WHITESTONE
ASSOCIATES, INC.
Environmental & Geotechnical Engineers & Consultants

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March 16, 2020

via email

HAMMER LAND ENGINEERING
663 Raritan Road
Suite E
Cranford, New Jersey 07016

Attention: Michael A. Rodrigues, P.E.
Associate

**Regarding: LIMITED GEOTECHNICAL INVESTIGATION &
STORMWATER MANAGEMENT AREA EVALUATION
PROPOSED WAREHOUSE DEVELOPMENT
490 ELIZABETH AVENUE
BLOCK 514, LOT 34
TOWNSHIP OF FRANKLIN, SOMERSET COUNTY, NEW JERSEY
WHITESTONE PROJECT NO.: GS2017025.000**

Dear Mr. Rodrigues:

Whitestone Associates, Inc. (Whitestone) has completed a limited geotechnical investigation and preliminary stormwater management (SWM) area evaluation at the above-referenced site. The purpose of the investigation was to evaluate the existing subsurface conditions and provide geotechnical recommendations in support of the proposed warehouse development. Whitestone's scope of services included performing test borings and soil profile pits across the subject site, evaluating the conditions encountered, performing laboratory infiltration testing and documenting estimated seasonal high groundwater levels within the proposed SWM area, and developing geotechnical recommendations for the proposed foundations and related earthwork.

1.0 PROJECT DESCRIPTION

1.1 Site Location & Existing Conditions

The subject property located at 490 Elizabeth Avenue (Block 514, Lot 34) in Franklin, Somerset County, New Jersey currently is a vacant, moderately- to heavily-wooded parcel.

Based on the January 24, 2020 *Boundary & Topographic Survey* prepared by DPK Consulting, the subject site has a high elevation of 79.49 feet above North America Vertical Datum 1988 (NAVD 88) in the western portion of the site and a low elevation of 72.66 feet above NAVD 88 in the eastern portion of the subject site.

1.2 Site Geology

The subject property is situated within a section of the Piedmont Physiographic Province known as the Newark Basin. Specifically, the subject site is underlain by the Lower Jurassic and Upper Triassic

Conglomeratic Sandstone member of the Passaic Formation, which is part of the Brunswick Group. The Conglomeratic Sandstone generally consists of brownish-red pebble conglomerate, with medium-grained to coarse-grained feldspathic sandstone and micaceous siltstone, and is cross laminated, burrowed, and locally contains pebble layers. The overburden materials at the site include glacial deposits associated with a Wisconsinan Glacier, residual deposits from the weathering underlying bedrock, and manmade fill.

1.3 Proposed Construction

Based on the January 20, 2020 (last revised) *Concept Plan* prepared by Hammer Land Engineering (Hammer), the proposed redevelopment will include clearing the subject site and constructing an approximately 58,980-square feet warehouse building with an associated SWM facility, septic system, pavements, landscaped areas, and utilities. The proposed warehouse is anticipated to be a single-story structure less than 40 feet in height.

Proposed grades were not available at the time of this report. However, Whitestone anticipates that the proposed building will be developed at or near existing grades. Detailed structural loading information was not available at the time of this report. However, based on Whitestone's past experience with similar structures, the maximum column and wall loads are anticipated to be less than 150 kips and 3.0 kips per foot, respectively. Any revisions or additions to the design details enumerated in this report should be brought to the attention of Whitestone for additional evaluation as warranted.

2.0 FIELD & LABORATORY WORK

2.1 Fieldwork

Field exploration at the project site was conducted by means of six soil test borings (identified as B-1 through B-6) performed with an ATV-mounted drill rig using hollow stem augers and split-spoon sampling techniques and three soil profile pits (identified as SPP-1 through SPP-3) performed with a track-mounted backhoe. The borings were performed within or near the proposed building footprint to a depth of approximately 18.2 feet below ground surface (fbgs) to 18.5 fbgs. The soil profile pits were performed within or near the proposed SWM basin to depths ranging from approximately nine fbgs to 10 fbgs. Test locations subsequently were backfilled to the surface with excavated soils from the investigation. The locations of the tests are shown on the accompanying *Test Location Plan* included as Figure 1. *Records of Subsurface Exploration* are provided in Appendix A.

The subsurface tests were conducted in the presence of a Whitestone engineer who performed field tests, recorded visual classifications, and collected samples of the various strata encountered. The tests were located in the field using normal taping procedures and estimated right angles. These locations are presumed to be accurate within a few feet.

Soil borings and Standard Penetration Tests (SPTs) were conducted in general accordance with American Society for Testing and Materials (ASTM) designation D 1586. The SPT resistance value (N) can be used as an indicator of the consistency of fine-grained soils and the relative density of coarse-grained soils. The N-value for various soil types can be correlated with the engineering behavior of earthworks and foundations.

Groundwater level observations were recorded during and immediately after the completion of field operations prior to backfilling the subsurface tests. Seasonal variations, temperature effects, man-made effects, and recent rainfall conditions may influence the levels of the groundwater, and the observed levels will depend on the permeability of the soils. Groundwater elevations derived from sources other than seasonally observed groundwater monitor wells may not be representative of true groundwater levels.

2.2 Laboratory Program

Representative samples of the various strata encountered were subjected to a laboratory program that included Atterberg limits determination (ASTM D-4318), moisture content determinations (ASTM D-2216) and washed gradation analyses (ASTM D-422) in order to perform supplementary engineering soil classifications in general accordance with ASTM D-2487. The soil strata tested were classified by the Unified Soil Classification System (USCS) and results of the laboratory testing are summarized in the following table. Quantitative test results are provided in Appendix B.

PHYSICAL/TEXTURAL ANALYSES SUMMARY							
Boring	**Sample**	**Depth (fbgs)**	**% Passing No. 200 Sieve**	**Moisture Content (%)**	**Liquid Limit (%)**	**Plastic Index (%)**	**USCS Classification**
B-1	S-2	2.0 - 4.0	25.6	14.5	17	1	SM
B-3	S-1	0.5 - 2.0	76.5	22.0	28	7	CL-ML
B-5	S-2	2.0 - 4.0	46.0	11.7	30	7	SC-SM

Notes: NP = Non-Plastic

The engineering classifications are useful when considered in conjunction with the additional site data to estimate properties of the soil types encountered and to predict the soil's behavior under construction and service loads. Laboratory test results are provided in Appendix B.

3.0 SUBSURFACE CONDITIONS

The subsurface soil conditions encountered within the subsurface tests consisted of the following generalized strata in order of increasing depth. *Records of Subsurface Exploration* are provided in Appendix A.

Surface Materials: The subsurface tests were performed within existing landscaped areas and encountered approximately two inches to 11 inches of topsoil and organic materials.

Residual Deposits: Underlying the surface cover, the subsurface tests performed encountered residual deposits generally consisting of silty and clayey sand (USCS: SM and SC-SM) with variable amounts of gravel, silty clay (USCS: CL-ML) with variable amounts of sand, and lean clay (USCS: CL). The soil profile pits and soil borings performed as part of the investigation encountered the residual deposits to depths ranging from 1.8 fbgs to seven fbgs. SPT N-values within this stratum ranged between two blows per foot (bpf) to 46, generally indicating very loose to dense relative densities and averaging approximately 27 bpf.

Weathered Rock: Beneath the residual deposits, weathered rock materials were encountered within the subsurface tests consisting of highly weathered sandstone. The soil borings and profile pits were terminated at the weathered rock/bedrock interface at depths ranging from nine fbgs to 18.3 fbgs. The SPT N-values within the weathered rock materials consistently were in the refusal range (defined as more than 50 blows per six inches of split spoon sampler penetration), generally indicating a very dense relative density.

Groundwater: Static groundwater was not encountered within the borings or test pits performed. However, perched groundwater conditions were encountered at depths as shallow as 7.5 fbgs. Groundwater levels should be expected to fluctuate seasonally and following periods of precipitation.

4.0 CONCLUSIONS & RECOMMENDATIONS

The results of the investigation indicate that the proposed warehouse development may be supported on conventional shallow foundations designed to bear within the underlying natural materials, weathered rock/bedrock, and/or controlled structural backfill. The following recommendations have been developed on the basis of the previously described project characteristics and subsurface conditions encountered within the exploration. If there are any significant changes to the project characteristics or if significantly different subsurface conditions are encountered during construction, Whitestone should be consulted so that the recommendations of this report can be reviewed.

4.1 Site Preparation & Earthwork

Surface Preparation/Proofrolling: Prior to placing any fill or subbase materials to raise or restore grades to the desired subgrade elevations, the existing exposed soils should be compacted to a firm surface with several passes in two perpendicular directions of a minimum 10-ton vibratory roller. The roller should be operated in the static mode or a kneading "sheepsfoot" roller should be used if silt and/or clay soils are encountered at subgrade elevations. The surface then should be proofrolled with a loaded tandem axle truck in the presence of the geotechnical engineer to help identify soft or loose pockets which may require removal and replacement or further investigation. Proofrolling should be performed after a suitable period of dry weather to avoid degrading an otherwise stable subgrade. Any fill or backfill should be placed and compacted in accordance with Section 4.2.

Weather Performance Criteria: Because portions of the site soils are highly moisture sensitive and will soften when exposed to water, every effort must be made to maintain drainage of surface water runoff away from construction areas by grading and limiting the exposure of excavations and prepared subgrades to rainfall. Accordingly, excavation and fill placement procedures should be performed during warm, dry weather conditions. Overexcavation of saturated soils and replacement with controlled structural fill per Section 4.2 of this report may be required prior to resuming work on disturbed subgrade soils.

Subgrade Protection and Inspection: Every effort should be made to minimize disturbance of the on-site soils by construction traffic and surface runoff. The on-site soils may deteriorate when subjected to repeated construction traffic and may require removal and replacement. These materials also may require wetting and recompaction during dry periods or discing, drying and aeration during wet periods. The contractor should be responsible for protection of subgrades and minimization of exposure of the site soils to precipitation by covering stockpiles and subgrades with plastic and preventing ponding of water by sealing subgrades before precipitation events and grading the site to allow proper drainage of surface water. All rutting from construction equipment should be removed prior to any forecasted or actual precipitation. The services of the geotechnical engineer should be retained to inspect soils conditions immediately prior to concrete placement to verify the suitability of prepared foundation subgrades for support of design loads.

Difficult Excavation Considerations: Very dense soil, weathered rock, and apparent bedrock were encountered during this subsurface investigation at variable depths. Based on proposed site grading, removal of weathered rock and intact rock should be anticipated during construction. Excavation difficulties will be more prevalent in confined excavations, such as foundations and utilities, footing and

utility excavations may inadvertently become oversized due to the presence of boulders and require additional backfill materials. The speed and ease of excavation will depend on the type of grading equipment, the equipment operator, and the geologic structure of the material, such as planes of weakness and spacing between discontinuities. Based on local experience and the results of test boring efforts, Whitestone expects that the upper few feet of the weathered rock materials typically can be removed with a large excavator equipped with ripping tools and extreme service buckets with rock teeth without considerable difficulty during mass grading operations. However, planned excavations beyond a few feet into the weathered materials and refusal depths in confined excavations are expected to require the use of large excavation machinery equipped with ripping tools and/or pneumatic hammers.

4.2 Structural Fill & Backfill

Imported Fill Material: Any imported material placed as structural fill or backfill to restore design grades should consist of clean, relatively well graded sand or gravel with a maximum particle size of three inches and five percent to 10 percent of material finer than a #200 sieve. Silts, clays, and silty or clayey sands and gravels with higher percentage of fines and with a liquid limit less than 40 and a plasticity index less than 20 may be considered subject to the owner's approval, provided that the required moisture content and compaction controls are met. The material should be free of clay lumps, organics, and deleterious material. Any imported structural fill material should be approved by a qualified geotechnical engineer prior to delivery to the site.

Soil Reusability/Moisture Sensitivity: Based on the conditions disclosed by the subsurface tests, Whitestone anticipates that a majority of the natural soils will be suitable for selective reuse as structural fill and/or backfill provided moisture contents are controlled within two percent of the optimum during favorable weather conditions. Laboratory results indicate that the existing site fine-grained soils (USCS: CL-ML and CL) are highly moisture sensitive. The reuse of these fine-grained soils and granular site materials with a high percentage of fines typically is possible only during extended periods of ideal weather conditions. Reuse of these soils is expected to require mixing with a granular material, extensive moisture conditioning, and/or drying to facilitate their reuse, workability, and compaction in fill areas. The on-site soils will become increasingly difficult to reuse and compact where wetted beyond the optimum moisture content. Immediate re-use of on-site soil should not be anticipated, and soil exchange or improvement should be expected.

Materials that become exceedingly wet likely will require discing and aerating which may not be practical during wet seasons. Alternatively, imported fill materials may be used to attain the desired grades and expedite earthwork operations. The stripped topsoil should not be used as fill or backfill.

Compaction and Placement Requirements: All fill and backfill should be placed in maximum nine-inch loose lifts and compacted to 95 percent of the maximum dry density within two percent of the optimum moisture content as determined by ASTM D 1557 (Modified Proctor). Whitestone recommends using a small hand-held vibratory compactor to compact the on-site soils within any footing excavations.

4.3 Groundwater Control

Static groundwater was not encountered as part of Whitestone's investigation. As such, static groundwater levels are anticipated to be deeper than most proposed building and pavement subgrade elevations. However, perched groundwater conditions are anticipated to be encountered at variable depths across the subject site. Additionally, perched groundwater may be encountered following periods of wet weather within the existing fill materials, at the existing fill materials/natural soil interface, and within fine-grained portions of the natural site soils. Therefore, temporary groundwater control measures should be implemented as described below.

4.4 Shallow Foundation Design Criteria

Whitestone recommends that the proposed structures be supported on conventional shallow spread and continuous wall footings designed to bear within the underlying natural site soils, weathered rock/bedrock and/or properly placed structural fill provided these materials are properly evaluated, placed and compacted in accordance with this report. Foundations bearing within the natural residual site soils may be designed using a maximum allowable net bearing pressure of 4,000 pounds per square foot (psf). Foundations bearing within the weathered rock/bedrock stratum may be designed using a maximum allowable net bearing pressure of 6,000 psf.

All footing bottoms should be improved by in-trench compaction in the presence of the geotechnical engineer. Regardless of loading conditions, proposed foundations should be sized no less than minimum dimensions of 24 inches for continuous wall footings and 36 inches for isolated column footings.

Foundation Inspection: Whitestone recommends that the suitability of the bearing soils along and below the footing bottoms be verified by a geotechnical engineer prior to placing concrete for the footings. Where areas of unsuitable materials, are encountered in footing excavations, overexcavation and recompaction or replacement may be necessary to provide a suitable footing subgrade in accordance with Section 4.1. Any overexcavation to be restored with structural fill will need to extend at least one foot laterally beyond footing edges for each vertical foot of overexcavation. Lateral overexcavation can be reduced if the grade is restored with lean concrete or approved flowable fill. The bottom of overexcavation should be compacted with vibrating plates or plate tampers ("jumping jacks") to compact locally disturbed materials.

Partial Weathered Rock/Bedrock Support: Foundations should not be supported partially on weathered rock or bedrock and partially on soil because of the risk of brittle fracture due to a hinging effect. If the proposed bearing elevations result with partial bearing on such materials, Whitestone recommends removing a minimum of six inches of the weathered rock/bedrock and restoring the bearing elevation with structural fill. Alternatively, the proposed footings may be extended deeper to bear entirely within weathered rock/bedrock.

Settlement: Whitestone estimates post construction settlements of proposed foundations to be approximately less than one inch if the recommendations outlined in this report are properly implemented. Differential settlement of foundations should be less than one-half inch.

Frost Coverage/Adjacent Structures: Footings subject to frost action should be placed at least 36 inches below adjacent exterior grades or the depth required by local building codes to provide protection from frost penetration. Interior footings not subject to frost action may be placed at a minimum depth of 18 inches below the slab subgrade.

Foundations in areas adjacent to the existing neighboring buildings will require special consideration. Care should be exercised during construction, if below-grade walls are planned, to avoid undermining the existing foundations. Excavation near existing infrastructure should anticipate the need for shoring and/or underpinning. Shoring is also anticipated in order to construct the below-grade portions of the proposed building.

Seismic Design: Based on the 2018 International Building Code – New Jersey Edition, the subject site may be classified as a Seismic Site Class C. As such, seismic activity is not anticipated to have a significant impact on construction.

4.5 Floor Slab Design Criteria

Whitestone anticipates that the underlying natural soils, and/or controlled structural fill materials will be suitable for support of the proposed floor slabs provided these materials are properly evaluated, placed, compacted and proofrolled in accordance with the recommendations outlined in this report. Localized areas of overexcavation may be anticipated if the subgrades are exposed to precipitation. Any areas that become softened or disturbed as a result of wetting and/or repeated exposure to construction traffic should be removed and replaced with compacted structural backfill. The properly prepared on-site soils are expected to yield a minimum subgrade modulus (k) of 150 psi/in.

A minimum four-inch layer of coarse aggregate, such as AASHTO #57 stone, dense graded aggregate, or equal, should be installed below ground-supported floor slabs to provide a capillary break. An impervious membrane also should be provided as a moisture vapor barrier beneath all floor slabs.

4.6 Lateral Earth Pressures

Permanent below grade walls may be required to resist lateral earth pressures. The following soil parameters apply to the encountered subsurface strata and may be used for design of the proposed temporary and permanent retaining structures:

LATERAL EARTH PRESSURE PARAMETERS			
Parameter	**On-Site Natural Soils**	**On-Site Weathered Rock**	**Structural Granular Backfill**
Moist Density (γ_{moist})	140 pcf	150 pcf	140 pcf
Internal Friction Angle (φ)	28°	35°	30°
Active Earth Pressure Coefficient (K_a)	0.36	0.27	0.33
Passive Earth Pressure Coefficient (K_p)	2.77	3.69	3.00
At-Rest Earth Pressure Coefficient (K_o)	0.53	0.43	0.50

Retaining/below grade walls free to rotate generally can be designed to resist active earth pressures. Retaining/below grade walls corners and restrained walls need to be designed to resist at-rest earth pressures. Retaining/below grade walls situated below static groundwater levels should also be designed to resist hydrostatic pressure.

Lateral earth pressure will depend on the backfill slope angle and the wall batter angle. A sloped backfill will add surcharge load and affect the angle of the resultant force. The effect of other surcharges will also need to be included in earth pressure calculations, including the loads imposed by adjacent structures and traffic. The effects of proposed sloped backfill surface grades, and proposed slopes beyond the toe of the retaining structure, if applicable, must be considered when calculating resultant forces to be resisted by the retaining structure. A coefficient of friction of 0.35 against sliding can be used for concrete on the existing site soils. Retaining/below-grade wall footings should be designed so that the combined effect of vertical and horizontal resultants and overturning moment does not exceed the maximum soil bearing capacity provided in Section 5.5.

Adequate drainage of water that may collect on the backfill side of the retaining wall should be incorporated into the design and/or hydrostatic pressures should be added to the pressure calculations.

Depending on the wall type, drainage along the backside and in front of the wall may be provided by a free draining, clean stone layer separated from surrounding soils by a filtration fabric. Numerous commercially fabricated drainage systems also are available. A system of perforated drain pipes and/or weep holes may be used at the base of the backfill side of the retaining wall in order to collect and remove the water and relieve hydrostatic pressure.

Backfill Criteria: Whitestone recommends that granular soils be used to backfill behind the proposed below-grade walls. The granular backfill materials should consist of clean, relatively well graded sand or gravel with a maximum particle size of three inches and five percent to 15 percent of material finer than a #200 sieve. The material should be free of clay lumps, organics, and deleterious material. Rock fragments and cobbles/boulders greater than three inches should not be used as backfill. Additionally, imported granular soils may be required. Maximum density as provided in the previous table should not be exceeded to avoid creating excessive lateral pressure on the walls during compaction operations.

Whitestone recommends that backfill directly behind the wall be compacted with light, hand-held compactors. Heavy compactors and grading equipment should not be allowed to operate within a zone measured at a 45-degree angle from the base of the wall during backfilling to avoid developing excessive temporary or long-term lateral soil pressures.

5.0 PRELIMINARY SWM AREA EVALUATION

General: Soil profile pits SPP-1 through SPP-3 were performed within accessible areas of the proposed SWM area provided by Hammer. The soil profile pits performed within the SWM area were terminated at depths ranging from approximately nine fbgs to 10 fbgs.

Estimated Seasonal High Groundwater Levels: The methods used in determining the estimated seasonal high groundwater (ESHGW) level include evaluating the soil morphology within a test excavation and identifying irregular spots or blotches of different colors or minerals unlike that of the surrounding soils (mottles). Mottling is the result of the oxidation of minerals within a soil structure as a water level slowly fluctuates. A summary of the estimated seasonal high groundwater observations as well as infiltration test results are included in the following table.

INFILTRATION TEST SUMMARY					
Profile Pit #	**Surface Elevation (feet*)**	**ESHGW (fbgs/feet*)**	**USDA Classification @ Test**	**Infiltration Test**	
				Depth (fbgs/feet*)	**Rate (in/hour)**
SPP-1	78.0	7.5/70.5	Silty Clay Loam	1.0/77.0	< 0.2
SPP-2	79.0	8.0/71.0	Silty Clay Loam	1.0/78.0	< 0.2
SPP-3	78.5	8.0/70.5	Silty Clay Loam	1.0/77.5	< 0.2

Notes: * Above NAVD 88
USDA - United Stated Department of Agriculture
NE – Not Encountered

Soil Infiltration Rates: Laboratory tube permeameter tests were performed at the anticipated levels of infiltration within the proposed SWM area at soil profile pits locations. Laboratory testing was performed using by the tube permeameter test method. Tests within SPP-1 through SPP-3 resulted in relatively impermeable infiltration rates of less than 0.2 inches per hour (iph). Infiltration test results are provided in Appendix C, *Soil Profile Pit Logs* are included in Appendix A.

6.0 CLOSING

Whitestone appreciates the opportunity to be of service to Hammer Land Engineering. Please note that Whitestone has the capability to perform the additional geotechnical engineering services recommended herein. Please contact us with any questions or comments regarding this report.

Sincerely,

WHITESTONE ASSOCIATES, INC.

Kyle J. Kopacz, P.E.
Project Manager

Laurence W. Keller, P.E.
Principal, Geotechnical Services

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Enclosures
Copy: Joseph Hanrahan, P.E., LEED AP, Hammer Land Engineering

WHITESTONE
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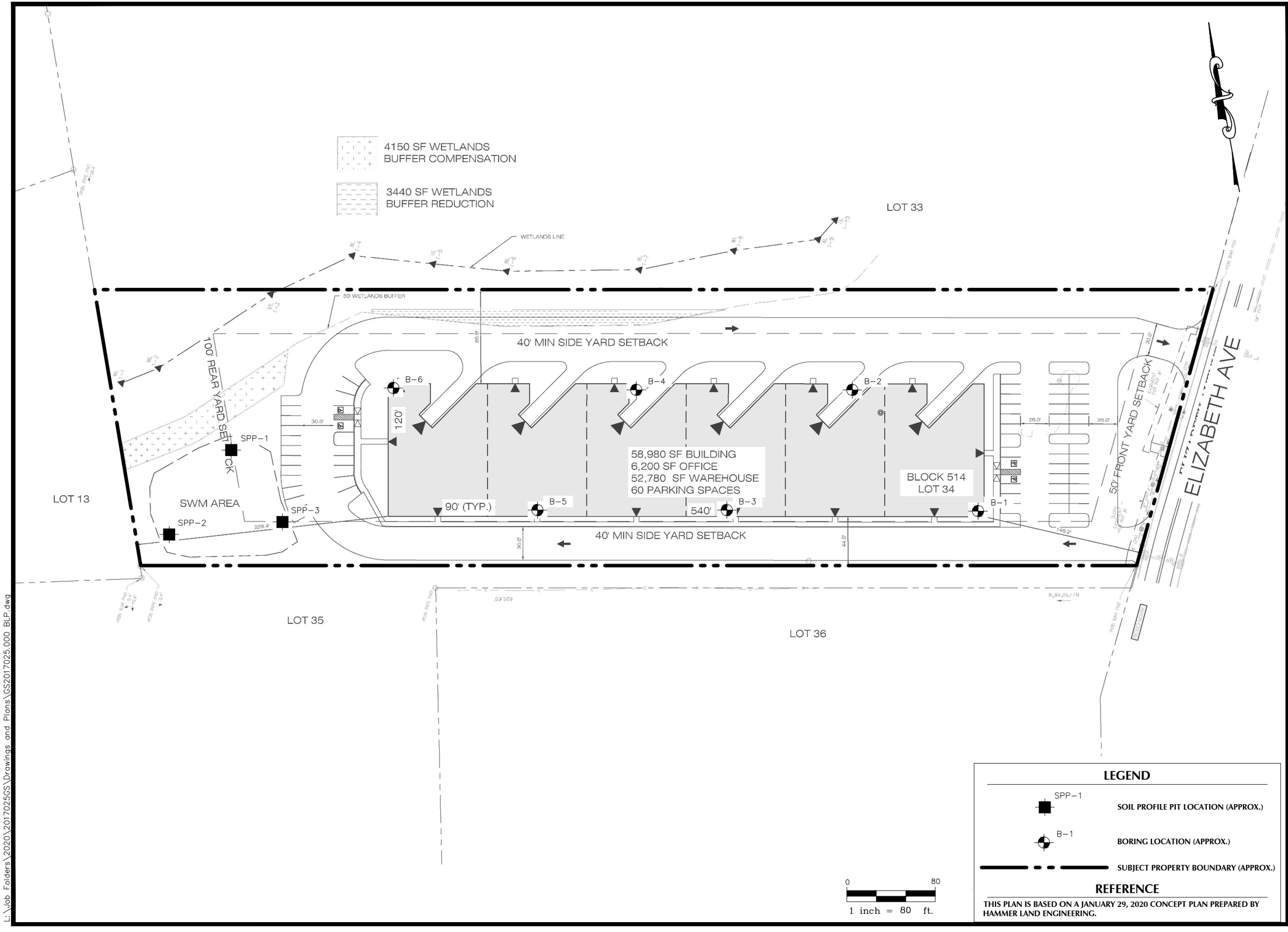
FIGURE 1
Test Location Plan



0 80

1 inch = 80 ft.

LEGEND

SPP-1 — SOIL PROFILE PIT LOCATION (APPROX.)

B-1 — BORING LOCATION (APPROX.)

SUBJECT PROPERTY BOUNDARY (APPROX.)

REFERENCE

THIS PLAN IS BASED ON A JANUARY 29, 2020 CONCEPT PLAN PREPARED BY HAMMER LAND ENGINEERING.

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DRAWING TITLE: **TEST LOCATION PLAN**

CLIENT: **HAMMER LAND ENGINEERING**

PROJECT: **PROPOSED WAREHOUSE**
490 ELIZABETH AVENUE
TOWNSHIP OF FRANKLIN, SOMERSET COUNTY, NEW JERSEY

PROJECT #: GS2017025.000	
DESIGNED BY: GR	PROJ. MGR.: KK
DATE: 3/5/20	FIGURE: 1
SCALE: 1" = 80'	

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WHITESTONE ASSOCIATES, INC.

APPENDIX A
Records of Subsurface Exploration

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-1

Page 1 of 1

Project:	Proposed Warehouse	**WAI Project No.:**	GS2017025.000
Location:	490 Elizabeth Avenue; Township of Franklin, Somerset County, NJ	**Client:**	Hammer Land Engineering
Surface Elevation:	± 75.5 feet	**Date Started:**	3/2/2020
Termination Depth:	18.5 feet bgs	**Date Completed:**	3/2/2020
Proposed Location:	Building	**Logged By:**	SEP
Drill / Test Method:	HSA / SPT	**Contractor:**	FS
		Equipment:	Geoprobe 7822DT

Water Depth | Elevation (feet bgs) | (feet)		Cave-In Depth | Elevation (feet bgs) | (feet)	
During:	NE | ---		
At Completion:	NE | ---	**At Completion:**	--- | ---
24 Hours:	--- | ---	**24 Hours:**	--- | ---

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
						0.5	TOPSOIL		6" Topsoil, Sod	
0 - 2	S-1		2 - 3 - 5 - 6	20	8		RESIDUAL		Gray and Light Reddish-Brown Lean Clay with Sand, Moist, Stiff (CL)	Qu = 2.5 tsf
2 - 4	S-2		12 - 12 - 14 - 12	24	26				Dark Reddish-Brown Silty Sand and Coarse to Fine Subangular Gravel, Moist, Stiff (SM)	
4 - 6	S-3		6 - 5 - 8 - 14	24	13	5.0			As Above, Higher Gravel Content (SM)	
6 - 8	S-4		20 - 22 - 24 - 32	24	46	7.0				
							WEATHERED ROCK		Dark Reddish-Brown Highly Weathered Shale Consisting of Silty Sand with Platy/Subangular Gravel, Moist, Dense (WR)	
8 - 9.4	S-5		22 - 34 - 50/3"	12	84/9"				As Above (WR)	Shale Itself is Soft and Fine but Matrix is Very Tight/Dense
						10.0				
13 - 13.8	S-6		37 - 50/3"	9	50/3"				As Above (WR)	Slower Auger Advancement with Depth
						15.0				
18 - 18.5	S-7		51 - 10/0"	6	61/6"	18.5			As Above (WR)	
						20.0			Boring Log B-1 Terminated at a Depth of 18.5 Feet Below Ground Surface Due to Split Spoon Sampler Refusal on Dense Weathered Rock	Split Spoon Sampler Refusal @ 18.5 fbgs
						25.0				

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-2

Page 1 of 1

Project:	Proposed Warehouse	**WAI Project No.:**	GS2017025.000
Location:	490 Elizabeth Avenue; Township of Franklin, Somerset County, NJ	**Client:**	Hammer Land Engineering
Surface Elevation:	± 73.0 feet	**Date Started:**	3/2/2020
Termination Depth:	18.3 feet bgs	**Date Completed:**	3/2/2020
Proposed Location:	Building	**Logged By:**	SEP
Drill / Test Method:	HSA / SPT	**Contractor:**	FS
		Equipment:	Geoprobe 7822DT

Water Depth | Elevation (feet bgs) | (feet)		Cave-In Depth | Elevation (feet bgs) | (feet)	
During:	NE | ---		
At Completion:	NE | ---	**At Completion:**	--- | ---
24 Hours:	--- | ---	**24 Hours:**	--- | ---

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0	TOPSOIL		2" Topsoil, Moss	
0 - 2	S-1	X	1 - 2 - 3 - 6	24	5		RESIDUAL		Brown to Dark Reddish-Brown Lean Clay with Sand, Moist, Stiff (CL)	Qu = 2.5 tsf
2 - 4	S-2	X	8 - 10 - 11 - 14	24	21				As Above, Hard (CL)	Qu = 4.0 tsf to 4.5 tsf
4 - 6	S-3	X	6 - 12 - 15 - 18	20	27	5.0			As Above (CL)	
6 - 8	S-4	X	18 - 15 - 18 - 33	22	33	6.0			Dark Reddish-Brown Silt with Sand and Coarse to Fine Gravel, Moist, Stiff (ML)	Qu = 4.0 tsf
						7.5	WEATHERED ROCK		Dark Reddish-Brown Highly Weathered Shale Consisting of Silty Sand with Platy/Subangular Gravel, Moist, Very Dense (WR)	
						10.0				
13 - 14.8	S-5	X	32 - 14 - 47 - 50/3"	18	61				As Above (WR)	Slower Auger Advancement with Depth
						15.0				
18 - 18.3	S-6	X	50/3"	2	50/3"	18.3			As Above (WR)	
									Boring Log B-2 Terminated at a Depth of 18.3 Feet Below Ground Surface Due to Split Spoon Sampler Refusal in Dense Weathered Rock	Split Spoon Sampler Refusal @ 18.3 fbgs
						20.0				
						25.0				

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-3

Page 1 of 1

Project:	Proposed Warehouse	**WAI Project No.:**	GS2017025.000
Location:	490 Elizabeth Avenue; Township of Franklin, Somerset County, NJ	**Client:**	Hammer Land Engineering
Surface Elevation:	± 76.5 feet	**Date Started:**	3/2/2020
Termination Depth:	18.2 feet bgs	**Date Completed:**	3/2/2020
Proposed Location:	Building	**Logged By:**	SEP
Drill / Test Method:	HSA / SPT	**Contractor:**	FS
		Equipment:	Geoprobe 7822DT

Water Depth | Elevation (feet bgs) | (feet)		Cave-In Depth | Elevation (feet bgs) | (feet)	
During:	NE | ---		
At Completion:	NE | ---	**At Completion:**	--- | ---
24 Hours:	--- | ---	**24 Hours:**	--- | ---

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
						0.5	TOPSOIL		6" Topsoil	
0 - 2	S-1	X	1 - 1 - 1 - 1	20	2		RESIDUAL		Yellowish-Brown Clayey Silt with Sand, Very Moist, Medium Stiff (CL-ML)	Qu = 0.5 tsf to 1.0 tsf
						2.0				
2 - 4	S-2	X	3 - 4 - 5 - 5	20	9				Dark Reddish-Brown Lean Clay with Sand, Moist, Hard (CL)	Qu = >4.5 tsf
4 - 6	S-3	X	5 - 9 - 12 - 10	8	21	5.0			As Above (CL)	Qu = >4.5 tsf
6 - 8	S-4	X	8 - 10 - 19 - 28	20	29	7.0			As Above (CL)	
							WEATHERED ROCK		Dark Reddish-Brown Highly Weathered Shale Consisting of Silty Sand with Platy/Subangular Gravel, Moist, Very Dense (WR)	
8 - 9.8	S-5	X	12 - 15 - 30 - 50/3"	24	45	9.8				
						10.0				
13 - 13.8	S-6	X	18 - 50/3"	8	50/3"				As Above, Fine Weak Gravel Fragments, Dry (WR)	Slower Auger Advancement with Depth
						15.0				
18 -18.2	S-7	X	50/2"		50/2"	18.2			As Above (WR)	
									Boring Log B-3 Terminated at a Depth of 18.2 Feet Below Ground Surface Due to Split Spoon Sampler Refusal in Dense Weathered Rock	Split Spoon Sampler Refusal @ 18.2 fbgs
						20.0				
						25.0				

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-4

Page 1 of 1

Project:	Proposed Warehouse	**WAI Project No.:**	GS2017025.000
Location:	490 Elizabeth Avenue; Township of Franklin, Somerset County, NJ	**Client:**	Hammer Land Engineering

Surface Elevation:	± 74.5 feet	**Date Started:**	3/2/2020		**Water Depth | Elevation (feet bgs) | (feet)**		**Cave-In Depth | Elevation (feet bgs) | (feet)**
Termination Depth:	18.3 feet bgs	**Date Completed:**	3/2/2020				
Proposed Location:	Building	**Logged By:**	SEP	**During:**	NE | ---		
Drill / Test Method:	HSA / SPT	**Contractor:**	FS	**At Completion:**	NE | ---	**At Completion:**	--- | ---
		Equipment:	Geoprobe 7822DT	**24 Hours:**	--- | ---	**24 Hours:**	--- | ---

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
						0.5	TOPSOIL		6" Topsoil, Root Mat	
0 - 2	S-1	X	1 - 1 - 2 - 4	24	3		RESIDUAL		Yellowish-Brown Clayey Silt with Sand, Very Moist, Medium Stiff (CL-ML)	Qu = 1.5 tsf
						2.0				
2 - 4	S-2	X	7 - 10 - 12 - 13	24	22				Dark Reddish-Brown Lean Clay with Sand and Medium to Fine Platy/Subangular Gravel, Moist, Very Stiff (CL)	Qu = 3.5 tsf
4 - 6	S-3	X	5 - 13 - 22 - 34	20	35	5.0			As Above (CL)	
							WEATHERED ROCK		Reddish-Brown Highly Weathered Shale Consisting of Silty Sand with Coarse to Fine Platy/Subangular Gravel, Moist, Very Dense (WR)	
6 - 6.8	S-4	X	45 - 50/4"	10	50/4"					
						10.0				
13 - 13.8	S-5	X	28 - 50/3"	8	50/3"				As Above, Dry (WR)	
						15.0				
18 - 18.3	S-6	X	50/4"	4	50/4"	18.3			As Above (WR)	
									Boring Log B-4 Terminated at a Depth of 18.3 Feet Below Ground Surface Due to Split Spoon Sampler Refusal in Dense Weathered Rock	Split Spoon Sampler Refusal @ 18.3 fbgs
						20.0				
						25.0				

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-5

Page 1 of 1

Project:	Proposed Warehouse	**WAI Project No.:**	GS2017025.000
Location:	490 Elizabeth Avenue; Township of Franklin, Somerset County, NJ	**Client:**	Hammer Land Engineering
Surface Elevation:	± 77.5 feet	**Date Started:**	3/2/2020
Termination Depth:	18.8 feet bgs	**Date Completed:**	3/2/2020
Proposed Location:	Building	**Logged By:**	SEP
Drill / Test Method:	HSA / SPT	**Contractor:**	FS
		Equipment:	Geoprobe 7822DT

Water Depth (feet bgs) | Elevation (feet)		Cave-In Depth (feet bgs) | Elevation (feet)	
During:	NE | ---		
At Completion:	NE | ---	**At Completion:**	--- | ---
24 Hours:	--- | ---	**24 Hours:**	--- | ---

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
						0.5	TOPSOIL		6" Topsoil	
0 - 2	S-1	X	2 - 2 - 5 - 6	24	7		RESIDUAL		Brown to Dark Reddish-Brown Silty Clayey Sand with Coarse to Fine Subangular Gravel, Moist, Stiff (SC-SM)	Qu = 1.5 tsf
2 - 4	S-2	X	7 - 7 - 17 - 25	24	24				As Above, Dark Reddish-Brown, Hard (SC-SM)	Qu = 4.0 tsf
4 - 6	S-3	X	5 - 20 - 28 - 32	20	48	5.0			As Above (SC-SM)	
6 - 6.8	S-4	X	40 - 50/3"	6	50/3"		WEATHERED ROCK		Reddish-Brown Highly Weathered Shale Consisting of Silty Sand with Medium to Fine Platy Gravel, Moist, Very Dense (WR)	
						10.0				
13 - 13.3	S-5	X	50/3"	4	50/3"				As Above, Dry (WR)	Slower Auger Advancement with Depth
						15.0				
18 - 18.8	S-6	X	35 - 50/3"		50/3"				As Above (WR)	
						18.8			Boring Log B-5 Terminated at a Depth of 18.8 Feet Below Ground Surface Due to Split Spoon Sampler Refusal in Dense Weathered Rock	Split Spoon Sampler Refusal @ 18.8 fbgs
						20.0				
						25.0				

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Boring No.: B-6

Page 1 of 1

Project:	Proposed Warehouse	**WAI Project No.:**	GS2017025.000
Location:	490 Elizabeth Avenue; Township of Franklin, Somerset County, NJ	**Client:**	Hammer Land Engineering
Surface Elevation:	± 76.5 feet	**Date Started:**	3/2/2020
Termination Depth:	18.2 feet bgs	**Date Completed:**	3/2/2020
Proposed Location:	Building	**Logged By:**	SEP
Drill / Test Method:	HSA / SPT	**Contractor:**	FS
		Equipment:	Geoprobe 7822DT

Water Depth (feet bgs) | Elevation (feet)		Cave-In Depth (feet bgs) | Elevation (feet)	
During:	NE | ---		
At Completion:	NE | ---	**At Completion:**	--- | ---
24 Hours:	--- | ---	**24 Hours:**	--- | ---

SAMPLE INFORMATION						DEPTH	STRATA		DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	No	Type	Blows Per 6"	Rec. (in.)	N	(feet)				
						0.0				
						0.5	TOPSOIL		6" Topsoil	
0 - 2	S-1	X	2 - 3 - 5 - 7	24	8		RESIDUAL		Dark Reddish-Brown Lean Clay with Sand and Coarse to Fine Subangular Gravel, Very Moist, Medium Stiff (CL)	Qu = 1.5 tsf
2 - 4	S-2	X	5 - 16 - 27 - 37	24	43	3.0	WEATHERED ROCK		Reddish-Brown Highly Weathered Shale Consisting of Silty Sand with Medium to Fine Platy/Subangular Gravel, Moist, Very Dense (WR)	
4 - 6	S-3	X	5 - 20 - 24 - 40	20	44	5.0			As Above (WR)	
6 - 8	S-4	X	22 - 28 - 40 - 44		68				As Above (WR)	
						10.0				
13 - 13.2	S-5	X	50/3"	4	50/3"				As Above (WR)	Slower Auger Advancement with Depth
						15.0				
18 - 18.2	S-6	X	50/2"	2	50/2"	18.2			As Above (WR)	
									Boring Log B-6 Terminated at a Depth of 18.2 Feet Below Ground Surface	
						20.0				
						25.0				

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Soil Profile Pit No.: SPP-1

Project:	Proposed Warehouse	**WAI Project No.:**	GS2017025.000
Location:	490 Elizabeth Avenue; Township of Franklin, Somerset County, NJ	**Client:**	Hammer Land Engineering

				Water Depth (feet bgs)	Elevation (feet)	Estimated Seasonal High Groundwater Depth (feet bgs)	Elevation (feet)
Surface Elevation:	± 78.0 feet	**Date Started:**	3/2/2020				
Termination Depth:	10.0 feet bgs	**Date Completed:**	3/2/2020				
Proposed Location:	SWM Basin	**Logged By:**	SEP	**During:**	7.5 | 70.5		
Excavating Method:	Test Pit Excavation	**Contractor:**	Carroccia	**At Completion:**	7.5 | 70.5	**At Completion:**	7.5 | 70.5
Test Method:	Visual Observation	**Rig Type:**	Deere 60G	**24 Hours:**	--- | ---		

SAMPLE INFORMATION			DEPTH		HORIZON	DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	Number	Type	feet				
			0.0	0 - 0.8	TS/ROOT MAT	4" Topsoil 5" Heavy Root Mat (Coarse to Fine Tree Roots)	
0.75 - 2.5	T-1A/B/C S-1	TUBES/ BAG	1.0 – 2.0	0.8 - 2.5	SILTY CLAY LOAM	Reddish-Brown (2.5YR 4/4) SILTY CLAY LOAM; 15% Gravel; Medium, Moderate Subangular Blocky Structure; Moist; Friable; Few Fine Roots; No Mottling; Clear Boundary	
			3.0 – 10.0	2.5 - 10	WEATHERED ROCK	Reddish-Brown Weathered Shale Consisting of Coarse to Fine Platy Gravel; Moist Grading to Wet @ 7.5 fbgs	Labored Excavation @ 3.5 fbgs to 10.0 fbgs Shale Fragments 1" x 1" x 0.5" to 6" x 8" x 1.5" Rapid Water Seepage @ 7.5 fbgs to 10.0 fbgs
			11.0 – 15.0			Soil Profile Pit SPP-1 Terminated at a Depth of 10.0 Feet Below Ground Surface Due to Machine Refusal on Apparent Intact Bedrock	Machine Refusal @ 10.0 fbgs

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Soil Profile Pit No.: SPP-2

Project:	Proposed Warehouse	**WAI Project No.:**	GS2017025.000
Location:	490 Elizabeth Avenue; Township of Franklin, Somerset County, NJ	**Client:**	Hammer Land Engineering

				Water Depth (feet bgs)	Elevation (feet)	Estimated Seasonal High Groundwater Depth (feet bgs)	Elevation (feet)
Surface Elevation:	± 79.0 feet	**Date Started:**	3/2/2020				
Termination Depth:	9.0 feet bgs	**Date Completed:**	3/2/2020				
Proposed Location:	SWM Basin	**Logged By:**	SEP	**During:**	8.0 | 71.0		
Excavating Method:	Test Pit Excavation	**Contractor:**	Carroccia	**At Completion:**	8.0 | 71.0	**At Completion:**	8.0 | 71.0
Test Method:	Visual Observation	**Rig Type:**	Deere 60G	**24 Hours:**	--- | ---		

SAMPLE INFORMATION			DEPTH	HORIZON	DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	Number	Type	feet			
			0.0			
			0 - 0.9	TS/ROOTS	3" Topsoil 8" Heavy Root Mat (Coarse to Fine Tree Roots)	
			1.0			
			0.9 - 1.8	SILTY CLAY LOAM	Reddish-Brown (2.5YR 4/4) SILTY CLAY LOAM; 35% Gravel; Medium, Moderate Subangular Blocky Structure; Moist; Friable; Few Fine Roots; No Mottling; Clear Boundary	
			2.0			
			1.8 - 9	WEATHERED ROCK	Reddish-Brown Weathered Shale Consisting of Coarse to Fine Platy Gravel; Moist Grading to Wet @ 8.0 fbgs	
			3.0			Labored Excavation @ 3.0 fbgs to 9.0 fbgs
			4.0			
			5.0			Shale Fragments 1" x 1" x 0.5" to 6" x 6" x 2"
			6.0			
			7.0			
			8.0 ▼▽			
			9.0			
			10.0		Soil Profile Pit SPP-2 Terminated at a Depth of 10.0 Feet Below Ground Surface Due to Machine Refusal on Apparent Intact Bedrock	
			11.0			
			12.0			
			13.0			
			14.0			
			15.0			

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

RECORD OF SUBSURFACE EXPLORATION

Soil Profile Pit No.: SPP-3

Project:	Proposed Warehouse	**WAI Project No.:**	GS2017025.000
Location:	490 Elizabeth Avenue; Township of Franklin, Somerset County, NJ	**Client:**	Hammer Land Engineering

				Water Depth (feet bgs)	Elevation (feet)	Estimated Seasonal High Groundwater Depth (feet bgs)	Elevation (feet)
Surface Elevation:	± 78.5 feet	**Date Started:**	3/2/2020				
Termination Depth:	10.0 feet bgs	**Date Completed:**	3/2/2020				
Proposed Location:	SWM Basin	**Logged By:**	SEP	**During:** 8.0	70.5		
Excavating Method:	Test Pit Excavation	**Contractor:**	Carroccia	**At Completion:** 8.0	70.5	**At Completion:** 8.0	70.5
Test Method:	Visual Observation	**Rig Type:**	Deere 60G	**24 Hours:** ---	---		

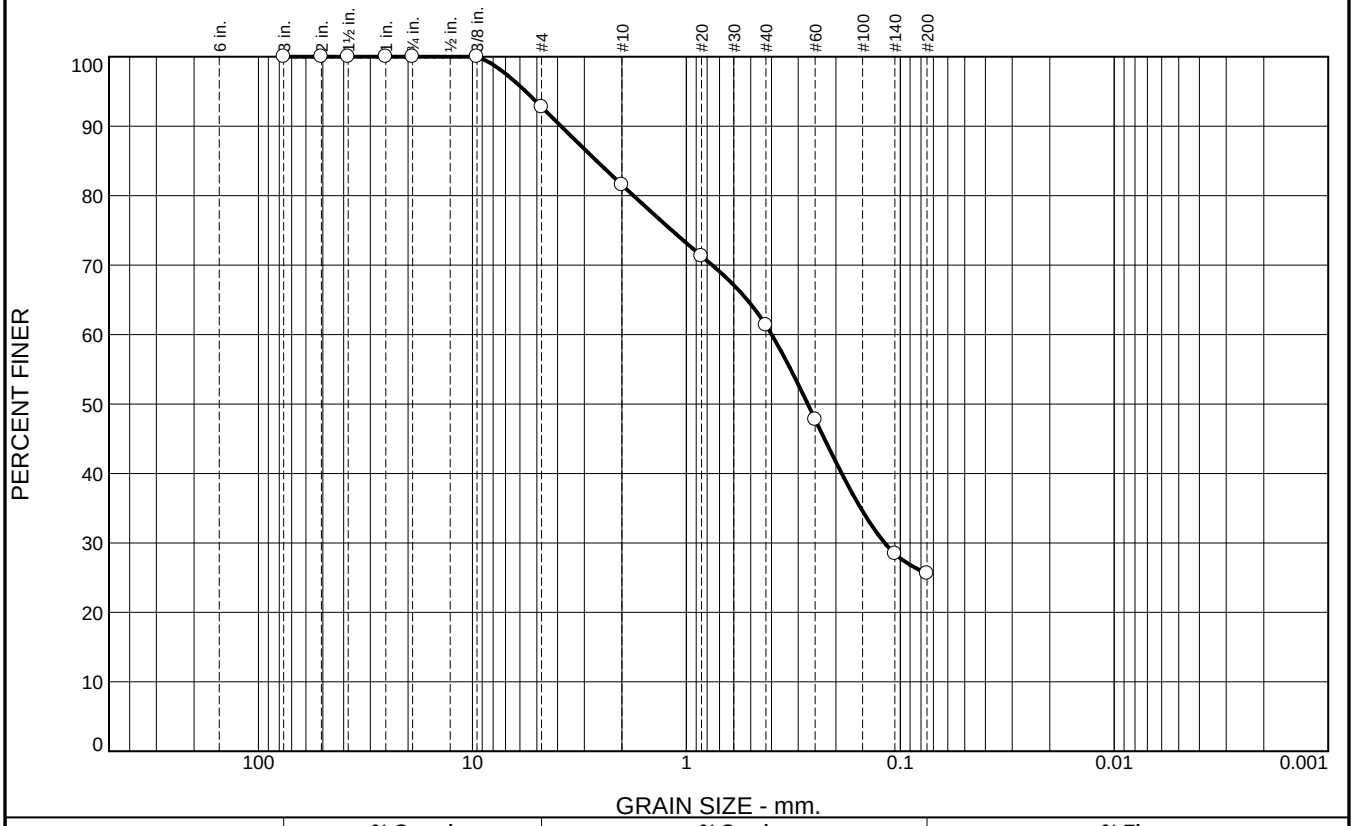
SAMPLE INFORMATION			DEPTH		HORIZON	DESCRIPTION OF MATERIALS (Classification)	REMARKS
Depth (feet)	Number	Type	feet				
			0.0				
				0 - 0.8	TS/ROOTS	5" Topsoil 4" Heavy Root Mat (Coarse to Fine Tree Roots)	
			1.0	0.8 - 2.5	SILTY CLAY LOAM	Reddish-Brown (2.5YR 4/4) SILTY CLAY LOAM; 15% Gravel; Medium, Moderate Subangular Blocky Structure; Moist; Friable; Few Fine Roots; No Mottling; Clear Boundary	
0.75 - 2.5	T-1A/B/C S-1	TUBES/ BAG	2.0				
			3.0	2.5 - 10	WEATHERED ROCK	Reddish-Brown Weathered Shale Consisting of Coarse to Fine Platy Gravel; Moist Grading to Wet @ 8.0 fbgs	Labored Excavation @ 3.0 fbgs to 10.0 fbgs
			4.0				
			5.0				
			6.0				Shale Fragments 1" x 1" x 0.5" to 6" x 8" x 2"
			7.0				
			8.0 ▼▽				Rapid Water Seepage @ 8.0 fbgs to 10.0 fbgs
			9.0				
			10.0				
			11.0			Soil Profile Pit SPP-3 Terminated at a Depth of 10.0 Feet Below Ground Surface Due to Machine Refusal on Apparent Intact Bedrock	
			12.0				
			13.0				
			14.0				
			15.0				

NOTES: bgs = below ground surface, NA = Not Applicable, NE = Not Encountered, NS = Not Surveyed, P = Perched

WHITESTONE ASSOCIATES, INC.

APPENDIX B
Laboratory Test Results

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	7.2	11.3	20.2	35.7	25.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	92.8		
#10	81.5		
#20	71.3		
#40	61.3		
#60	47.8		
#140	28.4		
#200	25.6		

* (no specification provided)

Material Description

Atterberg Limits

PL= 16 LL= 17 PI= 1

Coefficients

D_{90}= 3.8547 D_{85}= 2.6262 D_{60}= 0.3993
D_{50}= 0.2709 D_{30}= 0.1183 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

W_n = 14.5 %

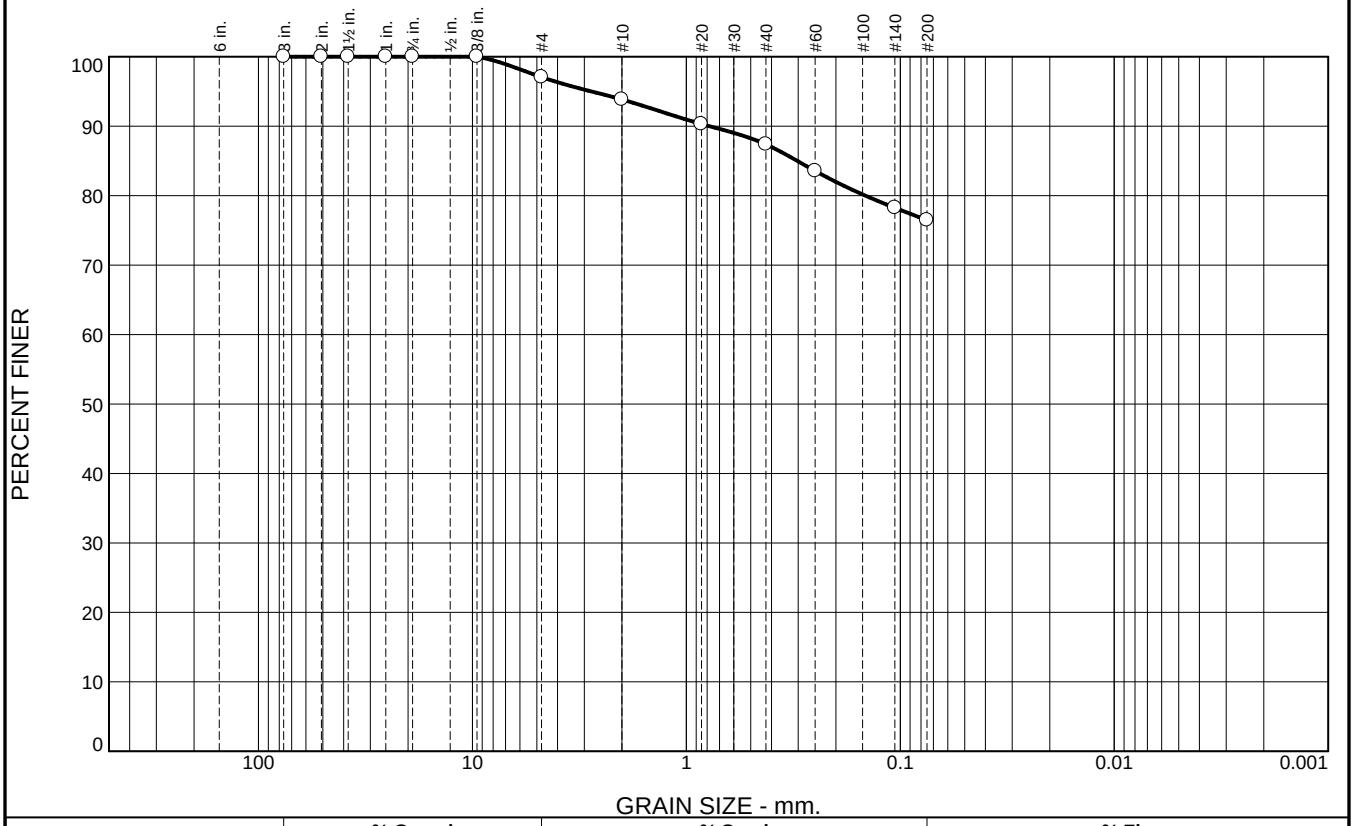
Source of Sample: B-1 **Depth:** 2.0' - 4.0'
Sample Number: S-2

Date: 03/12/2020

WHITESTONE ASSOCIATES, INC.
Warren, New Jersey

Client: Hammer Land Engineering
Project: Proposed Warehouse
490 Elizabeth Avenue, Township of Franklin, Somerset County, NJ
Project No: GS2017025.000 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.0	3.2	6.4	10.9	76.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	97.0		
#10	93.8		
#20	90.3		
#40	87.4		
#60	83.5		
#140	78.2		
#200	76.5		

* (no specification provided)

Material Description

Silty Clay with Sand

Atterberg Limits

PL= 21 LL= 28 PI= 7

Coefficients

D_{90}= 0.7813 D_{85}= 0.3031 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL-ML AASHTO= A-4(4)

Remarks

W_n = 22.0 %

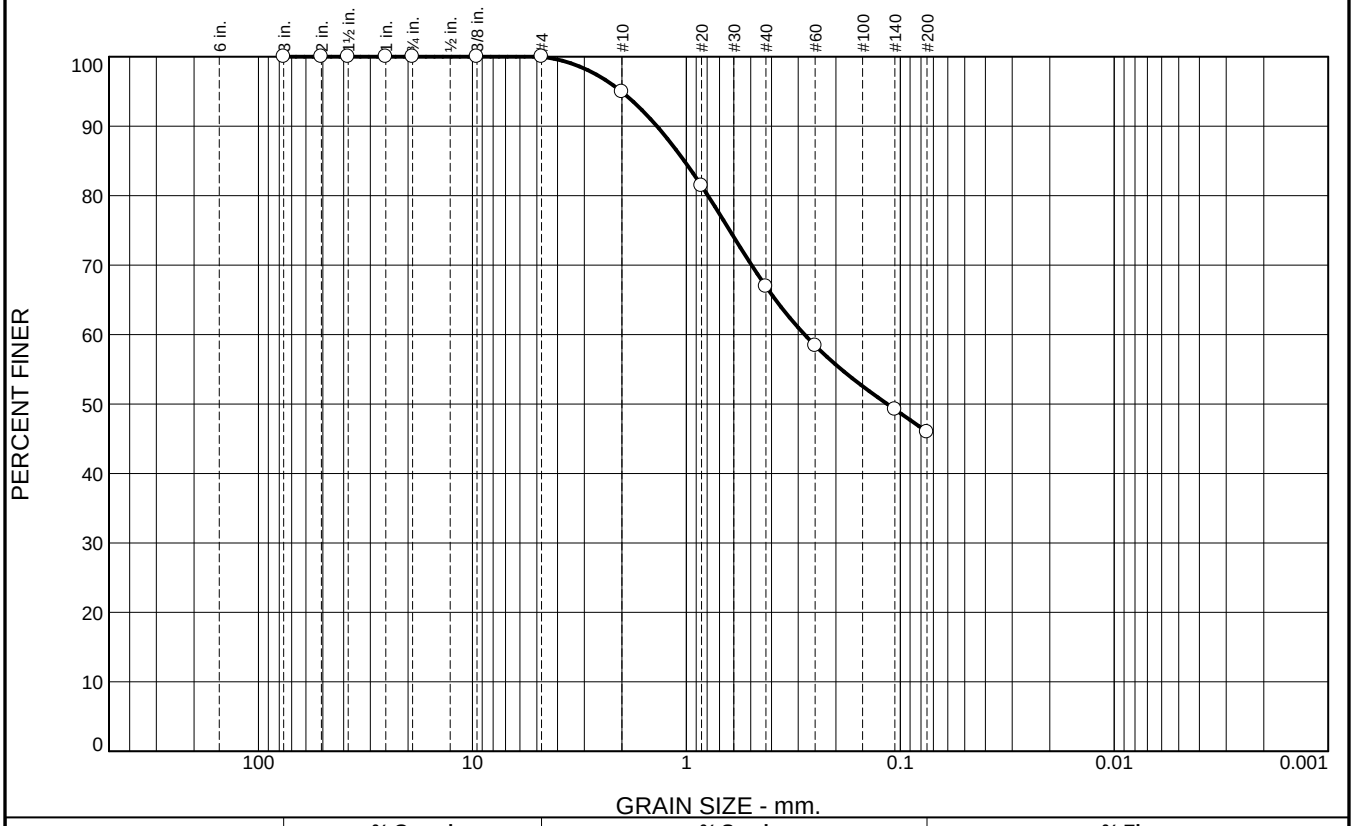
Source of Sample: B-3 **Depth:** 0.5' - 2.0'
Sample Number: S-1

Date: 03/12/2020

WHITESTONE ASSOCIATES, INC.
Warren, New Jersey

Client: Hammer Land Engineering
Project: Proposed Warehouse
490 Elizabeth Avenue, Township of Franklin, Somerset County, NJ
Project No: GS2017025.000 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	5.1	28.0	20.9	46.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1.5	100.0		
1	100.0		
.75	100.0		
.375	100.0		
#4	100.0		
#10	94.9		
#20	81.4		
#40	66.9		
#60	58.4		
#140	49.2		
#200	46.0		

* (no specification provided)

Material Description

Silty, Clayey Sand

Atterberg Limits

PL= 23 LL= 30 PI= 7

Coefficients

D_{90}= 1.3734 D_{85}= 1.0225 D_{60}= 0.2805
D_{50}= 0.1151 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SC-SM AASHTO= A-4(1)

Remarks

W_n = 11.7 %

Source of Sample: B-5 **Depth:** 2.0' - 4.0'
Sample Number: S-2

Date: 03/12/2020

WHITESTONE ASSOCIATES, INC.
Warren, New Jersey

Client: Hammer Land Engineering
Project: Proposed Warehouse
490 Elizabeth Avenue, Township of Franklin, Somerset County, NJ
Project No: GS2017025.000 **Figure**

WHITESTONE ASSOCIATES, INC.

APPENDIX C
Infiltration Test Results

Tube Permeameter Test Data

Job Number: GS2017025.000
Project: Proposed Warehouse
Client: Hammer Land Engineering
Lab Tech: SEP

Sample ID: **Profile Pit No.:** **SPP-1** **Sample No.:** **T-1** **Depth:** 1.0'

COUNTY/MUNICIPALITY Franklin Township BLOCK _____ LOT _____

1. Test Number 1 Replicate (letter) A Date Collected _____

2. Material Tested: _____ Fill X Test in Native Soil

3. Type of Sample: X Undisturbed _____ Disturbed

4. Sample Dimensions: Inside Radius of Sample Tube, R, in cm 1.91
Length of Sample, L, in inches 3.00

5. Bulk Density Determination (Disturbed Samples Only): N/A

6. Sample Weight (Wt. Tube Containing Sample-Wt. of Empty Tube), grams 0.00

Wt. of Tube Containing Sample _____
Wt. of Empty Tube _____

7. Sample Volume (L x 2.54 cm./inch x 3.14R2), cc. 86.83

8. Bulk Density (Sample Wt./Sample Volume), grams/cc. 0 > 1.2

9. Standpipe Used: X No _____ Yes, Indicate Internal Radius, cm. N/A

10. Height of Water Level Above Rim of Test Basin, in inches:

At the Beginning of Each Test Interval, H1 5.00
At the End of Each Test Interval, H2 4.99

11. Rate of Water Level Drop (Add additional lines if needed):

Time, Start of Test Interval, T1	Time End of Test Interval T2	Length of Test Interval, T, Minutes
		1440.00

***No appreciable movement after 24 hours**

12. Calculation of Permeability: K, (in/hr) = 60 min/hr x r2/R2 x L(in)/T(min) x ln (H1/H2) T= 1440.00

K (in/hr) = 0.00 **Classification:** **K0**

13. Defects in the Sample (Check appropriate items):

X None

_____ Soil/Tube Contact _____Large Gravel _____ Large Roots

_____ Dry Soil _____Smearing _____ Compaction

_____ Other - Specify _____

Tube Permeameter Test Data

Job Number: GS2017025.000
Project: Proposed Warehouse
Client: Hammer Land Engineering
Lab Tech: SEP

Sample ID: **Profile Pit No.:** **SPP-1** **Sample No.:** **T-1** **Depth:** 1.0'

COUNTY/MUNICIPALITY Franklin Township BLOCK _____ LOT _____

1. Test Number 1 Replicate (letter) B Date Collected _____

2. Material Tested: _____ Fill X Test in Native Soil

3. Type of Sample: X Undisturbed _____ Disturbed

4. Sample Dimensions: Inside Radius of Sample Tube, R, in cm 1.91
Length of Sample, L, in inches 3.00

5. Bulk Density Determination (Disturbed Samples Only): N/A

6. Sample Weight (Wt. Tube Containing Sample-Wt. of Empty Tube), grams 0.00

Wt. of Tube Containing Sample _____
Wt. of Empty Tube _____

7. Sample Volume (L x 2.54 cm./inch x 3.14R2), cc. 86.83

8. Bulk Density (Sample Wt./Sample Volume), grams/cc. 0 > 1.2

9. Standpipe Used: X No _____ Yes, Indicate Internal Radius, cm. N/A

10. Height of Water Level Above Rim of Test Basin, in inches:

At the Beginning of Each Test Interval, H1 5.00
At the End of Each Test Interval, H2 4.99

11. Rate of Water Level Drop (Add additional lines if needed):

Time, Start of Test Interval, T1	Time End of Test Interval T2	Length of Test Interval, T, Minutes
		1440.00

***No appreciable movement after 24 hours**

12. Calculation of Permeability: K, (in/hr) = 60 min/hr x r2/R2 x L(in)/T(min) x ln (H1/H2) T= 1440.00

K (in/hr) = 0.00 **Classification:** **K0**

13. Defects in the Sample (Check appropriate items):

X None

_____ Soil/Tube Contact _____Large Gravel _____ Large Roots

_____ Dry Soil _____Smearing _____ Compaction

_____ Other - Specify _____

Tube Permeameter Test Data

Job Number: GS2017025.000
Project: Proposed Warehouse
Client: Hammer Land Engineering
Lab Tech: SEP

Sample ID: **Profile Pit No.:** **SPP-2** **Sample No.:** **T-1** **Depth:** 1.0'

COUNTY/MUNICIPALITY Franklin Township BLOCK _____ LOT _____

1. Test Number 1 Replicate (letter) A Date Collected _____

2. Material Tested: _____ Fill X Test in Native Soil

3. Type of Sample: X Undisturbed _____ Disturbed

4. Sample Dimensions: Inside Radius of Sample Tube, R, in cm 1.91
Length of Sample, L, in inches 3.00

5. Bulk Density Determination (Disturbed Samples Only): N/A

6. Sample Weight (Wt. Tube Containing Sample-Wt. of Empty Tube), grams 0.00

Wt. of Tube Containing Sample _____
Wt. of Empty Tube _____

7. Sample Volume (L x 2.54 cm./inch x 3.14R2), cc. 86.83

8. Bulk Density (Sample Wt./Sample Volume), grams/cc. 0 > 1.2

9. Standpipe Used: X No _____ Yes, Indicate Internal Radius, cm. N/A

10. Height of Water Level Above Rim of Test Basin, in inches:

At the Beginning of Each Test Interval, H1 5.00
At the End of Each Test Interval, H2 4.99

11. Rate of Water Level Drop (Add additional lines if needed):

Time, Start of Test Interval, T1	Time End of Test Interval T2	Length of Test Interval, T, Minutes
		1440.00

***No appreciable movement after 24 hours**

12. Calculation of Permeability: K, (in/hr) = 60 min/hr x r2/R2 x L(in)/T(min) x ln (H1/H2) T= 1440.00

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_____ Soil/Tube Contact _____Large Gravel _____ Large Roots

_____ Dry Soil _____Smearing _____ Compaction

_____ Other - Specify _____

Tube Permeameter Test Data

Job Number: GS2017025.000
Project: Proposed Warehouse
Client: Hammer Land Engineering
Lab Tech: SEP

Sample ID: **Profile Pit No.:** **SPP-2** **Sample No.:** **T-1** **Depth:** 1.0'

COUNTY/MUNICIPALITY Franklin Township BLOCK _____ LOT _____

1. Test Number 1 Replicate (letter) B Date Collected _____

2. Material Tested: _____ Fill X Test in Native Soil

3. Type of Sample: X Undisturbed _____ Disturbed

4. Sample Dimensions: Inside Radius of Sample Tube, R, in cm 1.91
Length of Sample, L, in inches 3.00

5. Bulk Density Determination (Disturbed Samples Only): N/A

6. Sample Weight (Wt. Tube Containing Sample-Wt. of Empty Tube), grams 0.00

Wt. of Tube Containing Sample _____
Wt. of Empty Tube _____

7. Sample Volume (L x 2.54 cm./inch x 3.14R2), cc. 86.83

8. Bulk Density (Sample Wt./Sample Volume), grams/cc. 0 > 1.2

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10. Height of Water Level Above Rim of Test Basin, in inches:

At the Beginning of Each Test Interval, H1 5.00
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K (in/hr) = 0.00 **Classification:** **K0**

13. Defects in the Sample (Check appropriate items):

X None

_____ Soil/Tube Contact _____Large Gravel _____ Large Roots

_____ Dry Soil _____Smearing _____ Compaction

_____ Other - Specify _____

Tube Permeameter Test Data

Job Number: GS2017025.000
Project: Proposed Warehouse
Client: Hammer Land Engineering
Lab Tech: SEP

Sample ID: **Profile Pit No.:** **SPP-3** **Sample No.:** **T-1** **Depth:** 1.0'

COUNTY/MUNICIPALITY Franklin Township BLOCK _____ LOT _____

1. Test Number 1 Replicate (letter) A Date Collected _____

2. Material Tested: _____ Fill X Test in Native Soil

3. Type of Sample: X Undisturbed _____ Disturbed

4. Sample Dimensions: Inside Radius of Sample Tube, R, in cm 1.91
Length of Sample, L, in inches 3.00

5. Bulk Density Determination (Disturbed Samples Only): N/A

6. Sample Weight (Wt. Tube Containing Sample-Wt. of Empty Tube), grams 0.00

Wt. of Tube Containing Sample _____
Wt. of Empty Tube _____

7. Sample Volume (L x 2.54 cm./inch x 3.14R2), cc. 86.83

8. Bulk Density (Sample Wt./Sample Volume), grams/cc. 0 > 1.2

9. Standpipe Used: X No _____ Yes, Indicate Internal Radius, cm. N/A

10. Height of Water Level Above Rim of Test Basin, in inches:

At the Beginning of Each Test Interval, H1 5.00
At the End of Each Test Interval, H2 4.99

11. Rate of Water Level Drop (Add additional lines if needed):

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***No appreciable movement after 24 hours**

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K (in/hr) = 0.00 **Classification:** **K0**

13. Defects in the Sample (Check appropriate items):

X None

_____ Soil/Tube Contact _____Large Gravel _____ Large Roots

_____ Dry Soil _____Smearing _____ Compaction

_____ Other - Specify _____

Tube Permeameter Test Data

Job Number: GS2017025.000
Project: Proposed Warehouse
Client: Hammer Land Engineering
Lab Tech: SEP

Sample ID: **Profile Pit No.:** **SPP-3** **Sample No.:** **T-1** **Depth:** 1.0'

COUNTY/MUNICIPALITY Franklin Township BLOCK _____ LOT _____

1. Test Number 1 Replicate (letter) B Date Collected _____

2. Material Tested: _____ Fill X Test in Native Soil

3. Type of Sample: X Undisturbed _____ Disturbed

4. Sample Dimensions: Inside Radius of Sample Tube, R, in cm 1.91
Length of Sample, L, in inches 3.00

5. Bulk Density Determination (Disturbed Samples Only): N/A

6. Sample Weight (Wt. Tube Containing Sample-Wt. of Empty Tube), grams 0.00

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K (in/hr) = 0.00 **Classification:** **K0**

13. Defects in the Sample (Check appropriate items):

X None

_____ Soil/Tube Contact _____Large Gravel _____ Large Roots

_____ Dry Soil _____Smearing _____ Compaction

_____ Other - Specify _____

WHITESTONE ASSOCIATES, INC.

APPENDIX D
Supplemental Information (USCS, Terms & Symbols)

WHITESTONE ASSOCIATES, INC.
Environmental & Geotechnical Engineers & Consultants

2430 HIGHWAY 34
BUILDING B, SUITE 101
MANASQUAN, NJ 08736
732.592.2101
whitestoneassoc.com

UNIFIED SOIL CLASSIFICATION SYSTEM

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
			GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS	CLEAN SAND (LITTLE OR NO FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMITS LESS THAN 50	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMITS GREATER THAN 50	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS FOR SAMPLES WITH 5% TO 12% FINES

GRADATION*

% FINER BY WEIGHT

TRACE..... 1% TO 10%
LITTLE..... 10% TO 20%
SOME..... 20% TO 35%
AND..... 35% TO 50%

COMPACTNESS*
Sand and/or Gravel

RELATIVE DENSITY

LOOSE. ..... 0% TO 40%
MEDIUM DENSE.... 40% TO 70%
DENSE..... 70% TO 90%
VERY DENSE..... 90% TO 100%

CONSISTENCY*
Clay and/or Silt

RANGE OF SHEARING STRENGTH IN POUNDS PER SQUARE FOOT

VERY SOFT..... LESS THAN 250
SOFT..... ..... 250 TO 500
MEDIUM..... 500 TO 1000
STIFF..... 1000 TO 2000
VERY STIFF..... 2000 TO 4000
HARD..... GREATER THAN 4000

** VALUES ARE FROM LABORATORY OR FIELD TEST DATA, WHERE APPLICABLE. WHEN NO TESTING WAS PERFORMED, VALUES ARE ESTIMATED.*

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WHITESTONE
ASSOCIATES, INC.
Environmental & Geotechnical Engineers & Consultants

2430 HIGHWAY 34
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MANASQUAN, NJ 08736
732.592.2101
whitestoneassoc.com

GEOTECHNICAL TERMS AND SYMBOLS

SAMPLE IDENTIFICATION

The Unified Soil Classification System is used to identify the soil unless otherwise noted.

SOIL PROPERTY SYMBOLS

N: Standard Penetration Value: Blows per ft. of a 140 lb. hammer falling 30" on a 2" O.D. split-spoon.
Qu: Unconfined compressive strength, TSF.
Qp: Penetrometer value, unconfined compressive strength, TSF.
Mc: Moisture content, %.
LL: Liquid limit, %.
PI: Plasticity index, %.
δd: Natural dry density, PCF.
▼: Apparent groundwater level at time noted after completion of boring.

DRILLING AND SAMPLING SYMBOLS

NE: Not Encountered (Groundwater was not encountered).
SS: Split-Spoon - 1 ⅜" I.D., 2" O.D., except where noted.
ST: Shelby Tube - 3" O.D., except where noted.
AU: Auger Sample.
OB: Diamond Bit.
CB: Carbide Bit
WS: Washed Sample.

RELATIVE DENSITY AND CONSISTENCY CLASSIFICATION

Term (Non-Cohesive Soils)	Standard Penetration Resistance
Very Loose	0-4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	Over 50

Term (Cohesive Soils)	Qu (TSF)
Very Soft	0 - 0.25
Soft	0.25 - 0.50
Firm (Medium)	0.50 - 1.00
Stiff	1.00 - 2.00
Very Stiff	2.00 - 4.00
Hard	4.00+

PARTICLE SIZE

Boulders	8 in.+	Coarse Sand	5mm-0.6mm	Silt	0.074mm-0.005mm
Cobbles	8 in.-3 in.	Medium Sand	0.6mm-0.2mm	Clay	-0.005mm
Gravel	3 in.-5mm	Fine Sand	0.2mm-0.074mm		

Other Office Locations:

WARREN, NJ	CHALFONT, PA	SOUTHBOROUGH, MA	ROCKY HILL, CT	EVERGREEN, CO
908.668.7777	215.712.2700	508.485.0755	860.726.7889	303.670.6905