration at the depths explored. In addition, no apparent signs of the seasonal high water table were observed within the test pits completed. It is worth mentioning that the property contains a pond situated near the western corner of the property as well as streams which appear to run down gradient away from the pond along the western and northern property boundaries. The highest water elevation of these features is located at the pond which has an approximate elevation on the order of EL. 456.0 feet. Based on reviewed historical aerials, the pond appears to be manmade. Variations in the long-term water table may occur because of changes in precipitation, evaporation, surface water runoff, construction activities, and other factors.

3.4 LABORATORY TESTING

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 test pit 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.

The laboratory testing performed by ECS for this project consisted of selected tests performed on samples obtained during our field exploration operations. Classification and index property tests were performed on representative soil samples obtained from the test pits in order to aid in classifying soils according to the Unified Soil Classification System (USCS) and to quantify and correlate engineering properties. The laboratory results can be found in Appendix C.

4.0 DESIGN RECOMMENDATIONS

4.1 STORMWATER MANAGEMENT AREAS

4.1.1 Stormwater Management Facilities

General: The plan provided to ECS displayed the test locations within the proposed stormwater management facilities. Stormwater Management facilities for this project are anticipated to consist of four (4) at-grade basins. Final basin elevations and configurations should be provided to ECS to verify the conditions documented in this report are accurate.

4.1.1.a Infiltration Characteristics

Infiltration rates ranged between 0.00 in/hr to 0.35 in/hr, including a factor of safety of 2 or 3, depending on the infiltration method and the soil type. Based on guidance from the Pennsylvania. It should be noted that 21 out of 24 achieved infiltration rates were found to be less than 0.20 in/hr. Based on guidance from the Pennsylvania Department of Protection (DEP), a Managed Release Concept (MRC) can be utilized when infiltration rates are negligible (0.20 in/hr or less), which is the case on this property.

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.

4.1.1.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 the No. 200 sieve), a minimum liquid limit (LL) of 40 and minimum plasticity index (PI) of 20. This fill material must be approved by the ECS. Clay 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 material indicates clay soils meeting the criteria above are generally not present on site.

4.1.1.c Temporary Sediment Basin Fill Embankments

Soils used in temporary sediment basin fill embankments should satisfy the requirements for fill discussed above 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

In keeping with the guidelines and recommendations of the PA BMP Manual, ECS recommends that the following design principles be incorporated:

- Use existing drainage patterns
- Keep stormwater away from known problematic subsidence areas
- Avoid concentrating stormwater
- Reduce runoff volume and velocity
- Use broad shallow basins
- Maintain the facilities post construction
- Provide underdrains 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 generally conforming the table above, with field infiltration rates post placement determined and approved by ECS.

5.0 SITE CONSTRUCTION RECOMMENDATIONS

5.1 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.

Based on the data obtained, rock excavation is not anticipated during construction. However, difficult excavation efforts through highly weathered bedrock with a Bobcat E32 excavator was required to advanced select test pits to the required basin bottom and limiting zone check. It should be noted that Bobcat E32 is a small piece of excavator equipment, and larger excavation equipment is anticipated during construction.

If bedrock is encountered at depths/elevations which vary from those encountered during our subsurface exploration, some rock excavation could potentially be required to achieve bottom of basin elevations with the required 2-foot of buffer below the basin subgrade.

Stormwater management facilities should generally not be located within 25 feet of a building. If site constraints prohibit this recommendation, the facility may be located closer to a building subject to the review and approval of ECS.

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 Landworks Civil Design, LLC. If any of this information is inaccurate or changes, either because of our interpretation of the documents provided or site or design changes that may occur later, ECS should be contacted so we can review our recommendations and provide additional or alternate recommendations that 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 – Figures & Reports

Site Location Diagram
Exploration Location Plan
Geology Map
Soil Survey Map
Soils Mapping Description

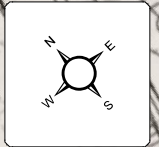
Service Layer Credits: Esri, HERE, Garmin, (c) OpenStreetMap contributors



SITE LOCATION DIAGRAM GREINER WAREHOUSE

2861 MOUNT PLEASANT ROAD, MOUNT JOY TOWNSHIP, PENNSYLVANIA
LANDWORKS CIVIL DESIGN, LLC

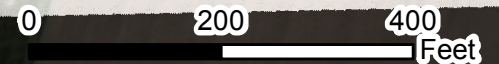
ENGINEER DGR
SCALE AS NOTED
PROJECT NO. 18:5665
FIGURE 1 OF 1
DATE 7/18/2022



Legend



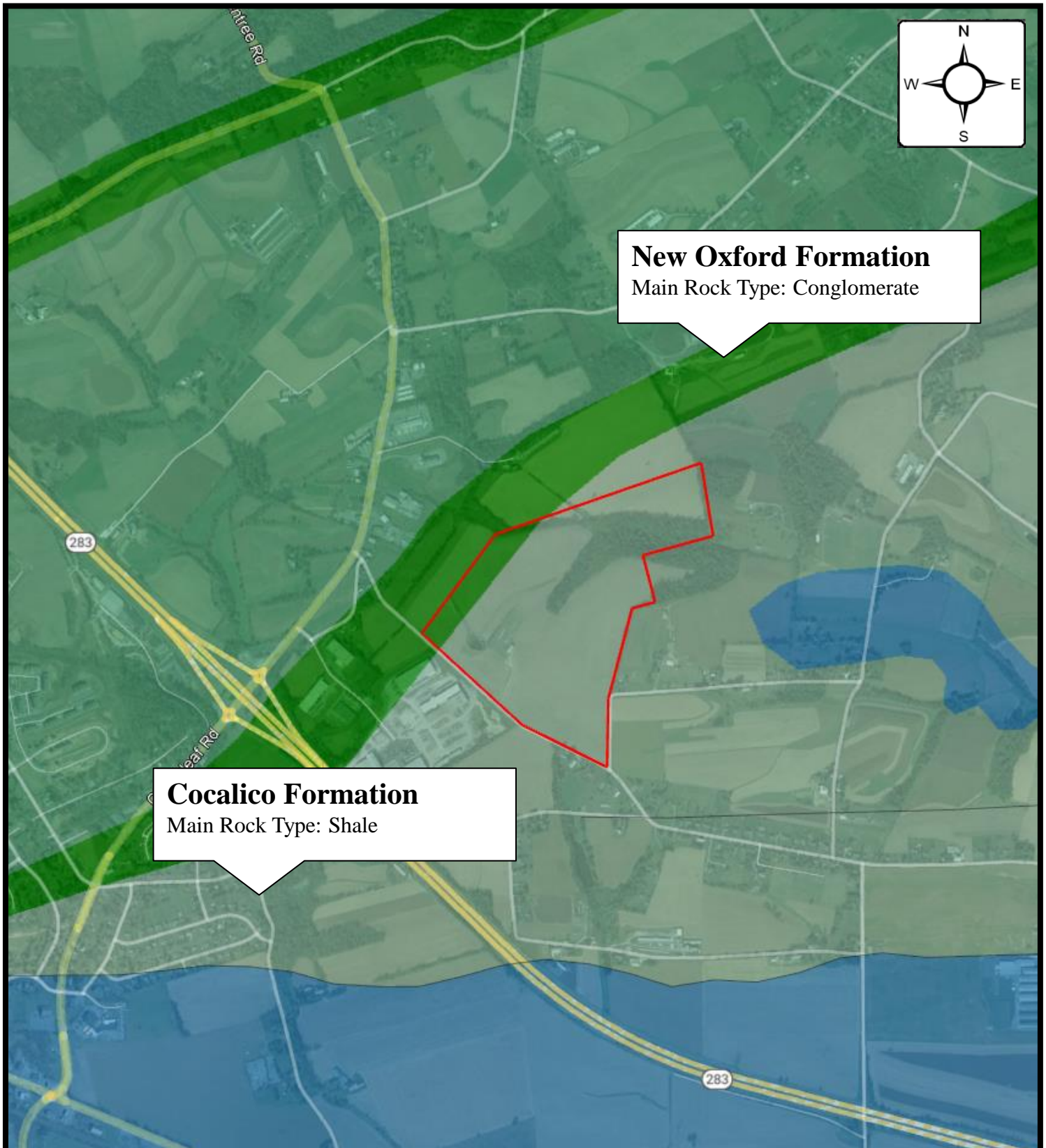
Approximate Test Pit Locations



EXPLORATION LOCATION PLAN GREINER WAREHOUSE

2861 MOUNT PLEASANT ROAD, MOUNT JOY TOWNSHIP, PA
LANDWORKS CIVIL DESIGN, LLC

ENGINEER DGR
SCALE AS NOTED
PROJECT NO. 18:5665
FIGURE 1 OF 1
DATE 8/5/2022



New Oxford Formation
Main Rock Type: Conglomerate

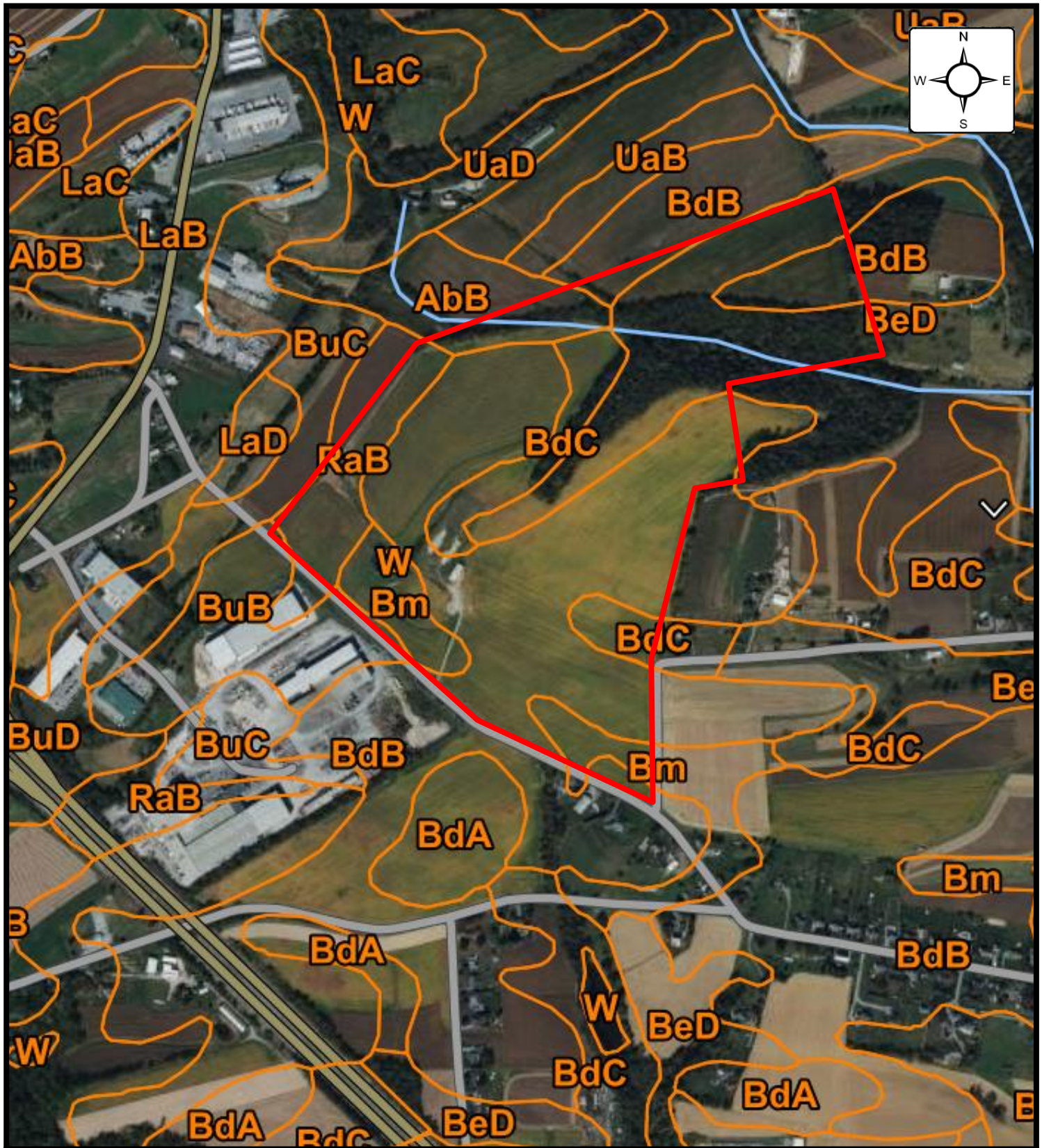
Cocalico Formation
Main Rock Type: Shale



Geology Map
GREINER WAREHOUSE

2861 MOUNT PLEASANT ROAD, MOUNT JOY
TOWNSHIP, PA
LANDWORKS CIVIL DESIGN, LLC

DRAFTER	SCA
SCALE	NTS
PROJECT NO.	18:5665
DATE	7/18/2022
SOURCE	PA DCNR Geologic Map http://www.gis.dcnr.state.pa.us



Soil Survey Map GREINER WAREHOUSE

2861 MOUNT PLEASANT ROAD, MOUNT JOY
TOWNSHIP, PA
LANDWORKS CIVIL DESIGN, LLC

DRAFTER	SCA
SCALE	NTS
PROJECT NO.	18:5665
DATE	7/18/2022
SOURCE	Web Soil Survey https://websoilsurvey.nrcs.usda.gov

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 Abbottstown silt loam, 3 to 8 percent slopes, Bedington silt loam, 3 to 15 percent slopes, Bedington channery silt loam, 15 to 25 percent slopes, Blairton silt loam, 3 to 10 percent slopes, and Readington silt loam, 3 to 8 percent slopes. 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)
Abbottstown silt loam, 3 to 8 percent slopes	AbB	Acid reddish brown residuum weathered from shale and siltstone	18 to 22 inches to fragipan; 40 to 60 inches to lithic bedrock	About 6 to 18 inches	D	(0.06 – 2.00)
Bedington silt loam, 3 to 15 percent slopes	BdB/BdC	Residuum weathered from shale and siltstone	48 to 99 inches to lithic bedrock	>80 inches	B	(0.60 – 2.00)
Bedington channery silt loam, 15 to 25 percent slopes	BeD	Acid residuum weathered from sedimentary rock	60 to 80 inches to lithic bedrock	>80 inches	B	(0.60 – 2.00)
Blairton silt loam, 3 to 10 percent slopes	Bm	Local silty colluvium derived from shale and siltstone over acid silty residuum weathered from shale and siltstone	20 to 40 inches to paralithic bedrock	About 6 to 36 inches	C/D	(0.60 – 0.60)
Readington silt loam, 3 to 8 percent slopes	RaB	Triassic colluvium derived from shale and siltstone and/or triassic residuum weathered from shale and siltstone	20 to 36 inches to fragipan; 40 to 60 inches to lithic bedrock	About 18 to 36 inches	C	(0.00)

Soils Mapping Description
ECS Project No. 18:5665



Greiner Warehouse
2861 Mount Pleasant Road
Mount Joy Township, Lancaster County,
Pennsylvania

APPENDIX B – Field Operations

Subsurface Exploration Procedure: Test Pit Excavation
Test Pit Logs IT-01 through IT-12
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: Landworks Civil Design, LLC	PROJECT NO.: 18:5665	SHEET: 1 of 1	
PROJECT NAME: Greiner Warehouse	TEST PIT NO.: IT-01	SURFACE ELEVATION: 444.8	
SITE LOCATION: 2861 Mount Pleasant Road, Mount Joy Township, Pennsylvania 17552		STATION:	
NORTHING:	EASTING:		

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
5		440	Topsoil Thickness[12.00"]	E		4.00	S-1	
			(ML) SILT WITH GRAVEL, reddish brown, moist, hard, 2.5YR 4/8	M				
			(GP-GM) GRAVEL WITH SILT, reddish brown, moist, 2.5YR 4/8, Potential Fragipan Encountered at 1'-5'	D				
			END OF TEST PIT AT 7.5 FT					
10		435						
15		430						

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) N/E	∇ WL (Seasonal High) N/E	CONTRACTOR:	OPERATOR:	MAKE/MODEL:
▼ WL (Completion) N/E		S.A. Way Excavating	Tim	Bobcat E 32

ECS REP.: SCA	DATE COMPLETED: Jul 28 2022	UNITS: English	CAVE-IN-DEPTH:
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TEST PIT LOG

CLIENT: Landworks Civil Design, LLC	PROJECT NO.: 18:5665	SHEET: 1 of 1	
PROJECT NAME: Greiner Warehouse	TEST PIT NO.: IT-02	SURFACE ELEVATION: 442.5	
SITE LOCATION: 2861 Mount Pleasant Road, Mount Joy Township, Pennsylvania 17552		STATION:	
NORTHING:	EASTING:		

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
			Topsoil Thickness[12.00"]	E				
			(SC) Clayey SAND with Gravel, light brown, moist, very dense, 2.5YR 7/6, Potential Fragipan Encountered at 1'-4.5'	D		4.50	S-1	11.8
5		438	END OF TEST PIT AT 4.5 FT					
10		433						
15		428						

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) N/E	∇ WL (Seasonal High) N/E	CONTRACTOR:	OPERATOR:	MAKE/MODEL:
▼ WL (Completion) N/E		S.A. Way Excavating	Tim	Bobcat E 32

ECS REP.: SCA	DATE COMPLETED: Jul 28 2022	UNITS: English	CAVE-IN-DEPTH:
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TEST PIT LOG


CLIENT: Landworks Civil Design, LLC	PROJECT NO.: 18:5665	SHEET: 1 of 1	
PROJECT NAME: Greiner Warehouse	TEST PIT NO.: IT-03	SURFACE ELEVATION: 446.5	
SITE LOCATION: 2861 Mount Pleasant Road, Mount Joy Township, Pennsylvania 17552		STATION:	
NORTHING:	EASTING:		

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
			Topsoil Thickness[12.00"]	E				
			(ML) SILT, light brown, moist, hard, 2.5YR 7/6	M		4.50		
5		442	(ML) SILT WITH GRAVEL, reddish brown, moist, hard, 2.5YR 4/8, Potential Fragipan Encountered at 1'-6'	D		3.50	S-1	
			END OF TEST PIT AT 8.5 FT					
10		437						
15		432						

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)	N/E	∇ WL (Seasonal High)	N/E	CONTRACTOR:	OPERATOR:	MAKE/MODEL:		
▼ WL (Completion)	N/E			S.A. Way Excavating	Tim	Bobcat E 32		
ECS REP.:	DATE COMPLETED:			UNITS:	CAVE-IN-DEPTH:			
SCA	Jul 28 2022			English				

TEST PIT LOG

CLIENT: Landworks Civil Design, LLC	PROJECT NO.: 18:5665	SHEET: 1 of 1	
PROJECT NAME: Greiner Warehouse	TEST PIT NO.: IT-04	SURFACE ELEVATION: 442.0	
SITE LOCATION: 2861 Mount Pleasant Road, Mount Joy Township, Pennsylvania 17552		STATION:	
NORTHING:		EASTING:	

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
			Topsoil Thickness[12.00"]	E				
			(ML) SILT WITH GRAVEL, light brown, moist, hard, 2.5YR 7/6, Potential Fragipan Encountered at 1' to EOP	M		4.50	S-1	
			END OF TEST PIT AT 4.0 FT					
5		437						
10		432						
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) N/E	CONTRACTOR:	OPERATOR:	MAKE/MODEL:
<input type="checkbox"/> WL (Completion) N/E		S.A. Way Excavating	Tim	Bobcat E 32
ECS REP.:	DATE COMPLETED:	UNITS:	CAVE-IN-DEPTH:	
SCA	Jul 28 2022	English		

TEST PIT LOG


CLIENT: Landworks Civil Design, LLC	PROJECT NO.: 18:5665	SHEET: 1 of 1	
PROJECT NAME: Greiner Warehouse	TEST PIT NO.: IT-05	SURFACE ELEVATION: 437.9	
SITE LOCATION: 2861 Mount Pleasant Road, Mount Joy Township, Pennsylvania 17552		STATION:	
NORTHING:		EASTING:	

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
5		433	Topsoil Thickness[12.00"]	E		4.00	S-1	
			(ML) SILT, light brown to reddish brown, moist, hard, 2.5YR 7/6, 2.5YR 4/8, Potential Fragipan Encountered at 1'-EOP	M				
10		428	END OF TEST PIT AT 8.0 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)	N/E	∇ WL (Seasonal High)	N/E	CONTRACTOR:	OPERATOR:	MAKE/MODEL:		
▼ WL (Completion)	N/E			S.A. Way Excavating	Tim	Bobcat E 32		
ECS REP.:	DATE COMPLETED:			UNITS:	CAVE-IN-DEPTH:			
SCA	Jul 28 2022			English				

TEST PIT LOG

CLIENT: Landworks Civil Design, LLC	PROJECT NO.: 18:5665	SHEET: 1 of 1	
PROJECT NAME: Greiner Warehouse	TEST PIT NO.: IT-06	SURFACE ELEVATION: 435.5	
SITE LOCATION: 2861 Mount Pleasant Road, Mount Joy Township, Pennsylvania 17552		STATION:	
NORTHING:		EASTING:	

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
5		431	Topsoil Thickness[12.00"]	E		3.50	S-1	
			(ML) GRAVELLY SILT, reddish brown, moist, very stiff, 2.5YR 4/8, Potential Fragipan Encountered at 1'-5.5'	M				
			END OF TEST PIT AT 5.5 FT					
10		426						
15		421						


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) N/E	∇ WL (Seasonal High) N/E	CONTRACTOR:	OPERATOR:	MAKE/MODEL:
▼ WL (Completion) N/E		S.A. Way Excavating	Tim	Bobcat E 32
ECS REP.: SCA	DATE COMPLETED: Jul 28 2022	UNITS: English	CAVE-IN-DEPTH:	

TEST PIT LOG

CLIENT: Landworks Civil Design, LLC	PROJECT NO.: 18:5665	SHEET: 1 of 1	
PROJECT NAME: Greiner Warehouse	TEST PIT NO.: IT-07	SURFACE ELEVATION: 433.5	
SITE LOCATION: 2861 Mount Pleasant Road, Mount Joy Township, Pennsylvania 17552		STATION:	
NORTHING:		EASTING:	

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
			Topsoil Thickness[12.00"]	E				
			(ML) SILT, light brown, moist, hard, 2.5YR 7/6, Potential Fragipan Encountered at 1'-4'	M		4.00	S-1	
			END OF TEST PIT AT 4.0 FT					
5		429						
10		424						
15		419						


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) N/E	CONTRACTOR:	OPERATOR:	MAKE/MODEL:
<input type="checkbox"/> WL (Completion) N/E		S.A. Way Excavating	Tim	Bobcat E 32
ECS REP.:	DATE COMPLETED:	UNITS:	CAVE-IN-DEPTH:	
SCA	Jul 28 2022	English		

TEST PIT LOG


CLIENT: Landworks Civil Design, LLC	PROJECT NO.: 18:5665	SHEET: 1 of 1	
PROJECT NAME: Greiner Warehouse	TEST PIT NO.: IT-08	SURFACE ELEVATION: 460	
SITE LOCATION: 2861 Mount Pleasant Road, Mount Joy Township, Pennsylvania 17552		STATION:	
NORTHING:	EASTING:		

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
			Topsoil Thickness[12.00"]	E		4.50	S-1	
			(ML) SILT WITH GRAVEL, light brown, moist, hard, 2.5YR 7/6, Potential Fragipan Encountered at 1'-3'	M				
			END OF TEST PIT AT 3.0 FT					
5		455						
10		450						
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)	N/E	∇ WL (Seasonal High)	N/E	CONTRACTOR:	OPERATOR:	MAKE/MODEL:		
▼ WL (Completion)	N/E			S.A. Way Excavating	Tim	Bobcat E 32		
ECS REP.:	DATE COMPLETED:			UNITS:	CAVE-IN-DEPTH:			
SCA	Jul 28 2022			English				

TEST PIT LOG

CLIENT: Landworks Civil Design, LLC	PROJECT NO.: 18:5665	SHEET: 1 of 1	
PROJECT NAME: Greiner Warehouse	TEST PIT NO.: IT-09	SURFACE ELEVATION: 467.5	
SITE LOCATION: 2861 Mount Pleasant Road, Mount Joy Township, Pennsylvania 17552		STATION:	
NORTHING:		EASTING:	

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
5		463	Topsoil Thickness[12.00"]	E		4.00		
			(ML) SILT WITH GRAVEL, light brown, moist, hard, 2.5YR 7/6	M				
			(ML) GRAVELLY SILT, orangish brown, moist, hard, 2.5YR 6/8, Potential Fragipan Encountered at 1'-5'	D				
10		458	END OF TEST PIT AT 10 FT			4.50	S-1	
15		453						

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) N/E	CONTRACTOR:	OPERATOR:	MAKE/MODEL:
<input checked="" type="checkbox"/> WL (Completion) N/E		S.A. Way Excavating	Tim	Bobcat E 32

ECS REP.:	DATE COMPLETED:	UNITS:	CAVE-IN-DEPTH:
SCA	Jul 27 2022	English	

TEST PIT LOG

CLIENT: Landworks Civil Design, LLC	PROJECT NO.: 18:5665	SHEET: 1 of 1	
PROJECT NAME: Greiner Warehouse	TEST PIT NO.: IT-10	SURFACE ELEVATION: 467.6	
SITE LOCATION: 2861 Mount Pleasant Road, Mount Joy Township, Pennsylvania 17552		STATION:	
NORTHING:	EASTING:		

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
			Topsoil Thickness[12.00"]	E				
			(ML) SILT WITH GRAVEL, light brown, moist, 2.5YR 7/6	M				
5		463	(ML) GRAVELLY SILT, orangish brown, moist, 2.5YR 6/8, Potential Fragipan Encountered at 1'-5'	D		4.00	S-1	
10		458	END OF TEST PIT AT 10.0 FT					
15		453						


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) N/E	∇ WL (Seasonal High) N/E	CONTRACTOR:	OPERATOR:	MAKE/MODEL:
▼ WL (Completion) N/E		S.A. Way Excavating	Tim	Bobcat E 32
ECS REP.: SCA	DATE COMPLETED: Jul 27 2022	UNITS: English	CAVE-IN-DEPTH:	

TEST PIT LOG

CLIENT: Landworks Civil Design, LLC	PROJECT NO.: 18:5665	SHEET: 1 of 1	
PROJECT NAME: Greiner Warehouse	TEST PIT NO.: IT-11	SURFACE ELEVATION: 479.5	
SITE LOCATION: 2861 Mount Pleasant Road, Mount Joy Township, Pennsylvania 17552		STATION:	
NORTHING:		EASTING:	

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
5		475	Topsoil Thickness[12.00"]	E		4.00	S-1	
			(ML) SILT, light brown, moist, hard, 2.5YR 7/6, Potential Fragipan Encountered at 1'-5'	M				
			END OF TEST PIT AT 5.0 FT					
10		470						
15		465						


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) N/E	CONTRACTOR:	OPERATOR:	MAKE/MODEL:
<input type="checkbox"/> WL (Completion) N/E		S.A. Way Excavating	Tim	Bobcat E 32
ECS REP.:	DATE COMPLETED:	UNITS:	CAVE-IN-DEPTH:	
SCA	Jul 28 2022	English		

TEST PIT LOG

CLIENT: Landworks Civil Design, LLC	PROJECT NO.: 18:5665	SHEET: 1 of 1	
PROJECT NAME: Greiner Warehouse	TEST PIT NO.: IT-12	SURFACE ELEVATION: 480.5	
SITE LOCATION: 2861 Mount Pleasant Road, Mount Joy Township, Pennsylvania 17552		STATION:	
NORTHING:	EASTING:		

DEPTH (FT)	WATER LEVELS	ELEVATION (FT)	DESCRIPTION OF MATERIAL	EXCAVATION EFFORT	DCP	QP (TSF)	SAMPLE NUMBER	MOISTURE CONTENT (%)
5		476	Topsoil Thickness[12.00"]	E		4.00	S-1	18.9
			(ML) Sandy SILT, light brown, moist, hard, 2.5YR 7/6, Potential Fragipan Encountered at 1'-6'	E				
			END OF TEST PIT AT 6.0 FT					
10		471						
15		466						

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) N/E	CONTRACTOR:	OPERATOR:	MAKE/MODEL:
<input checked="" type="checkbox"/> WL (Completion) N/E		S.A. Way Excavating	Tim	Bobcat E 32
ECS REP.: SCA	DATE COMPLETED: Jul 28 2022	UNITS: English	CAVE-IN-DEPTH:	

TEST PIT LOG

Double Ring Infiltration Test Results
Greiner Warehouse
ECS Project No. 18:5665

Date Tested: 7/28/2022 7/28/2022 7/28/2022 7/28/2022 7/28/2022 7/28/2022

Field Data	IT-01		IT-02		IT-03		IT-04		IT-05		IT-06	
Test Depth (ft)	4.8		2.5		6.5		2.0		5.9		3.5	
	Time	Reading	Time	Reading	Time	Reading	Time	Reading	Time	Reading	Time	Reading
Presoak Start/Water Depth (in)	11:48	6.00	11:53	6.00	11:46	6.00	11:55	6.00	11:50	6.00	11:57	6.00
Presoak 30 Min (in)	12:18	0.00	12:23	0.00	12:16	0.00	12:25	0.00	12:20	0.00	12:27	0.00
Presoak 60 Min (in)	12:48	0.00	12:53	0.00	12:46	0.00	12:55	0.00	12:50	0.00	12:57	0.00
START TEST (in)	12:48	6.00	12:53	6.00	12:46	6.00	12:55	6.00	12:50	6.00	12:57	6.00
Reading Interval	30 min		30 min		30 min		30 min		30 min		30 min	
Reading # 1 (in)	13:18	0.00	13:23	0.00	13:16	0.00	13:25	0.00	13:20	0.00	13:27	0.00
Reading # 2 (in)	14:24	0.00	14:29	0.00	14:22	0.00	14:31	0.00	14:26	0.00	14:33	0.00
Reading # 3 (in)	14:54	0.00	14:59	0.00	14:52	0.00	15:01	0.00	14:56	0.00	15:03	0.00
Reading # 4 (in)	15:24	0.00	15:29	0.00	15:22	0.00	15:31	0.00	15:26	0.00	15:33	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	
Initial Water Depth (in)	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	
Average Reading (in)	0.00		0.00		0.00		0.00		0.00		0.00	
Infiltration Rate (in/hr)	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	
Corrected Infiltration Rate (in/hr)	0.00		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
Greiner Warehouse
ECS Project No. 18:5665

Date Tested: 7/28/2022 7/28/2022 7/27/2022 7/27/2022 7/28/2022 7/28/2022

Field Data	IT-07		IT-08		IT-09		IT-10		IT-11		IT-12	
Test Depth (ft)	1.5		1.0		7.5		7.6		2.5		3.5	
	Time	Reading	Time	Reading	Time	Reading	Time	Reading	Time	Reading	Time	Reading
Presoak Start/Water Depth (in)	12:00	6.00	11:42	6.00	14:08	6.00	14:06	6.00	14:07	6.00	14:09	6.00
Presoak 30 Min (in)	12:30	0.00	12:12	0.00	14:38	0.00	14:36	0.00	14:37	0.00	14:39	0.00
Presoak 60 Min (in)	13:00	0.00	12:42	0.00	15:08	0.00	15:06	0.00	15:07	0.00	15:09	0.00
START TEST (in)	13:00	6.00	12:42	6.00	15:08	6.00	15:06	6.00	15:07	6.00	15:09	6.00
Reading Interval	30 min		30 min		30 min		30 min		30 min		30 min	
Reading # 1 (in)	13:30	0.00	13:12	0.00	15:38	0.00	15:36	0.00	15:37	0.00	15:39	0.00
Reading # 2 (in)	14:35	0.00	14:50	0.00	16:08	0.00	16:06	0.00	16:07	0.00	16:09	0.00
Reading # 3 (in)	15:05	0.00	15:20	0.00	16:38	0.00	16:36	0.00	16:37	0.00	16:39	0.00
Reading # 4 (in)	15:35	0.00	15:50	0.00	17:08	0.00	17:06	0.00	17:07	0.00	17:09	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	
Initial Water Depth (in)	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	
Average Reading (in)	0.00		0.00		0.00		0.00		0.00		0.00	
Infiltration Rate (in/hr)	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	
Corrected Infiltration Rate (in/hr)	0.00		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.

Percolation Testing Results
Greiner Warehouse
ECS Project No. 18:5665

Date Tested: 7/28/2022 7/28/2022 7/28/2022 7/28/2022

Field Data	IT-01		IT-02		IT-03		IT-04	
Test Depth (ft)	4.8		2.5		6.5		2.0	
	Time	Reading	Time	Reading	Time	Reading	Time	Reading
Presoak Start/Water Depth (in)	11:48	6.00	11:53	6.00	11:46	6.00	11:55	6.00
Presoak 30 Min (in)	12:18	0.75	12:23	1.00	12:16	1.25	12:25	0.50
Presoak 60 Min (in)	12:48	0.50	12:53	1.00	12:46	1.00	12:55	0.50
START TEST	12:48	6.00	12:53	6.00	12:46	6.00	12:55	6.00
Reading Interval	30 min		30 min		30 min		30 min	
Reading # 1 (in)	13:18	0.50	13:23	0.75	13:16	0.75	13:25	0.50
Reading # 2 (in)	14:24	0.38	14:24	0.75	14:22	0.75	14:31	0.50
Reading # 3 (in)	14:54	0.38	14:54	0.75	14:52	0.75	15:01	0.50
Reading # 4 (in)	15:24	0.38	15:24	0.75	15:22	0.75	15:31	0.50
Reading # 5 (in)								
Reading # 6 (in)								
Reading # 7 (in)								
Reading # 8 (in)								
Average Diameter of Hole (in)	10.00		10.00		9.50		10.00	
Initial Water Depth (in)	6.00		6.00		6.00		6.00	
Final Water Level Drop (in)	0.38		0.75		0.75		0.50	
Average Reading (in)	0.41		0.75		0.75		0.50	
Infiltration Rate (in/hr)	0.81		1.50		1.50		1.00	
Reduction Factor	2.16		2.13		2.18		2.15	
Safety Factor	3.00		2.00		3.00		3.00	
Corrected Infiltration Rate (in/hr)	0.13		0.35		0.23		0.16	

Notes:

1. Refilled to water depth of 6 inches after each reading.

Percolation Testing Results
Greiner Warehouse
ECS Project No. 18:5665

Date Tested: 7/28/2022 7/28/2022 7/28/2022 7/28/2022

Field Data	IT-05		IT-06		IT-07		IT-08	
Test Depth (ft)	5.9		3.5		1.5		1.0	
	Time	Reading	Time	Reading	Time	Reading	Time	Reading
Presoak Start/Water Depth (in)	11:50	6.00	11:57	6.00	12:00	6.00	11:42	6.00
Presoak 30 Min (in)	12:20	0.50	12:27	0.75	12:30	0.75	12:12	1.25
Presoak 60 Min (in)	12:50	0.50	12:57	0.25	13:00	0.50	12:42	0.75
START TEST	12:50	6.00	12:57	6.00	13:00	6.00	12:42	6.00
Reading Interval	30 min		30 min		30 min		30 min	
Reading # 1 (in)	13:20	0.50	13:27	0.25	13:30	0.38	13:12	0.38
Reading # 2 (in)	14:26	0.50	14:33	0.25	14:35	0.38	14:50	0.38
Reading # 3 (in)	14:56	0.50	15:03	0.25	15:05	0.25	15:20	0.38
Reading # 4 (in)	15:26	0.50	15:33	0.25	15:35	0.25	15:50	0.38
Reading # 5 (in)								
Reading # 6 (in)								
Reading # 7 (in)								
Reading # 8 (in)								
Average Diameter of Hole (in)	9.50		10.50		10.00		10.50	
Initial Water Depth (in)	6.00		6.00		6.00		6.00	
Final Water Level Drop (in)	0.50		0.25		0.25		0.38	
Average Reading (in)	0.50		0.25		0.31		0.38	
Infiltration Rate (in/hr)	1.00		0.50		0.63		0.75	
Reduction Factor	2.21		2.12		2.17		2.11	
Safety Factor	3.00		3.00		3.00		3.00	
Corrected Infiltration Rate (in/hr)	0.15		0.08		0.10		0.12	

Notes:

1. Refilled to water depth of 6 inches after each reading.

Percolation Testing Results
Greiner Warehouse
ECS Project No. 18:5665

Date Tested: 7/27/2022 7/27/2022 7/28/2022 7/28/2022

Field Data	IT-09		IT-10		IT-11		IT-12	
Test Depth (ft)	7.5		7.6		2.5		3.5	
	Time	Reading	Time	Reading	Time	Reading	Time	Reading
Presoak Start/Water Depth (in)	14:08	6.00	14:06	6.00	14:07	6.00	14:09	6.00
Presoak 30 Min (in)	14:38	0.50	14:36	0.50	14:37	0.75	14:39	0.25
Presoak 60 Min (in)	15:08	0.50	15:06	0.50	15:07	0.75	15:09	0.25
START TEST	15:08	6.00	15:06	6.00	15:07	6.00	15:09	6.00
Reading Interval	30 min		30 min		30 min		30 min	
Reading # 1 (in)	15:38	0.25	15:36	0.38	15:37	0.75	15:39	0.25
Reading # 2 (in)	16:08	0.25	16:06	0.25	16:07	0.75	16:09	0.25
Reading # 3 (in)	16:38	0.25	16:36	0.25	16:37	0.75	16:39	0.25
Reading # 4 (in)	17:08	0.25	17:06	0.25	17:07	0.75	17:09	0.25
Reading # 5 (in)								
Reading # 6 (in)								
Reading # 7 (in)								
Reading # 8 (in)								
Average Diameter of Hole (in)	10.00		10.00		10.50		10.00	
Initial Water Depth (in)	6.00		6.00		6.00		6.00	
Final Water Level Drop (in)	0.25		0.25		0.75		0.25	
Average Reading (in)	0.25		0.28		0.75		0.25	
Infiltration Rate (in/hr)	0.50		0.56		1.50		0.50	
Reduction Factor	2.18		2.17		2.07		2.18	
Safety Factor	3.00		3.00		3.00		3.00	
Corrected Infiltration Rate (in/hr)	0.08		0.09		0.24		0.08	

Notes:

1. Refilled to water depth of 6 inches after each reading.



Test Pit IT-01



Test Pit IT-02



Test Pit IT-03



Test Pit IT-04

GREINER WAREHOUSE
ECS PROJECT NO. 18:5665
LANCASTER COUNTY, PENNSYLVANIA



TEST PIT PHOTOGRAPHS

JULY 2022



Test Pit IT-05



Test Pit IT-06



Test Pit IT-07



Test Pit IT-08

GREINER WAREHOUSE
ECS PROJECT NO. 18:5665
LANCASTER COUNTY, PENNSYLVANIA



TEST PIT PHOTOGRAPHS

JULY 2022



Test Pit IT-09



Test Pit IT-10



Test Pit IT-11



Test Pit IT-12

GREINER WAREHOUSE
ECS PROJECT NO. 18:5665
LANCASTER COUNTY, PENNSYLVANIA



TEST PIT PHOTOGRAPHS

JULY 2022

APPENDIX C – Laboratory Testing

Laboratory Test Results Summary

Plasticity Chart

Grain Size Analysis

Textural Triangle USDA Test

Laboratory Testing Summary

Sample Location	Sample Number	Depth (feet)	^MC (%)	Soil Type	Atterberg Limits			**Percent Passing No. 200 Sieve	Moisture - Density		CBR (%)		#Organic Content (%)
					LL	PL	PI		<Maximum Density (pcf)	<Optimum Moisture (%)	0.1 in.	0.2 in.	
IT-02	S-1	2.5	11.8	SC	34	23	11	46.7					
IT-12	S-1	3.5	18.9	ML	41	28	13	62.8					

Notes: See test reports for test method, ^ASTM D2216-19, *ASTM D2488, **ASTM D1140-17, #ASTM D2974-20e1 < See test report for D4718 corrected values

Definitions: MC: Moisture Content, Soil Type: USCS (Unified Soil Classification System), LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index, CBR: California Bearing Ratio, OC: Organic Content

Project: Greiner Warehouse
Client: Landworks Civil Design, LLC

Project No.: 18:5665
Date Reported: 8/16/2022



Office / Lab

ECS Mid-Atlantic LLC - York

Address

52-6 Grumbacher Road
York, PA 17406

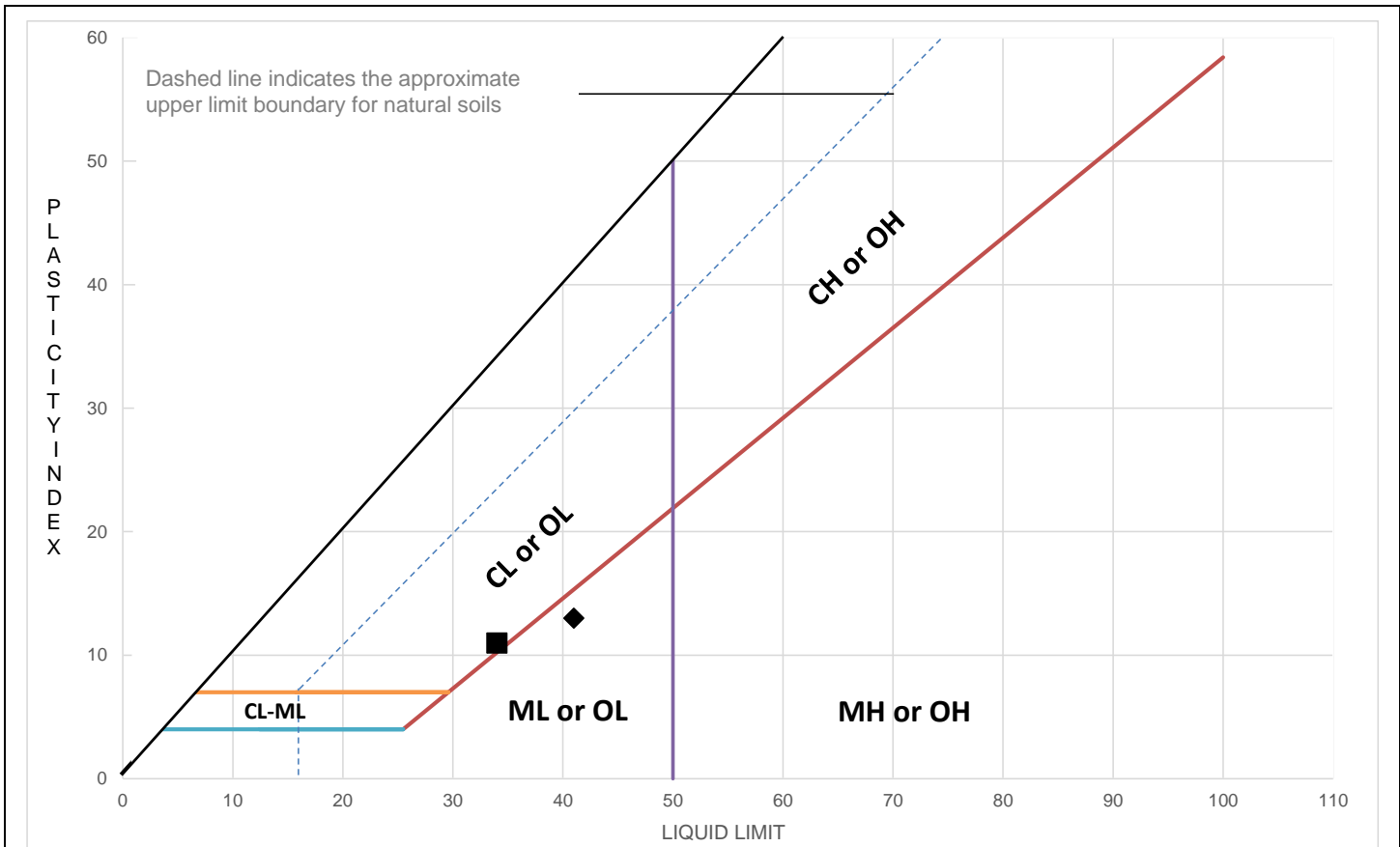
Office Number / Fax

(717)767-4788

(717)767-5658

Tested by	Checked by	Approved by	Date Received
agolihew		agolihew	

LIQUID AND PLASTIC LIMITS TEST REPORT



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

Symbol	Sample Location	Sample Number	Sample Depth (ft)	LL	PL	PI	%<#40	%<#200	AASHTO	USCS	Material Description
■	IT-02	S-1	2.5	34	23	11	58.4	46.7	A-6	SC	Clayey Sand with Gravel
◆	IT-12	S-1	3.5	41	28	13	68.6	62.8	A-7-6	ML	Sandy Silt

Project: Greiner Warehouse
Client: Landworks Civil Design, LLC

Project No.: 18:5665
Date Reported: 8/16/2022



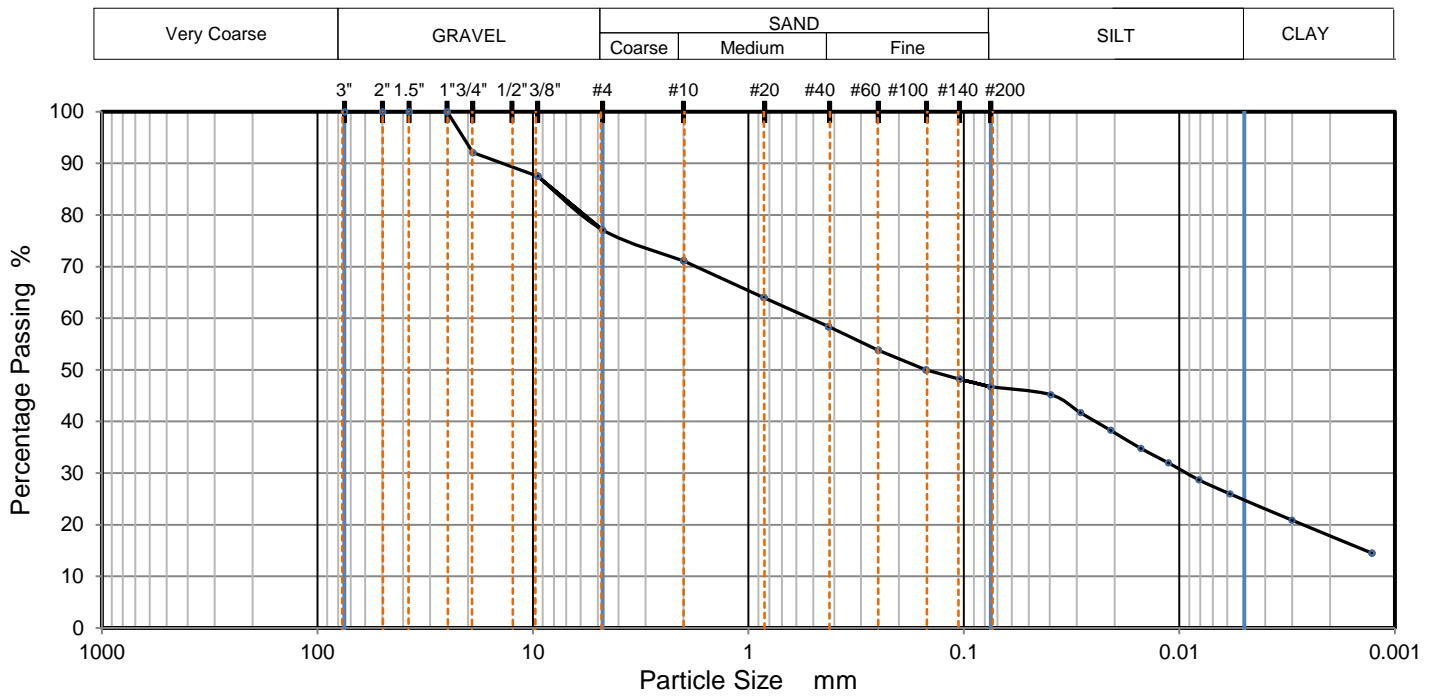
Office / Lab
ECS Mid-Atlantic LLC - York

Address
52-6 Grumbacher Road
York, PA 17406

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

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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	0.0396	45
2"	100	0.0288	42
1 1/2"	100	0.0209	38
1"	100	0.0151	35
3/4"	92	0.0113	32
3/8"	88	0.0081	29
#4	77	0.0058	26
#10	71	0.0030	21
#20	64	0.0013	15
#40	58		
#60	54		
#100	50		
#140	48		
#200	47		
		Specific Gravity (Historical) 2.65	

Dry Mass of sample, g

239.1

Sample Proportions	% dry mass
Very coarse, >3" sieve	0
Gravel, 3" to # 4 sieve	23
Coarse Sand, #4 to #10 sieve	6
Medium Sand, #10 to #40	13
Fine Sand, #40 to #200	12
Silt, 75µm to 5 µm	22
Clay < 5µm	25

USCS	SC	Liquid Limit	34	D90	13.850	D50	0.150	D10	
AASHTO	A-6	Plastic Limit	23	D85	8.042	D30	0.009	Cu	
USCS Group Name	Clayey sand with gravel	Plasticity Index	11	D60	0.518	D15	0.001	Cc	

Project: Greiner Warehouse
 Client: Landworks Civil Design, LLC
 Sample Description: Clayey Sand with Gravel
 Sample Source: IT-02

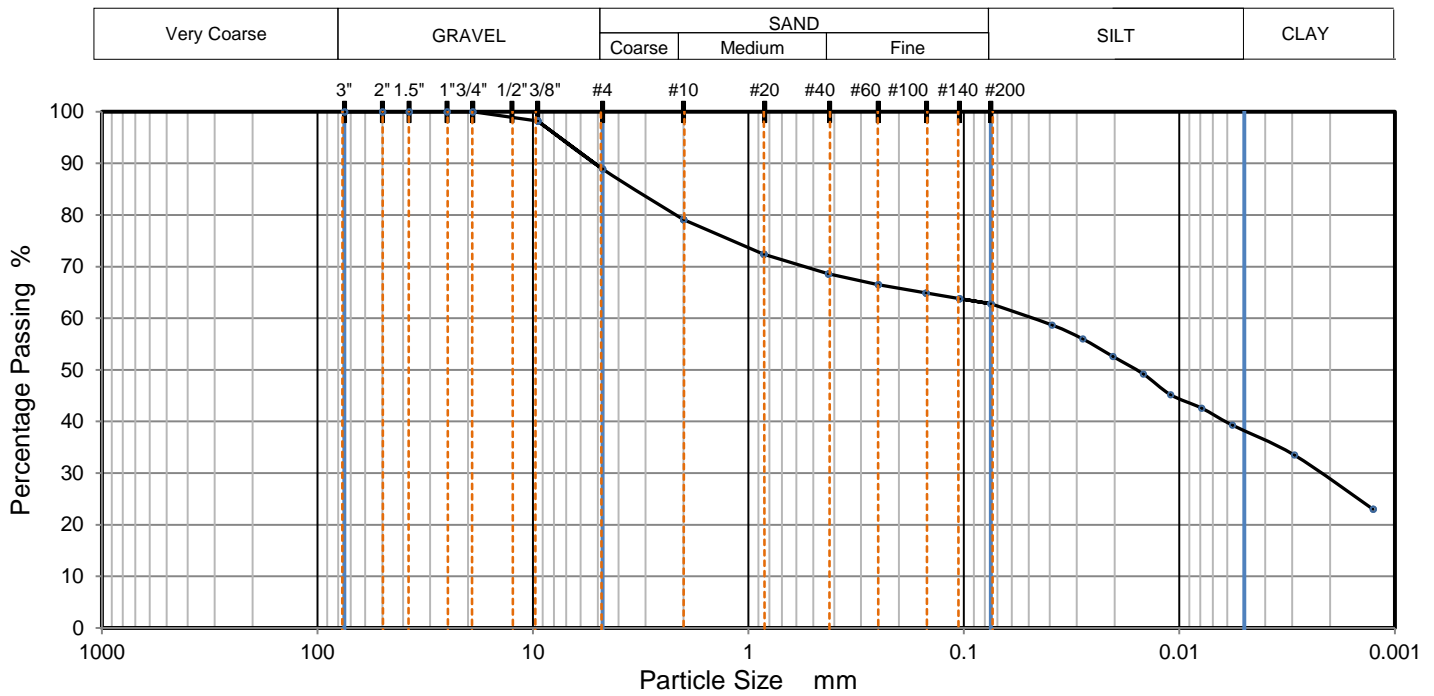
Project No.: 18:5665
 Depth (ft): 2.5
 Sample No.: S-1
 Date Reported: 8/16/2022



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ECS Mid-Atlantic LLC - York	52-6 Grumbacher Road York, PA 17406	(717)767-4788 (717)767-5658

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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	0.0391	59
2"	100	0.0282	56
1 1/2"	100	0.0204	53
1"	100	0.0147	49
3/4"	100	0.0110	45
3/8"	98	0.0079	43
#4	89	0.0057	39
#10	79	0.0029	34
#20	72	0.0013	23
#40	69		
#60	67		
#100	65		
#140	64		
#200	63		
		Specific Gravity (Historical) 2.65	

Dry Mass of sample, g 195.0

Sample Proportions	% dry mass
Very coarse, >3" sieve	0
Gravel, 3" to # 4 sieve	11
Coarse Sand, #4 to #10 sieve	10
Medium Sand, #10 to #40	11
Fine Sand, #40 to #200	6
Silt, 75µm to 5 µm	25
Clay < 5µm	38

USCS	ML	Liquid Limit	41	D90	5.156	D50	0.016	D10	
AASHTO	A-7-6	Plastic Limit	28	D85	3.367	D30	0.002	Cu	
USCS Group Name	Sandy silt	Plasticity Index	13	D60	0.048	D15		Cc	

Project: Greiner Warehouse
 Client: Landworks Civil Design, LLC
 Sample Description: Sandy Silt
 Sample Source: IT-12

Project No.: 18:5665
 Depth (ft): 3.5
 Sample No.: S-1
 Date Reported: 8/16/2022



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

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USDA Classification

TEST RESULTS (ASTM D6913M-17-METHOD A)

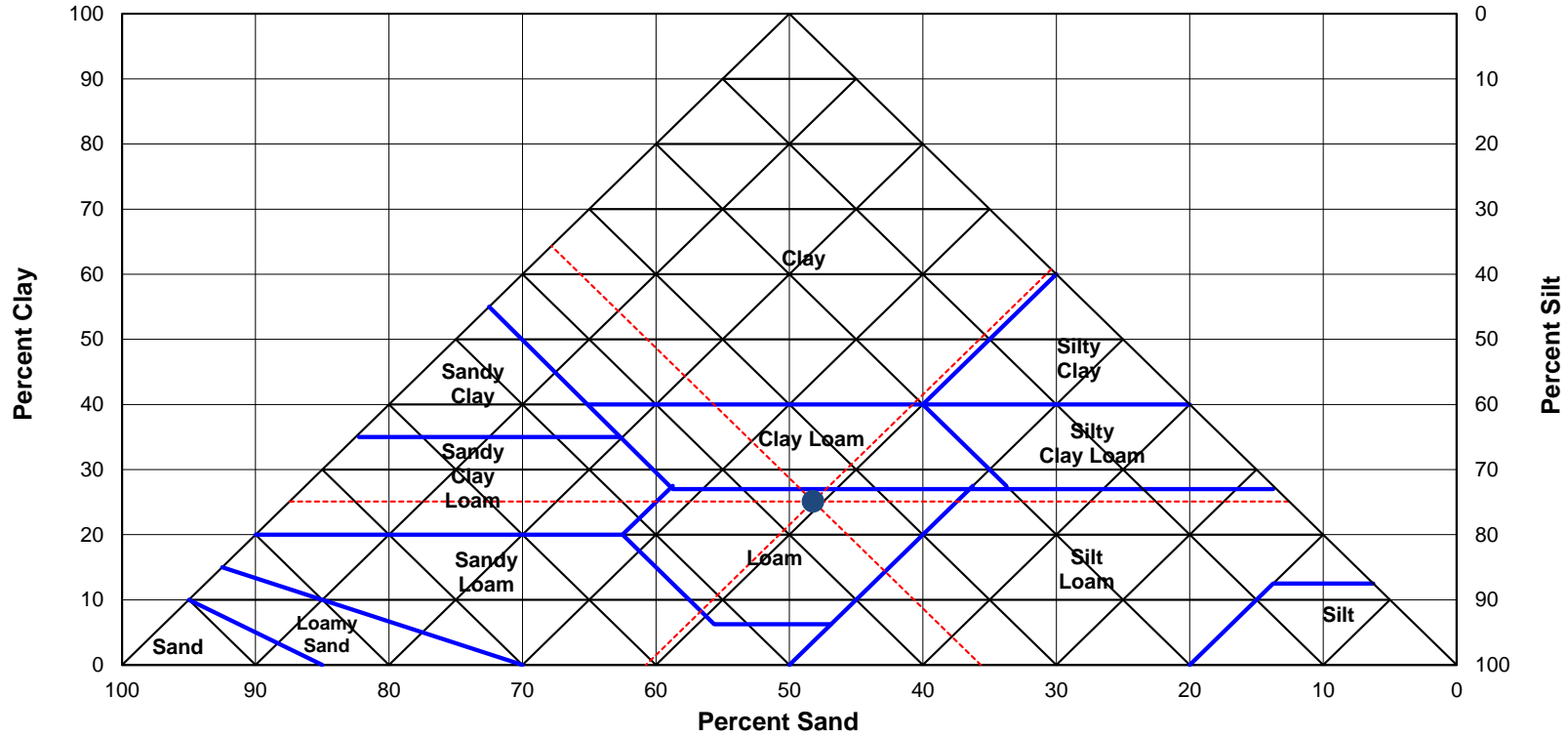
USDA Classification:

Loam

USDA Soil Percentages
(Corrected for Gravel):

%Sand	%Silt	%Clay
35.7	39.2	25.1

Textural Triangle USDA



Project: Greiner Warehouse
 Client: Landworks Civil Design, LLC
 Sample Description: Clayey Sand with Gravel
 Sample Source: IT-02

Project No.: 18:5665
 Depth (ft): 2.5
 Sample No.: S-1
 Date Reported: 8/16/2022



Office / Lab
 ECS Mid-Atlantic LLC - York

Address
 52-6 Grumbacher Road
 York, PA 17406

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

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USDA Classification

TEST RESULTS (ASTM D6913M-17-METHOD A)

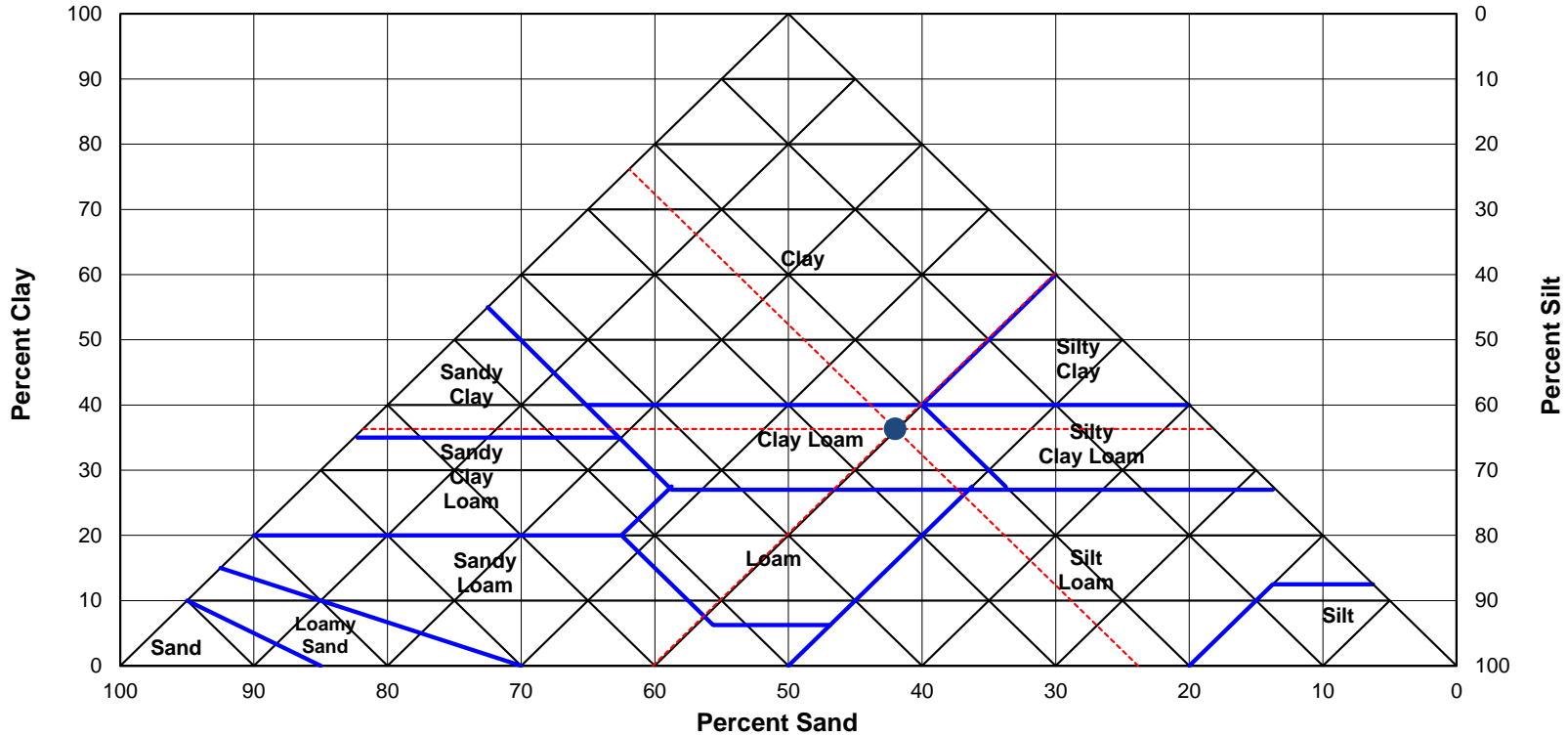
USDA Classification:

Clay Loam

USDA Soil Percentages
(Corrected for Gravel):

%Sand	%Silt	%Clay
23.8	39.8	36.3

Textural Triangle USDA



Project: Greiner Warehouse
 Client: Landworks Civil Design, LLC
 Sample Description: Sandy Silt
 Sample Source: IT-12

Project No.: 18:5665
 Depth (ft): 3.5
 Sample No.: S-1
 Date Reported: 8/16/2022



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Address
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