GEOTECHNICAL ENGINEERING REPORT

UMBC HARBOR HALL COURTYARD RENOVATION

BALTIMORE, MARYLAND

KIM PROJECT NO. G23048

PREPARED FOR

A. MORTON THOMAS AND ASSOCIATES, INC.
901 DULANEY VALLEY RD #710
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PREPARED BY

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September 22, 2023

Matthew Ernest P.E., LEED AP
Director of Site/Civil Engineering
A. Morton Thomas and Associates, Inc. (AMT)
901 Dulaney Valley Rd #710
Towson, MD 21204

Re: **Geotechnical Engineering Services**
UMBC Harbor Hall Courtyard Renovation
UMBC Project 23-126
Baltimore, Maryland
KIM Project No. G23048

Dear Mr. Ernest

Kim Engineering Inc. (KIM) is pleased to submit a copy of our report for the above-referenced project. This investigation was conducted in accordance with our revised proposals dated March 3, 2023, and your subsequent approval.

Services performed include the drilling of five (5) Standard Penetration Test (SPT) soil borings, field infiltration test, laboratory testing, and preparation of this geotechnical engineering investigation report. Our geotechnical report includes the following:

- Reviewed available geologic and subsurface information relative to the project site.
- An evaluation of the project site's estimated subsurface soil and groundwater conditions.
- Recommendations for soil bearing capacity for proposed hardscape structures and light poles.
- Recommendations for concrete slab-on-grade
- Stormwater management facility recommendations.
- Seismic site classification information.
- Comments on geotechnical aspects of construction that were readily apparent at the time of, in the area of, and to the depth of the investigation.

Services with respect to surveying for line and grade, specific dewatering recommendations, environmental matters, pavement sections, temporary slopes, retaining walls, seepage analysis, slope stability, erosion control, cost or quantity estimates, plans, specifications, and construction observation and testing were not included in the scope of services.

We appreciate the opportunity to be of service to you for this project. If you have any questions regarding this report, please do not hesitate to contact either of the undersigned.

Very truly yours,
KIM ENGINEERING, INC.

Kamal Bhusal
Project Manager

Tom Labuda, PE, PG
Principal Engineer

PROFESSIONAL CERTIFICATION: I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO.:PE 42702 EXPIRATION DATE: 10-12-2024.

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1.0 SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

The following is a summary of our conclusions and recommendations:

1. The subsurface investigation within the proposed construction areas generally indicates presence of existing fill/probable fill consisting of silty Sand, clayey Sand, sandy Lean Clay with organics, asphalt and concrete fragments in Stratum A and naturally occurring soils consisting of Poorly Graded SAND with Silt (SP-SM), Silty Sand (SM), Clayey SAND (SC), and Sandy LEAN CLAY (CL) below the surface and existing fill in borings and are designated as Stratum B.
2. Foundation recommendations are presented in section 7.1 of this report.
3. The in-situ infiltration testing was performed at the selected boring locations. The test results are summarized in section 7.4 of this report.
4. Variations in soil conditions may be encountered during construction. Determination of such variations will permit correlation between the subsurface exploration data of this report and actual conditions encountered during construction and verification of conformance with the plans and specifications. We recommend that Kim Engineering, Inc. be retained to perform professional observations of foundation subgrades.

This report is based on information available to us on the proposed construction. If the project characteristics are changed from those indicated herein, our recommendations may require modifications.

We recommend that the project specifications include the following statement:

> "A geotechnical report has been prepared for this project by Kim Engineering, Inc. and is available to prospective bidders and/or contractors for informational purposes only. The report has been prepared for design purposes only and may not be sufficient to prepare an accurate bid for construction. Contractors wishing copies of this report may secure them from Kim Engineering Inc. at a nominal charge with the understanding that its scope is limited solely to generalized design considerations."

We have prepared this report in accordance with contemporary geotechnical engineering practices and make no warranties, either expressed or implied, as to the professional services provided under the terms of our agreement and included in this report.

2.0 SITE DESCRIPTION AND PROPOSED CONSTRUCTION

The site is located at 1000 Hilltop Circle in Baltimore, MD within the University of Maryland Baltimore County Campus. The existing Harbor Hall courtyard consists of landscaped/hardscaped areas, benches, picnic tables, and concrete sidewalks. The site topography is relatively flat with an elevation of 176±2 feet. Drawing Number 1, Site Location Plan, attached to this report shows the location of the project site.

According to the provided project's information, the proposed construction includes renovation of hardscape and softscape to improve aesthetics, functionality, and maintenance requirements. The site improvement will include modification to the irrigation and drain systems, lights, shades, seatings, site furniture, and micro bioretention ponds.

3.0 SUBSURFACE EXPLORATION

3.1 Test Boring

In order to evaluate the subsurface conditions of the site, a total of five (5) standard penetration test (SPT) borings and five (5) continuous flight auger infiltration test borings were drilled at the site. The approximate locations of the test borings are depicted in the attached Boring Location Plan, which was provided to us for this project.

The SPT borings for the proposed facilities were drilled to predetermined depths of 20 feet below existing grades. The table below summarizes the test boring schedule.

Table 1: Summary of Test Borings

Boring No.	Depth of Boring (ft)	Proposed Infiltration Depth (ft)	Approximate Existing Elevation (ft)*
SB-1	20	10	176
SB-2	20	10	176
SB-3	20	10	176
SB-4	20	10	176.2
SB-5	20	10	176.5

*Surface elevations were interpolated from the provided boring location plan.

The test borings were accomplished using a track mounted drill rig CME 55. The exploration program was performed in the field on July 27th and July 28th, 2023. Hollow-stem augers were advanced to pre-selected depths and representative soil samples were recovered with a standard split-spoon sampler in general accordance with ASTM D-1586. Disturbed representative soil samples were recovered while performing the Standard Penetration Test. This test consists of a 140-pound (lb) hammer falling over a distance of 30 inches. The number of blows required to drive the standard split spoon sampler (2-inch O.D., 1-3/8-inch I.D.) a distance of 12 inches after an initial set of 6 inches to ensure the sampler is in undisturbed material, is recorded as the Standard Penetration Resistance (N-Value) of the soil.

The N-value, for the majority of subsurface situations, provides a generalized indication of in-situ soil conditions when reviewed by individuals with established geotechnical backgrounds. N-values can be used to provide a qualitative indication of the in-place relative density of granular soils. Similarly, N-values provide an indication of consistency for cohesive soils.

Subsurface water level readings were taken in each of the test borings during drilling, at the completion of the drilling process and, 24 hours after completion of the drilling process. Upon completion, the boreholes were back filled with auger cuttings (soil).

Representative portions of the split-spoon soil samples obtained throughout the exploration program were placed in glass jars and transported to our laboratory for further evaluation and visual classification per the visual-manual identification procedure (ASTM D-2488) and the Unified Soil Classification System. The soil descriptions and classifications discussed in this report and shown on the attached boring logs are based on visual observation and as previously noted, should be considered approximate.

Soil samples recovered on this project will be stored at Kim Engineering, Inc. for a period of thirty (30) days from the date of this report. After thirty (30) days, the samples will be discarded unless prior notification for an alternate disposition is provided to us in writing.

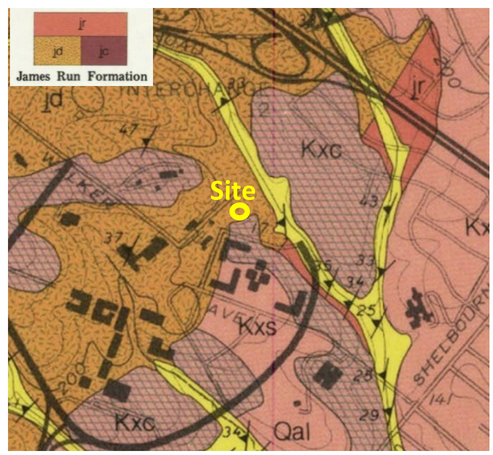
3.2 Infiltration Testing

Two (2) field infiltration tests were performed adjacent to the test borings SB-4 and SB-5. The infiltration test was not performed at the soil boring locations SB-1, SB-2, and SB-3 due to the existing fill and groundwater encountered within the test depths. A continuous flight auger borings were offset 5 feet from the test borings and extended to the infiltration test depth of 10 ft. Then, the center plug was removed, and PVC pipes were installed in the boreholes. The pipes were gently tapped to seat it into the base of the borings. The annular space was backfilled with soil material. Subsequent to the installation, a minimum 24-inch head of water was added to the

PVC pipe at completion of the installation to satisfy the presoak criterium. After the 24-hour presoak period, KIM engineer returned to the site to conduct in-situ infiltration testing at the location. The field infiltration test was performed in general accordance with the stipulations of the 2000 Maryland Stormwater Design Manual, Appendix D.1.

4.0 GEOLOGY

According to the Geologic map of the Baltimore West Quadrangle, Maryland by Crowley, W.P., and Reinhardt, Juergen, 1979, the proposed project is located within Druid Hill Amphibolite Member of James Run Formation (jd) and described as;



"Fine- to medium-grained, generally well foliated amphibolite, locally with irregular anastomosing patches of coarser-grained, lighter colored amphibolite. Chlorite fels and actinofels, locally foliated, associated with the amphibolite in places. Includes subordinate quartzo-feldspathic gneiss and granofels to the south which increase northward to nearly half the volume of the unit. Scale of layering ranges from a few tens of centimeters to more than 10 meters. Felsic rocks are generally fine-grained and well foliated, but may also be coarser grained, massive, and intricately jointed."

As per the map, the southern side of the site is underlain by Clay facies (Kxc) of Patuxent Formation and defined as: *"Light gray to black or brown clay containing variable amounts of quartz silt and gravel; local concentrations of lignitic, partially pyritized wood or macerated leaf and cone debris are associated with some sideritic concretions. Thin planar beds of sand and/or gravelly clay are interbedded with massive clay. These isolated clay pods are thought to be accumulations on deflated surfaces such as abandoned stream channels or in pre-Cretaceous topographic lows."*

5.0 SUBSURFACE CONDITIONS

5.1 General Stratification

The subsurface conditions discussed below and those shown on the boring logs represent an estimate of the subsurface conditions based on an interpretation of the boring data using geotechnical engineering judgment. Transitions between different soil strata are usually less distinct than those shown on the boring logs. Although individual test borings are representative of the subsurface conditions at the boring locations on the dates shown, they are not necessarily indicative of subsurface conditions at other locations or at other times.

More comprehensive descriptions of the materials encountered are included in the attached test boring logs. The subsurface investigation indicated that the following generalized strata underlie the site in the areas and to the depths investigated.

Ground Cover:
A 2 to 4 inches topsoil layer was encountered at the existing ground surface at boring locations.

Stratum A: Existing Fill
Existing Fill was encountered below the ground cover at the boring locations SB-1, SB-2, SB-3, and SB-5. The fill material extended to depths ranging from 2.5 feet to 20 feet and generally consisted of silty Sand, clayey Sand, and sandy Lean Clay with varying amounts of organics, asphalt and concrete, fragments. The Standard Penetration Test N-values in the existing fill ranged from 5 blows per foot (bpf) to 50 blows per 2 inches.

Stratum B: Natural Soil
Natural soil was encountered below the ground cover in SB-4 and the existing fill in the rest of borings. The soil generally consisted of Poorly Graded SAND with Silt (SP-SM), Silty Sand (SM), Clayey SAND (SC), and Sandy LEAN CLAY (CL) with traces of organics. The SPT N-values obtained in the coarse-grained soils ranged from 12 bpf to 50 blows per 3 inches, indicating medium dense to very dense relative densities. The SPT N-values obtained in the fine-grained soils ranged from 4 to 13 bpf indicating soft to stiff consistency.

The soil symbols indicated in the stratum descriptions and on the boring logs represent the Unified Soil Classification (ASTM D-2488) group symbols and are based primarily on visual observation of the specimens recovered. Criteria for visual-manual classification of soil samples are given in Appendix B of this report.

5.2 Groundwater

Groundwater observations were performed at all the test borings during drilling, at the completion of the drilling process and 24 hours after completion of the drilling. Groundwater was encountered at the soil boring locations SB-1 to SB-4 at the depth ranging from 6.3 ft to 17.1 feet. Groundwater was not encountered at the test boring SB-5. The groundwater level encountered at these times is presented in the table below.

Table 2: Summary of Groundwater Readings

Boring Identification	Groundwater Readings			
	During drilling (ft)		24 hr after completion of drilling (ft)	
	Depth	Elevation	Depth	Elevation
SB-1	Dry	-	7.1	168.9
SB-2	Dry	-	10.1	165.9
SB-3	6.3	169.7	10.9	165.1
SB-4	Dry	-	17.1	159.1
SB-5	Dry	-	Dry	-

Groundwater level readings are considered to be reliable indication of the water levels at the time indicated. However, fluctuations of groundwater levels as well as perched water may be expected with variations in precipitation, evaporation, surface runoff, and related factors.

6.0 SOIL GEOTECHNICAL LABORATORY TESTING

Geotechnical laboratory testing was performed on selected jar and bag samples obtained from test borings for soil classification and determination of the moisture content. All tests were performed in accordance with ASTM Standards. The results of these tests are included in the Summary of Lab Test Results in Appendix C.

Classification tests were performed on selected samples recovered from the boreholes. The tests that were performed and the associated ASTM methods are presented below:

ASTM Method	Description
D-2216	Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
D-422	Standard Test Method for Particle Analysis (Grain Size)
D-4318	Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

Laboratory test results revealed that the approximate composition of the soils of Stratum B ranged generally as follows:

Table 3: Summary of Laboratory Test Results – USCS

Boring No.	Sample No.	Depths (ft)	Percent Fines (#200)	Liquid Limit (LL)	Plasticity Index (PI)	Natural Moisture (%)	USCS
SB-1	S-5	10.0-11.5	66.1	28	10	22	CL
SB-2	S-5	10.0-11.5	33.3	NV	NP	10.7	SM
SB-3	S-5	10.0-11.5	39.5	30	9	15.3	SC
SB-4	S-5	10.0-11.5	30.4	NV	NP	9.3	SM
SB-5	S-5	10.0-11.5	31.3	31	11	10.8	SC

USCS Soil classification as determined by the Unified Soil Classification System.

LL: Liquid limit: the moisture percentage at which soil behavior transitions from plastic to liquid.

PI: Plastic index: Difference between the plastic and liquid limits (PI = LL – PL), indicates the range of moisture that the soil acts in a plastic manner. The plastic limit is defined as the minimum moisture percentage at which a soil behaves in a plastic manner.

NP Non-Plastic.

NV Non-Viscous

Table 4: Summary of Laboratory Test Results – USDA

Boring No.	Sample No.	Depths (ft)	Percentage from Material Passing #10 Sieve			USDA Classification
			Sand	Silt	Clay	
SB-1	S-5	10.0-11.5	30.3	40.8	28.9	Clay Loam
SB-2	S-5	10.0-11.5	66.8	19.8	13.4	Sandy Loam
SB-3	S-5	10.0-11.5	48.4	30.3	21.3	Loam
SB-4	S-5	10.0-11.5	72.8	16.0	11.3	Sandy Loam
SB-5	S-5	10.0-11.5	60.7	23.5	15.8	Sandy Loam

7.0 GEOTECHNICAL ENGINEERING ANALYSIS

The following evaluations and recommendations are based on our observations at the site, interpretation of the field data obtained during this exploration, and our experience with similar subsurface conditions and projects. Soil penetration data have been used to estimate an allowable bearing pressure using established correlations. Subsurface conditions in unexplored locations may vary from those encountered.

Determination of an appropriate foundation system for a given structure is dependent on the proposed structural loads, soil conditions, and construction constraints such as proximity to other structures, etc. Subsurface exploration aids the geotechnical engineer in determining the soil stratum appropriate for structural support. This determination includes considerations with regard to both allowable bearing pressure and compressibility of the soil strata. In addition, since the method of construction greatly affects the soils intended for structural support, consideration must be given to the implementation of suitable methods of site preparation, fill compaction, and other aspects of construction. Once the architectural and structural designs are finalized, KIM should review copies of the plans and specifications to revise or expand our recommendations.

7.1 Foundation Design Consideration

Soil profiles encountered across the proposed new construction site were defined by existing fill and naturally occurring medium dense to very dense granular soils and soft to stiff cohesive soils. Some traces of organic matter were present in all the borings. We understand that the proposed construction will include landscaping, hardscaping, new picnic tables, and light poles. For the general design purposes, we recommend maximum allowable bearing pressure of 2,000 psf for foundations bearing on competent and tested soils with N-value of 5 and above.

Based on subsurface exploration and our experience with similar subsurface conditions and projects, the following foundation recommendation is proposed for the design.

Drilled Shafts for Light Poles and Bollards

As per the information provided to us, a 10 ft hammock pole, bollard, and 14 ft PAA412-CS-FS type light poles are planned at the location. Based on the provided site plans, the required minimum diameter for the light pole base is 18 inches, and 8 inches for the bollard support. Based on the soil boring data, an 18-inch diameter and 5-ft deep drilled shaft will provide an axial capacity of 15 kips with less than 0.1-inch settlement for the light pole shaft foundation and a 12-inch diameter and 4-ft deep drilled shaft will provide axial capacity of 8 kips with less than 0.1-inch settlement for the proposed hammock pole.

Lateral loads on the proposed light pole/hammock pole will be resisted by passive soil pressure on the perimeter of the drilled shaft foundation. Following passive earth pressures and unit weight can be used for estimating the resistance provided by the soil surrounding the shaft foundation.

Table 5: Earth Pressure Coefficient

Soil Type	Passive Earth Pressure Coefficient (Kp)	Unit Weight (psf)
CL	1.89	105
SM/SC	2.28	120

Groundwater was encountered at approximately 6.3 feet below the existing ground surface at the time of the drilling operation at boring SB-3. The contractor should be prepared to drill through concrete and other construction debris, install a temporary casing to protect sidewalls from caving and dewatering the hole prior to the concrete pour. Shafts should extend through the deleterious material to competent strata. The bottom of each shaft should be cleaned and tested to verify whether the soil bearing capacity matches or exceeds design requirements.

7.2 Slab-On-Grade

The presence of soft, loose, and organic matter will increase the possibility for differential settlement and damage to the concrete floor surface. Therefore, the exposed subgrade should be thoroughly proofrolled with a loaded 20 tons tandem truck. Any soft areas should be further undercut to a stable ground prior to placement of new structural fill. We do not recommend undercuts deeper than 2 feet. The undercut should be restored using a compacted and tested structural fill.

For slabs placed on new compacted structural fill or on approved natural soil, we recommend a modulus of subgrade reaction (k) of 120 pounds per cubic inch (pci) for approved subgrades (k value considers a 1-ft by 1-ft square plate). A minimum 6-inch-thick layer of free draining aggregate is recommended to be placed below the floor slab to serve as a capillary moisture barrier. A polyethylene membrane or similar vapor barrier should be placed over the aggregate to prevent concrete contamination. Proper mix designs, placement methods, and curing methods must be utilized to reduce the potential for concrete shrinkage issues and curling that are sometimes associated with use of a vapor barrier. Control joints should be provided to control shrinkage cracks of the concrete floor system.

7.3 Seismic Site Coefficient

We are providing a Seismic Site Class Definition per the 2018 International Building Code (IBC) and American Society of Civil Engineers ASCE 7 guidance.

Our scope of services did not include a seismic conditions survey to determine site-specific (accurate) shear wave velocity information. IBC 2018 provides a methodology for interpretation of Standard Penetration Test resistance values (N-values) to determine a Site Class Definition. However, this method requires averaging N- values over the top 100 feet of the subsurface profile, a depth well in excess of the depths of the test borings.

Based on the subsurface data presently obtained and in general accordance with the 2018 IBC, it appears reasonable to assign the site a Classification "D".

The U.S. Seismic Design Map Web Application available through the USGS and ASCE websites provides hazard curves, uniform hazard response spectra, and design parameters. These parameters were developed using two percent probability of exceedance (PE) in 50 years. The mapped spectral response acceleration values for the project site are provided in the table below.

Table 6: Mapped Spectral Response Acceleration Values

Description	Period (Sec)	Sa
Mapped Short Period Spectral Response Acceleration (S_s)	0.2	0.139
Mapped 1-Second Period Spectral Response Acceleration (S_1)	1.0	0.043

For a Site Class D, with the above-indicated mapped spectral acceleration values and risk category II, the calculated site coefficient values and the maximum and design spectral response acceleration values are provided in table below.

Table 7: Site Coefficients, and Design Spectral Response Acceleration

Site Coefficient (Fa)	1.6
Site Coefficient (Fv)	2.4
Short Period, Maximum Spectral Response Acceleration (S_{MS})	0.222
1.0 Second Period, Maximum Spectral Response Acceleration (S_{M1})	0.103

Short Period, Design Spectral Response Acceleration (S_{DS})	0.148
1.0 Second Period, Design Spectral Response Acceleration (S_{D1})	0.069

Based on our subsurface investigation and engineering judgement, the site is not susceptible to liquefaction under the design earthquake magnitude provided by the code.

7.4 Stormwater Management

Based on the 2000 Maryland Stormwater Design Manual, Appendix D.1, a minimum field infiltration rate of 0.52 inches per hour is required for infiltration practices. Lower infiltration rates preclude the use of infiltration practices. Infiltration practices are also precluded if groundwater or bedrock, or fill are encountered within four feet of the bottom of the proposed facility.

The infiltration test result for the location tested is included in Appendix B. Estimated infiltration rates, USDA Classification and hydrologic soil groups are presented in table below.

Table 8: Estimated Infiltration Rate

Boring No.	Test Depth (ft)	In-situ Infiltration Rate (in/hr)	USDA Soil Classification	USDA Recommended Infiltration Rate (in/hr)	Hydrologic Soil Grouping
SB-1*	10	-	Clay Loam	0.09	D
SB-2*	10	-	Sandy Loam	1.02	A
SB-3*	10	-	Loam	0.52	B
SB-4	10	0.0	Sandy Loam	1.02	A
SB-5	10	0.48	Sandy Loam	1.02	A

*Field infiltration test was not performed due to groundwater and existing fill encountered within the test depth.

For design purposes, we recommend using the value of the last hour field infiltration rate and minimum USDA infiltration rate associated with the textural classification. Infiltration practices may not be feasible at the boring locations and at the test depths, based on USDA soil classification, existing fill and groundwater encountered within the test depth.

8.0 CONSTRUCTION CONSIDERATIONS

8.1 General

The principal purpose of this section is to comment in general on the items related to foundation construction, earthwork, and related geotechnical engineering aspects of construction that should be expected for this project. It is recommended that the geotechnical engineer be retained to provide soil engineering services during the actual site preparation and foundation construction phases of the project to perform appropriate evaluations to help ensure that conditions encountered during construction are similar to conditions encountered in the borings. The geotechnical engineer can also assist in interpretation of differing subsurface conditions that may be encountered and recommend remedial work, if needed.

8.2 Site and Subgrade Preparation

Areas proposed for grading or construction should be stripped and grubbed of all existing pavement, topsoil, vegetation, roots, organics, and loose and soft on-site soils before placing structural fill. Surficial stripping depths averaging 24 inches may be anticipated.

In addition, existing foundations, abandoned utilities, underground tanks, cisterns, or surface drainage systems such as field tile or perforated pipes possibly encountered in the construction areas should be undercut, removed, or appropriately plugged and backfilled with structural fill in accordance with the recommendations provided in Section 8.3 of this report and at the discretion of a Geotechnical Engineer.

Following preparation of exposed subgrades, accessible portions of the new structure and pavement subgrade should be proof rolled with a loaded 20-ton tandem axle dump truck and witnessed by the Geotechnical Engineer or qualified representative. The purpose of the proof rolling will be to locate any isolated soft, unstable or “pumping” pockets of soil, which should be excavated or otherwise stabilized as directed by the Geotechnical Engineer. Proper site drainage should be maintained at all times to prevent ponding of water at the site during construction. If the soil does become wet, care should be taken to minimize heavy construction equipment from operating on the prone subgrade.

Grades shall be sloped at no steeper than 1.5 horizontal to 1 vertical (1.5H:1V). All cleared and grubbed material shall be disposed of outside and below the limits of the project area.

8.3 Fill Material and Compaction

The onsite soil classified as silty Sand (SM) or more granular free of organics and other deleterious material is considered suitable for backfill or for reuse as compacted structural fill.

If imported fill is required at the site, we recommend that the material have low expansive characteristics and should have Unified Soils Classification (ASTM D 2487) of SM or better. Any imported soil fill required to balance the site should adhere to the following parameters unless specifically accepted in writing by the Geotechnical Engineer at time of placement:

Maximum Dry Density (ASTM D698)	> 110 pcf
Liquid Limit	< 30
Plasticity Index	< 15

We recommend that the fill material be placed in lifts having a maximum loose lift thickness commensurate with the equipment being utilized to perform the compaction. In no case should those lifts exceed eight (8) inches. Each lift should be uniformly compacted to at least 95 percent of the laboratory maximum dry density as determined by ASTM D698 Standard Proctor.

8.4 Groundwater Control and Site Drainage

Based upon the borings, shallow excavations may encounter perch water or groundwater. Standard de-watering practices utilizing sloped lifts, mid-sized trash pump, and “tail ditches” or sump holes should be sufficient to prevent extended saturation of exposed subgrades.

Exposed subgrades must be sloped to facilitate surface runoff away from the construction area and to prevent ponding of surface water. If ponding of surface water does occur, it should be removed by pumping, ditching or as otherwise directed by the inspecting geotechnical engineer. During periods of anticipated inclement weather, exposed surfaces shall be graded and sealed to preclude infiltration of surface water. Subgrades, which become disturbed due to inclement weather or construction traffic and require over-excavation, should be reworked at no additional cost to the project.

8.5 Inspection of Subgrades

We recommend that all subgrades be inspected by a Geotechnical Engineer or an experienced engineering technician. Subgrades should be tested to check whether any unstable areas exist. Any unstable zones that are identified that cannot be re-compacted should be undercut to a depth, within the area marked by the inspecting engineer. The depths and extent of undercuts should be determined by the inspecting Geotechnical Engineer. Deeper undercuts should be avoided, and it is requested that KIM be extended an opportunity to review the conditions warranting any deeper undercuts before undercutting commences. Undercut volume should be backfilled to grade with compacted structural fill in accordance with the requirements in this report.

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

9.0 LIMITATIONS

This report has been prepared for the exclusive use by our client for specific application to the proposed construction as presented herein. Our services were performed in accordance with contemporary soil and foundation engineering practices. No warranty, either expressed or implied, is made. Our conclusions and recommendations are based on the preliminary design information furnished to us, the data obtained from the subsurface exploration program, and/or current geotechnical engineering practices. The findings and recommendations do not reflect variations in subsurface conditions that could exist between the boring locations or in unexplored areas of the site. Should such variations become apparent during construction, it will be necessary to re-evaluate our conclusions and recommendations based upon on-site observations of the conditions.

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

In the event that changes are made in the design or location of the proposed facilities, the recommendations presented in the report shall not be considered valid unless the changes are reviewed by our firm and conclusions of this report modified and/or verified in writing.

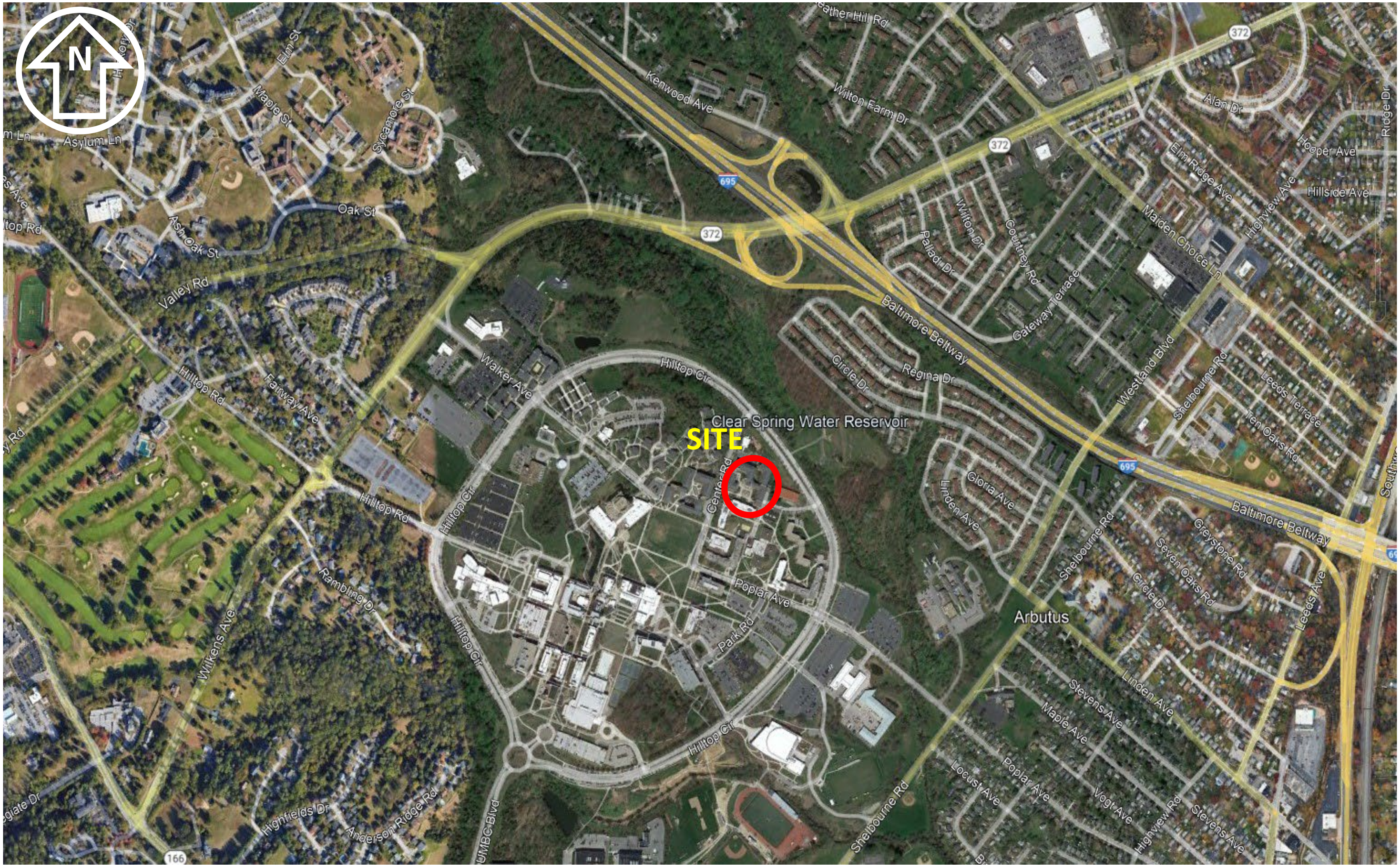
If this report is copied or transmitted to a third party, it must be copied or transmitted in its entirety, including text, attachments, and enclosures. Interpretations based on only a part of this report may not be valid.

It is important to note that our study was done in an effort to assist planning and design personnel in the preparation of generalized drawings and specifications for the project. As a result of this, potential contractors should be encouraged to conduct their own individually tailored studies to assess soils conditions, rock levels, excavation slope gradients, temporary excavation support methods, and groundwater/perched water levels and conditions. Specifically, our report has been prepared for generalized purposes of planning and design and may not be sufficiently comprehensive for bid preparation purposes.

APPENDIX A

Site Location Plan

Boring Location Plan



Sourced by Google Map

KIM ENGINEERING

3916 VERO ROAD, SUITE K BALTIMORE, MD 21227

SITE LOCATION PLAN

HARBOR HALL COURTYARD RENOVATION – UMBC

1000 Hilltop Cir, Baltimore, Maryland

PROJECT NO.: G23048	
SCALE: NTS	
DATE: August 17, 2023	
DRAWING NO. 1	

KIM ENGINEERING
3916 VERO ROAD, SUITE K BALTIMORE, MD 21227

BORING LOCATION PLAN
HARBOR HALL COURTYARD RENOVATION – UMBC
1000 Hilltop Cir, Baltimore, Maryland

PROJECT NO.: G23048
SCALE: NTS
DATE: August 17, 2023
DRAWING NO. 2

APPENDIX B

SUBSURFACE INVESTIGATION

Identification of Soil

Soil Test Boring Logs

Field Infiltration Test Results

IDENTIFICATION OF SOIL

Soil Classification - ASTM D-2487

Coarse Grained Soils, More than 50% is retained on the No. 200 sieve	**Gravels -** More than 50% of the course fraction is retained on the No. 4 sieve. Coarse = 1" - 3" Medium = 1/2" - 1 " Fine = 1/4" to 1/2"	Clean Gravels <5% Passing No. 200 sieve	**GW**	Well Graded Gravel
			GP	Poorly Graded Gravel
		Gravels with fines >12% passing No. 200 sieve	**GM**	Silty Gravel
			GC	Clayey Gravel
	Sands - More than 50% of the coarse fraction passes the No.4 sieve Coarse = No. 10 to No. 4 Medium = No. 10 to No. 40 Fine = No. 40 to No. 200	Clean Sands <5% passing No. 200 sieve	**SW**	Well Graded Sand
			SP	Poorly Graded Sand
		Sands with fines >12% passing No. 200 sieve	**SM**	Silty Sand
			SC	Clayey Sand
Fine Grained Soils, More than 50% passes the No. 200 sieve	**Silts and Clays** Liquid Limit of 50 or less Low to medium plasticity	Inorganic	**ML**	Silt
			CL	Lean Clay
		Organic	**OL**	Organic silt
				Organin clay
	Silts and Clays **L**iquid limit of 50 or greater Medium to high plasticity	Inorganic	**MH**	Elastic silt
			CH	Fat clay
		Organic	**OH**	Organic silt
				Organic clay
Highly Organic	Primarily Organic matter, dark color, organic odor		**PT**	Peat

Terminology and Definitions

Portions of Soil Components		
Component Form	Description	Label
Noun	Gravel, Sand, Silt, Clay	50% or more
Adjective	Sandy, Silty, Clayey	35% to 49%
Some	some Sand, some Silt	12% to 34%
Trace	trace Sand, trace Clay	1% to 11%
With	with Sand, with Silt	presence only

Particle Size Identification	
Particle Size	Particle Dimension
Boulder	12" diamter or more
Cobble	3" to 12" diamter
Gravel	1/4" to 3" diamter
Sand	0.005" to 1/4" diamter
Silt/ Clay (fines)	Cannot See Particle

Cohesive Soils		
Field Description	N- Value	Consistency
Easily Molded in Hands	0-2	Very Soft
Easily Penetrated Several inches by thumb	3-4	Soft
Penetrated by thumb with Moderate Effort	5-8	Medium Stiff
Penetrated by Thumb with Great Effort	9-15	Stiff
Indented by Thumb with only Great Effort	16-30	very Stiff
Difficult to indent by thumbnail	> 30	Hard

Granular Soils	
N- Values	Relative Density
0-4	Very Loose
5-10	Loose
11-30	Medium Dense
31-50	Dense
Greater than 50	Very Dense

Fill: Man made deposit of soils, rock and waste material.
Probable Fill: Soils which contain no visually detected foreign matter but which may be man made deposit.
Rock Fragments: Angular Pieces of rock, distinguished from transported gravel, which have seperated from orginal wein or strata and are present in soil matrix.
Disintregrated Rock: Residual rock material with SPT of more than 60 blows per ft. and less than refusal.
Karst: Descriptive term which denotes the potential for solutioning of limestone rock and the development of sink holes.
Alluvium: Recently depositied soils placed by water action, typically stream or river flood plain soils.
Ironite: Iron oxide deposited within a soil layer forming cemented deposits.
Quarts: A hard silica mineral often found in residual soils.
Mica: A soft plate of silica mineral found in many rocks. And in residual or transported soil derived there from.
Layers: 1/2 to 12 inch seam of minor soil component.
Lenses: 0 to 1/2 inch seam of minor soil component.
Pocket: Discontinuous body of minor soil component.

Soil Test Boring Logs

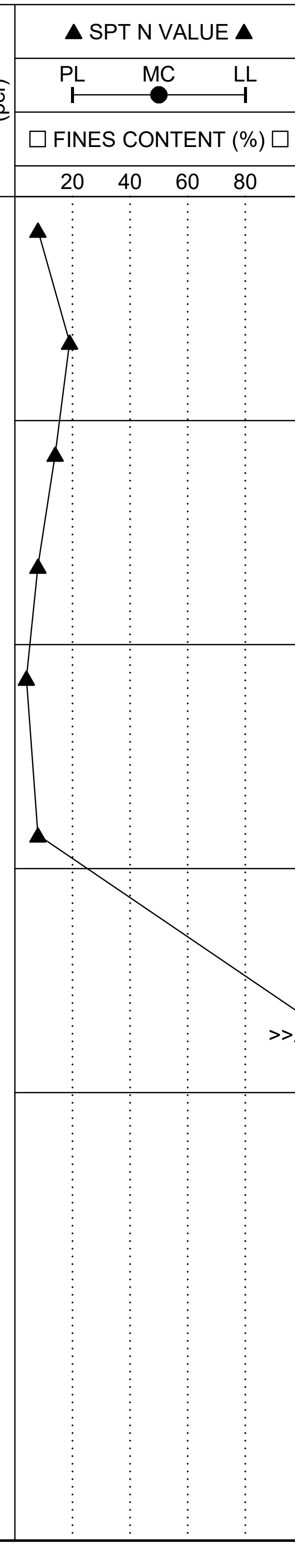
KIM

KIM ENGINEERING, INC.
Consulting Geotechinical Engineers
Baltimore, Maryland

BORING NUMBER SB-1

CLIENT AMT
PROJECT NAME UMBC Harbor Hall Courtyard Renovation
PROJECT NUMBER G23048
PROJECT LOCATION Baltimore County, MD
DATE STARTED 7/27/23 **COMPLETED** 7/27/23
GROUND ELEVATION 176 ft **HOLE SIZE** 6"
DRILLING CONTRACTOR Kim Engineering Inc.
GROUND WATER LEVELS:
DRILLING METHOD H.S.A.
AT TIME OF DRILLING Dry
LOGGED BY J.C. **CHECKED BY** TL
AT END OF DRILLING Dry
NOTES Caved @ 6.67'
24hrs AFTER DRILLING 7.1 ft / Elev 168.9 ft

DEPTH (ft)	GRAPHIC LOG	ELEVATION	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)
		175.75	3-inches of Topsoil					
			Light brown, light gray, red, moist, clayey Sand with asphalt fragments (FILL)	SS 1	67	3-3-5 (8)		
		173.50	Light brown, light gray, pinkish brown, grayish brown, brown, moist, medium dense, Silty SAND (SM) with gravel	SS 2	89	4-7-12 (19)		
5				SS 3	78	12-9-5 (14)		
		168.50	Brown, gray, grayish brown, moist, medium stiff, Sandy LEAN CLAY (CL) with organics	SS 4	78	4-4-4 (8)		
10				SS 5	44	2-2-2 (4)		
15				SS 6	100	3-4-4 (8)		
		157.50	Greenish gray, wet, very dense, Silty SAND (SM) with gravel	SS 7	80	50/5"		
20		156.00	Bottom of hole at 20.0 feet.					



KIM

KIM ENGINEERING, INC.
Consulting Geotechinical Engineers
Baltimore, Maryland

BORING NUMBER SB-2

CLIENT AMT

PROJECT NAME UMBC Harbor Hall Courtyard Renovation

PROJECT NUMBER G23048

PROJECT LOCATION Baltimore County, MD

DATE STARTED 7/27/23 **COMPLETED** 7/27/23

GROUND ELEVATION 176 ft **HOLE SIZE** 6"

DRILLING CONTRACTOR Kim Engineering Inc.

GROUND WATER LEVELS:

DRILLING METHOD H.S.A.

AT TIME OF DRILLING Dry

LOGGED BY J.C. **CHECKED BY** TL

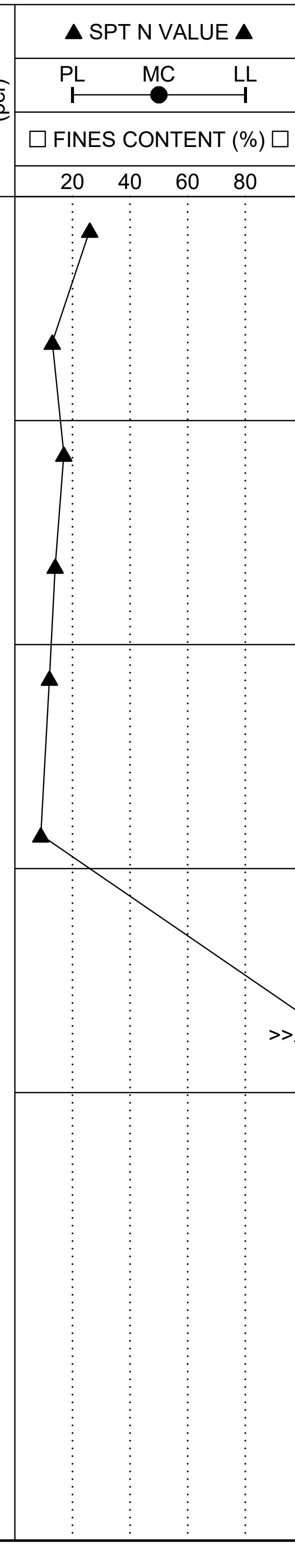
AT END OF DRILLING Dry

NOTES Caved @ 7.33'

24hrs AFTER DRILLING 10.1 ft / Elev 165.9 ft

ELEVATION	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)
	3-inches of Topsoil					
175.75	Dark gray, dark brown, moist, sandy lean Clay with organics (FILL)	SS 1	56	4-11-15 (26)		
173.50	Dark gray, dark brown, moist, clayey Sand with gravel (FILL)	SS 2	56	3-5-8 (13)		
171.00	Light gray, moist, poorly-graded Sand with silt (FILL)	SS 3	44	7-8-9 (17)		
168.50	Dark brown, brown, grayish brown, dark gray, gray, moist, silty Sand, traces of organics (FILL)	SS 4	61	7-5-9 (14)		
		SS 5	56	7-5-7 (12)		
162.50	Gray, orangish brown, dark brown, moist, stiff, sandy Lean Clay (FILL)	SS 6	78	3-3-6 (9)		
157.50	Brown, dark brown, gray, moist, very dense, silty Sand with concrete fragments (FILL)	SS 7	80	50/5"		
156.00	Bottom of hole at 20.0 feet.					

DEPTH (ft): 5, 10, 15, 20

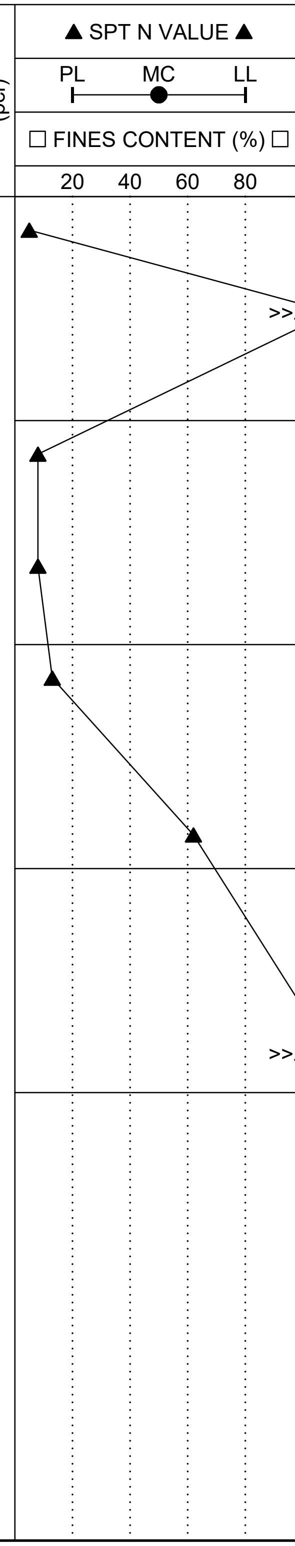


KIM ENGINEERING, INC.
Consulting Geotechinical Engineers
Baltimore, Maryland

BORING NUMBER SB-3

CLIENT AMT
PROJECT NAME UMBC Harbor Hall Courtyard Renovation
PROJECT NUMBER G23048
PROJECT LOCATION Baltimore County, MD
DATE STARTED 7/27/23 **COMPLETED** 7/27/23
GROUND ELEVATION 176 ft **HOLE SIZE** 6"
DRILLING CONTRACTOR Kim Engineering Inc.
GROUND WATER LEVELS:
DRILLING METHOD H.S.A.
AT TIME OF DRILLING 6.3 ft / Elev 169.7 ft
LOGGED BY J.C. **CHECKED BY** TL
AT END OF DRILLING ---
NOTES Caved @ 10.33'
24hrs AFTER DRILLING 10.9 ft / Elev 165.1 ft

DEPTH (ft)	ELEVATION	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)
	175.67	4-inches of Topsoil					
		Red, reddish brown, dark brown, moist, silty Sand with gravel and roots (FILL)	SS 1	67	2-2-3 (5)		
	173.50	Concrete fragments	SS 2	50	50/2"		
5	171.00	Brown, dark gray, moist to wet, clayey Sand, traces of organics and asphalt fragments (FILL)	SS 3	56	3-3-5 (8)		
			SS 4	78	4-4-4 (8)		
10			SS 5	89	4-6-7 (13)		
	162.50	Light brown, light gray, wet, medium dense, Poorly-Graded SAND with silt (SP-SM) and gravel	SS 6	44	6-28-34 (62)		
15							
	157.50	Black, yellowish brown, moist, very dense, Silty SAND (SM)	SS 7	67	4-16-50/3"		
20	156.00	Bottom of hole at 20.0 feet.					



KIM ENGINEERING, INC.
Consulting Geotechinical Engineers
Baltimore, Maryland

BORING NUMBER SB-4

CLIENT AMT
PROJECT NAME UMBC Harbor Hall Courtyard Renovation
PROJECT NUMBER G23048
PROJECT LOCATION Baltimore County, MD
DATE STARTED 7/28/23 **COMPLETED** 7/28/23
GROUND ELEVATION 176.2 ft **HOLE SIZE** 6"
DRILLING CONTRACTOR Kim Engineering Inc.
GROUND WATER LEVELS:
DRILLING METHOD H.S.A.
AT TIME OF DRILLING Dry
LOGGED BY J.C. **CHECKED BY** TL
AT END OF DRILLING Dry
NOTES Caved @ 11.83'
24hrs AFTER DRILLING 17.1 ft / Elev 159.1 ft

DEPTH (ft)	GRAPHIC LOG	ELEVATION	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	▲ SPT N VALUE ▲ / PL MC LL / ☐ FINES CONTENT (%) ☐ / 20 40 60 80
		175.91	3.5-inches of Topsoil						
			Brown, grayish brown, light brown, moist, medium dense, Silty SAND (SM) with gravel	SS 1	56	3-5-9 (14)			
				SS 2	89	5-5-7 (12)			
5		171.20	Light brown, moist, medium dense, Poorly-Graded SAND with silt (SP-SM)	SS 3	67	5-7-6 (13)			
		168.70	Light brown, dark brown, grayish brown, moist, medium dense, Silty, Clayey SAND (SC-SM)	SS 4	78	10-11-13 (24)			
10		166.20	Dark brown, dark gray, moist, medium dense, Silty SAND (SM) with gravel	SS 5	78	10-7-7 (14)			
		162.70	Dark brown, moist, medium dense, Clayey SAND (SC), traces of organics	SS 6	78	18-10-10 (20)			
15									
		157.70	Dark gray, moist, stiff, LEAN CLAY (CL), traces of organics	SS 7	78	6-7-6 (13)			
20		156.20	Bottom of hole at 20.0 feet.						

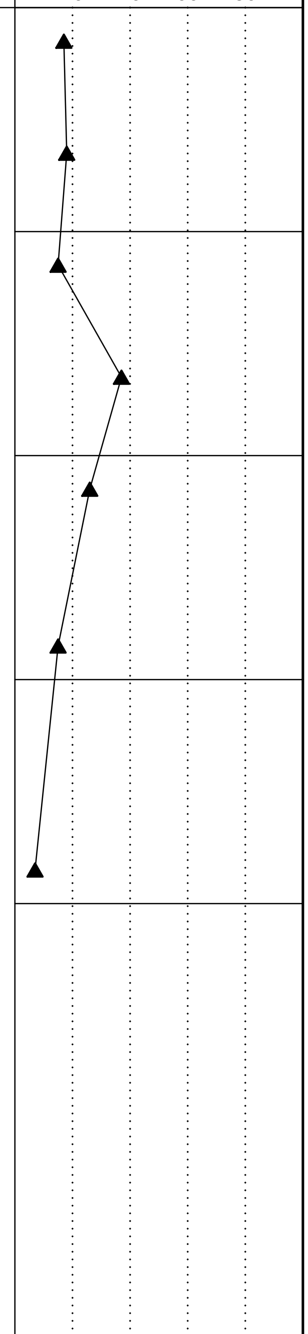
BORING NUMBER SB-5

KIM ENGINEERING, INC.
Consulting Geotechinical Engineers
Baltimore, Maryland

CLIENT AMT
PROJECT NAME UMBC Harbor Hall Courtyard Renovation
PROJECT NUMBER G23048
PROJECT LOCATION Baltimore County, MD
DATE STARTED 7/27/23 **COMPLETED** 7/27/23
GROUND ELEVATION 176.5 ft **HOLE SIZE** 6"
DRILLING CONTRACTOR Kim Engineering Inc.
GROUND WATER LEVELS:
DRILLING METHOD H.S.A.
AT TIME OF DRILLING Dry
LOGGED BY J.C. **CHECKED BY** TL
AT END OF DRILLING Dry
NOTES Caved @ 11.83'
24hrs AFTER DRILLING Dry

DEPTH (ft)	ELEVATION	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)
	176.30	2.5-inches of Topsoil					
		Brown, moist, silty Sand, traces of gravel (FILL)	SS 1	44	5-8-9 (17)		
	174.00	Light brown, moist, poorly-graded, silty Sand (FILL)	SS 2	89	8-8-10 (18)		
5	171.50	Brown, moist, lean Clay with gravel and concrete fragments (FILL)	SS 3	67	8-7-8 (15)		
	169.00	Brown, gray, grayish brown, black, moist, poorly-graded Sand with silt and asphalt fragments (FILL)	SS 4	67	8-27-10 (37)		
10	166.50	Brown, dark gray, moist, medium dense, Clayey SAND (SC) with organics	SS 5	78	11-16-10 (26)		
15			SS 6	78	6-8-7 (15)		
	158.00	Dark gray, brown, moist, medium stiff, Sandy LEAN CLAY (CL) with organics	SS 7	100	3-3-4 (7)		
20	156.50	Bottom of hole at 20.0 feet.					

▲ SPT N VALUE ▲
PL MC LL
☐ FINES CONTENT (%) ☐
20 40 60 80



Field Infiltration Test Results

KIM ENGINEERING

3916 Vero Rd, Suite K
Baltimore, MD 21227
TEL (410) 501-3669
www.kimengineering.com

Infiltration Test Data

Name of Project: UMBC Harbor Hall Courtyard Renovations
Project No.: G23048
Contracted With: AMT
Location: Catonsville, MD
Test Date: 8/1/2023
Tested by: SE
Checked by: TL

Boring No.: **SB-4**

Surface Elevation: 176.20 ft.
Test Depth: 10.00 ft.
Test Elevation: 166.20 ft.

Depth from Top of Pipe: 10.35 ft.
Casing Stick-up: 0.35 ft.

1st Hour Run		2nd Hour Run		3rd Hour Run		4th Hour Run	
Time	Depth (ft)	Time	Depth (ft)	Time	Depth (ft)	Time	Depth (ft)
8:50 AM		9:50 AM		10:50 AM		11:50 AM	
0 min	8.35	0 min	8.35	0 min	8.35	0 min	8.35
10 mins		10 mins		10 mins		10 mins	
30 mins		30 mins		30 mins		30 mins	
45 mins		45 mins		45 mins		45 mins	
60 mins	8.35	60 mins	8.35	60 mins	8.35	60 mins	8.35

Rates (ft.) 0.00 0.00 0.00 0.00

Last Hour Infiltration Rate **0.00** **inch/hr**

USDA Textural Classification **Sandy Loam**

Soil Texture Min. Infiltration Rate **1.02** **inch/hr**

KIM ENGINEERING

3916 Vero Rd, Suite K
Baltimore, MD 21227
TEL (410) 501-3669
www.kimengineering.com

Infiltration Test Data

Name of Project:	UMBC Harbor Hall Courtyard Renovations
Project No.:	G23048
Contracted With:	AMT
Location:	Catonsville, MD
Test Date:	8/1/2023
Tested by:	SE
Checked by:	TL

Boring No.:	**SB-5**

Surface Elevation: 176.50 ft.
Test Depth: 10.00 ft.
Test Elevation: 166.50 ft.

Depth from Top of Pipe: 10.13 ft.
Casing Stick-up: 0.13 ft.

1st Hour Run		2nd Hour Run		3rd Hour Run		4th Hour Run	
Time	Depth (ft)	Time	Depth (ft)	Time	Depth (ft)	Time	Depth (ft)
8:56 AM		9:56 AM		10:56 AM		11:56 AM	
0 min	8.13	0 min	8.13	0 min	8.13	0 min	8.13
10 mins		10 mins		10 mins		10 mins	
30 mins		30 mins		30 mins		30 mins	
45 mins		45 mins		45 mins		45 mins	
60 mins	8.67	60 mins	8.50	60 mins	8.26	60 mins	8.17

Rates (ft.) 0.54 0.37 0.13 0.04

Last Hour Infiltration Rate **0.48** **inch/hr**

USDA Textural Classification **Sandy Loam**

Soil Texture Min. Infiltration Rate **1.02** **inch/hr**

APPENDIX C

GEOTECHNICAL LABORATORY TESTS

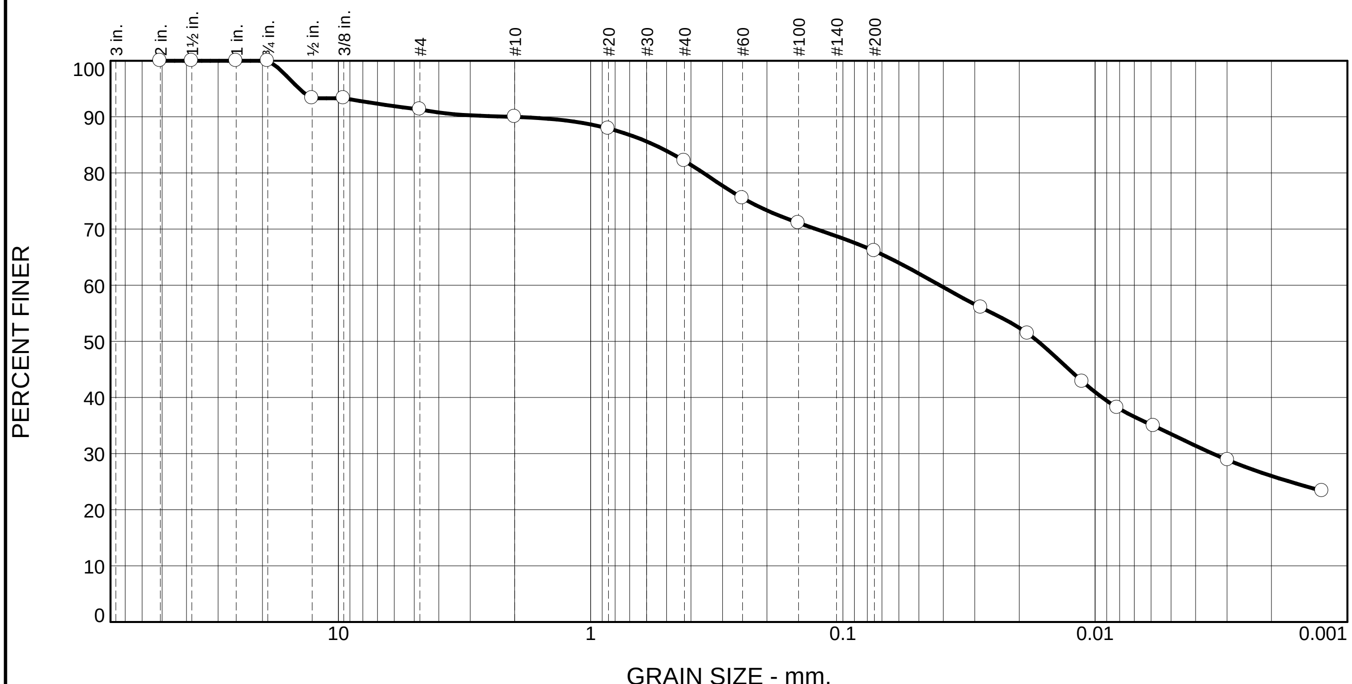
Particle Size Distribution Report

Liquid Limit and Plastic Limit Report

USDA Classification

Particle Size Distribution Report

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	8.7	1.3	7.8	16.1	32.6	33.5

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2"	100.0		
1 1/2"	100.0		
1"	100.0		
3/4"	100.0		
1/2"	93.3		
3/8"	93.3		
#4	91.3		
#10	90.0		
#20	87.9		
#40	82.2		
#60	75.5		
#100	71.1		
#200	66.1		
0.0284 mm.	56.0		
0.0185 mm.	51.4		
0.0112 mm.	42.9		
0.0082 mm.	38.2		
0.0059 mm.	35.0		
0.0030 mm.	28.9		
0.0013 mm.	23.3		

* (no specification provided)

Material Description

sandy lean clay (CL)

Atterberg Limits (ASTM D 4318)

PL= 18 **LL=** 28 **PI=** 10

Classification

USCS (D 2487)= CL **AASHTO (M 145)=** A-4(4)

Coefficients

D_{90}= 2.0225 D_{85}= 0.5586 D_{60}= 0.0413
D_{50}= 0.0169 D_{30}= 0.0034 D_{15}=
D_{10}= C_u= C_c=

Remarks

Date Received: **Date Tested:** 8/16/23
Tested By: SE
Checked By: TL
Title: Principal Engineer

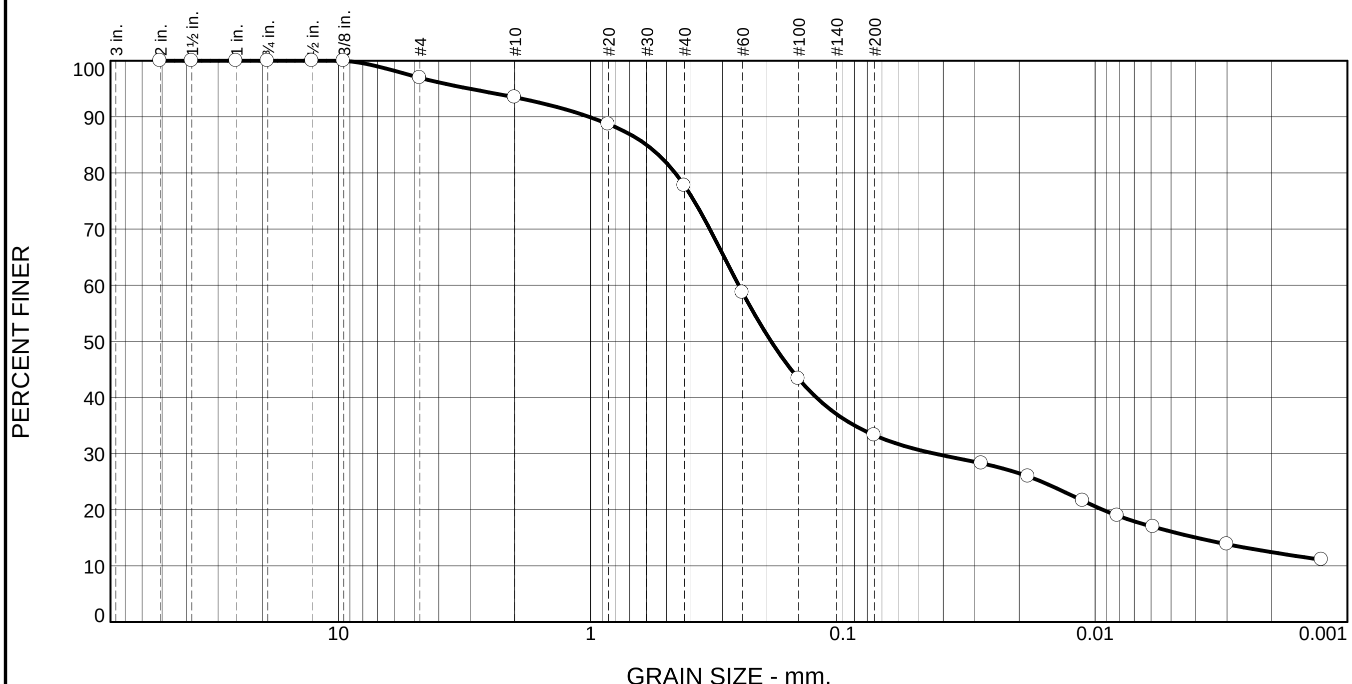
Source of Sample: SB-1 **Depth:** 10.0-11.5 **Date Sampled:**
Sample Number: S-5

KIM ENGINEERING, INC.

Beltsville, Maryland

Client: AMT
Project: UMBC Harbor Hall Courtyard Renovations
Project No: G23048 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.0	3.5	15.7	44.5	17.2	16.1

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2"	100.0		
1 1/2"	100.0		
1"	100.0		
3/4"	100.0		
1/2"	100.0		
3/8"	100.0		
#4	97.0		
#10	93.5		
#20	88.7		
#40	77.8		
#60	58.7		
#100	43.4		
#200	33.3		
0.0282 mm.	28.3		
0.0184 mm.	25.9		
0.0112 mm.	21.6		
0.0082 mm.	19.0		
0.0059 mm.	17.0		
0.0030 mm.	13.9		
0.0013 mm.	11.1		

* (no specification provided)

Material Description

silty sand (SM)

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-2-4(0)

Coefficients

D_{90}= 1.0145 D_{85}= 0.5999 D_{60}= 0.2589
D_{50}= 0.1926 D_{30}= 0.0433 D_{15}= 0.0039
D_{10}= C_u= C_c=

Remarks

Date Received: **Date Tested:** 8/16/23
Tested By: SE
Checked By: TL
Title: Principaal Engineer

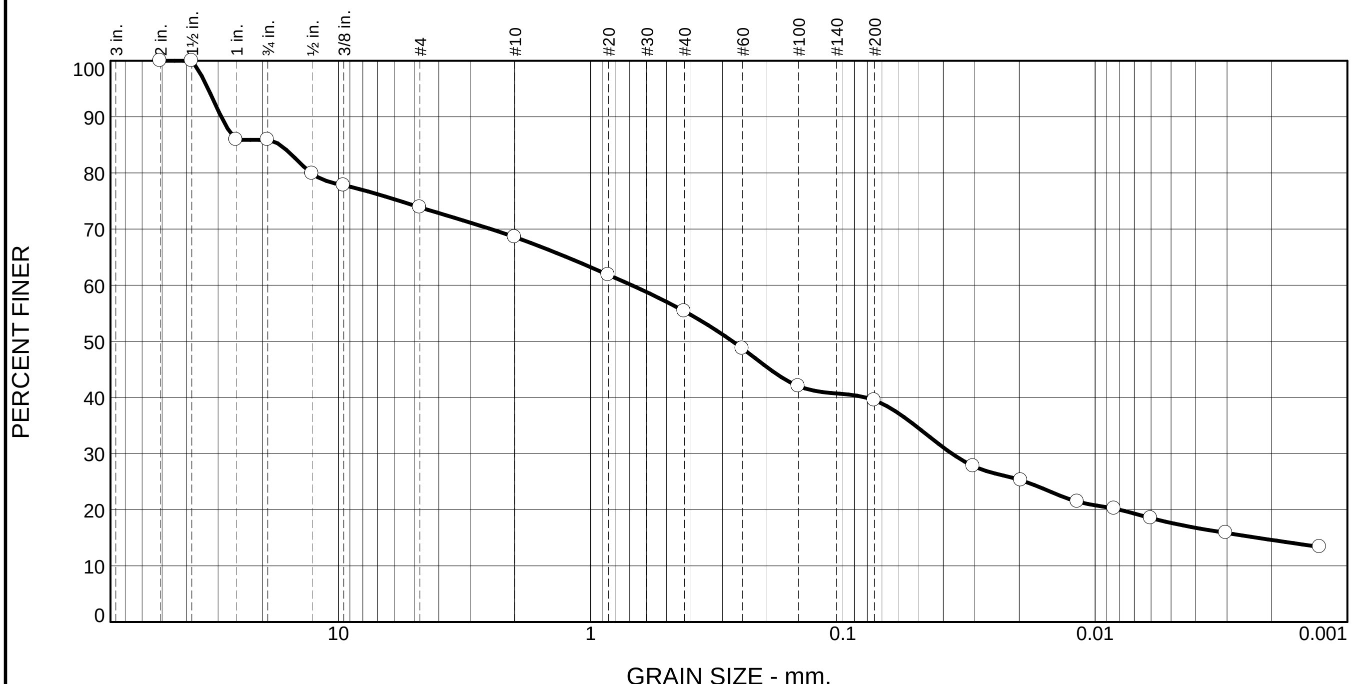
Source of Sample: SB-2 **Depth:** 10.0-11.5 **Date Sampled:**
Sample Number: S-5

KIM ENGINEERING, INC.

Beltsville, Maryland

Client: AMT
Project: UMBC Harbor Hall Courtyard Renovations
Project No: G23048 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	14.1	12.0	5.3	13.2	15.9	21.8	17.7

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2"	100.0		
1 1/2"	100.0		
1"	85.9		
3/4"	85.9		
1/2"	79.9		
3/8"	77.8		
#4	73.9		
#10	68.6		
#20	61.8		
#40	55.4		
#60	48.7		
#100	42.0		
#200	39.5		
0.0304 mm.	27.8		
0.0197 mm.	25.3		
0.0118 mm.	21.5		
0.0084 mm.	20.2		
0.0060 mm.	18.5		
0.0030 mm.	15.9		
0.0013 mm.	13.4		

* (no specification provided)

Material Description

clayey sand with gravel (SC)

Atterberg Limits (ASTM D 4318)

PL= 21 **LL=** 30 **PI=** 9

Classification

USCS (D 2487)= SC **AASHTO (M 145)=** A-4(0)

Coefficients

D_{90}= 29.1267 D_{85}= 17.0153 D_{60}= 0.6871
D_{50}= 0.2734 D_{30}= 0.0370 D_{15}= 0.0023
D_{10}= C_u= C_c=

Remarks

Date Received: **Date Tested:** 8/18/23

Tested By: SE

Checked By: TL

Title: Principal Engineer

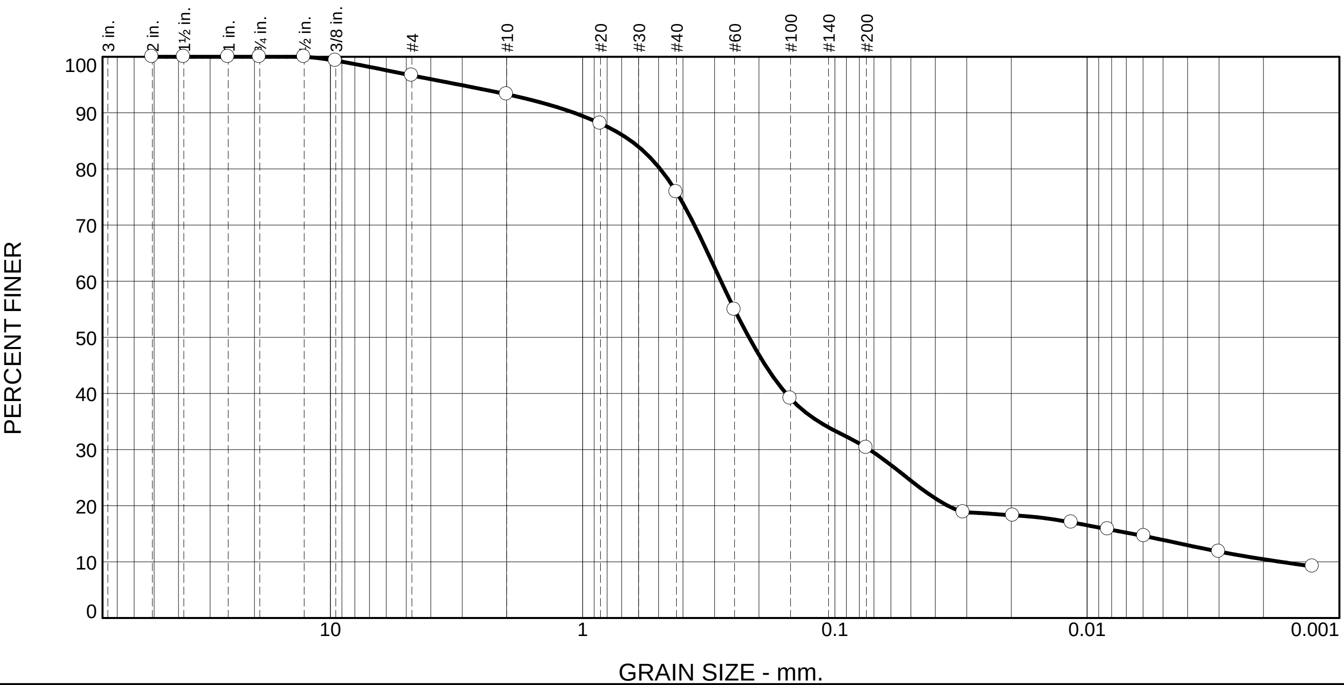
Source of Sample: SB-3 **Depth:** 10.0-11.5 **Date Sampled:**
Sample Number: S-5

KIM ENGINEERING, INC.

Beltsville, Maryland

Client: AMT
Project: UMBC Harbor Hall Courtyard Renovations
Project No: G23048 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.3	3.4	17.4	45.5	16.5	13.9

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2"	100.0		
1 1/2"	100.0		
1"	100.0		
3/4"	100.0		
1/2"	100.0		
3/8"	99.3		
#4	96.7		
#10	93.3		
#20	88.1		
#40	75.9		
#60	55.0		
#100	39.1		
#200	30.4		
0.0309 mm.	18.9		
0.0197 mm.	18.3		
0.0115 mm.	17.0		
0.0083 mm.	15.8		
0.0059 mm.	14.6		
0.0030 mm.	11.8		
0.0013 mm.	9.2		

* (no specification provided)

Material Description

silty sand (SM)

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SM **AASHTO (M 145)=** A-2-4(0)

Coefficients

D_{90}= 1.0796 D_{85}= 0.6428 D_{60}= 0.2828
D_{50}= 0.2192 D_{30}= 0.0729 D_{15}= 0.0066
D_{10}= 0.0017 C_u= 166.21 C_c= 11.04

Remarks

Date Received: **Date Tested:** 8/29/23
Tested By: SE
Checked By: TL
Title: Principal Engineer

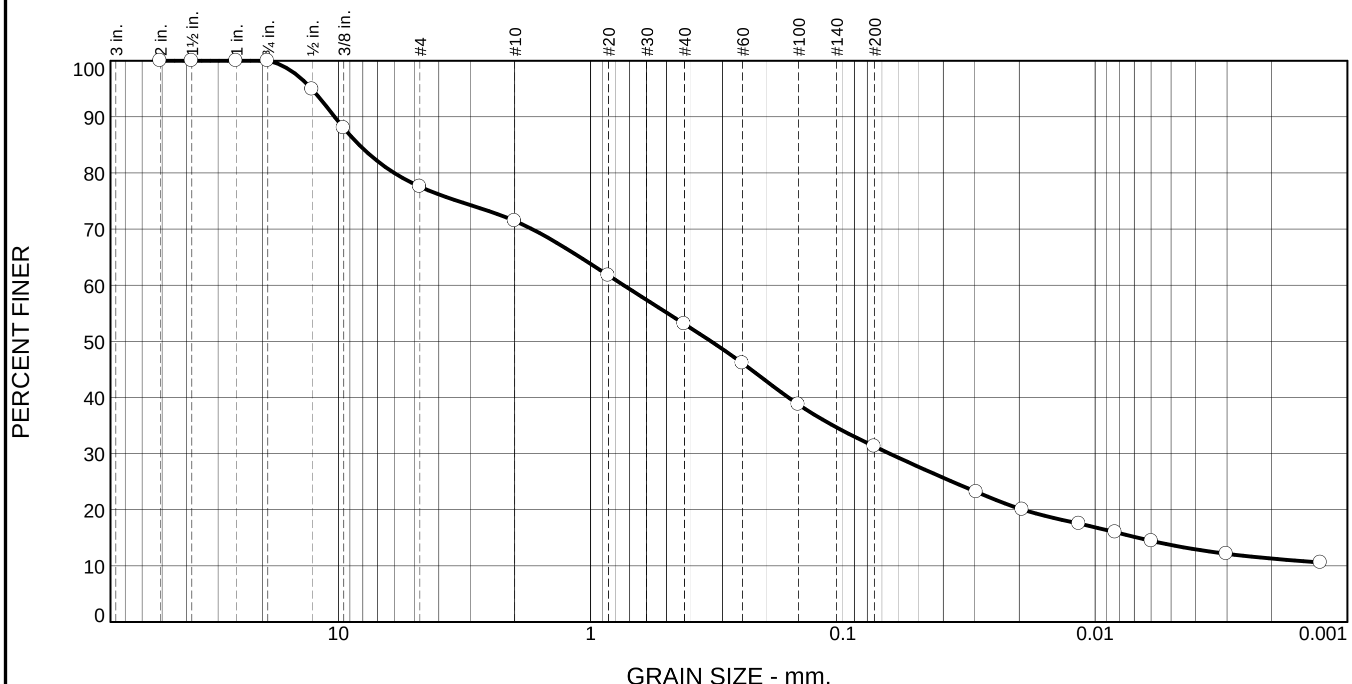
Source of Sample: SB-4 **Depth:** 10.0-11.5 **Date Sampled:**
Sample Number: S-5

KIM ENGINEERING, INC.

Beltsville, Maryland

Client: AMT
Project: UMBC Harbor Hall Courtyard Renovations
Project No: G23048 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	22.4	6.1	18.4	21.8	17.6	13.7

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
2"	100.0		
1 1/2"	100.0		
1"	100.0		
3/4"	100.0		
1/2"	94.9		
3/8"	88.0		
#4	77.6		
#10	71.5		
#20	61.7		
#40	53.1		
#60	46.1		
#100	38.8		
#200	31.3		
0.0296 mm.	23.2		
0.0194 mm.	20.0		
0.0116 mm.	17.5		
0.0083 mm.	16.0		
0.0060 mm.	14.4		
0.0030 mm.	12.2		
0.0013 mm.	10.6		

* (no specification provided)

Material Description

clayey sand with gravel (SC)

Atterberg Limits (ASTM D 4318)

PL= 20 **LL=** 31 **PI=** 11

Classification

USCS (D 2487)= SC **AASHTO (M 145)=** A-2-6(0)

Coefficients

D_{90}= 10.3489 D_{85}= 8.2687 D_{60}= 0.7397
D_{50}= 0.3331 D_{30}= 0.0652 D_{15}= 0.0067
D_{10}= C_u= C_c=

Remarks

Date Received: **Date Tested:** 8/18/23
Tested By: SE
Checked By: TL
Title: Principal Engineer

Source of Sample: SB-5 **Depth:** 10.0-11.5 **Date Sampled:**
Sample Number: S-5

KIM ENGINEERING, INC.

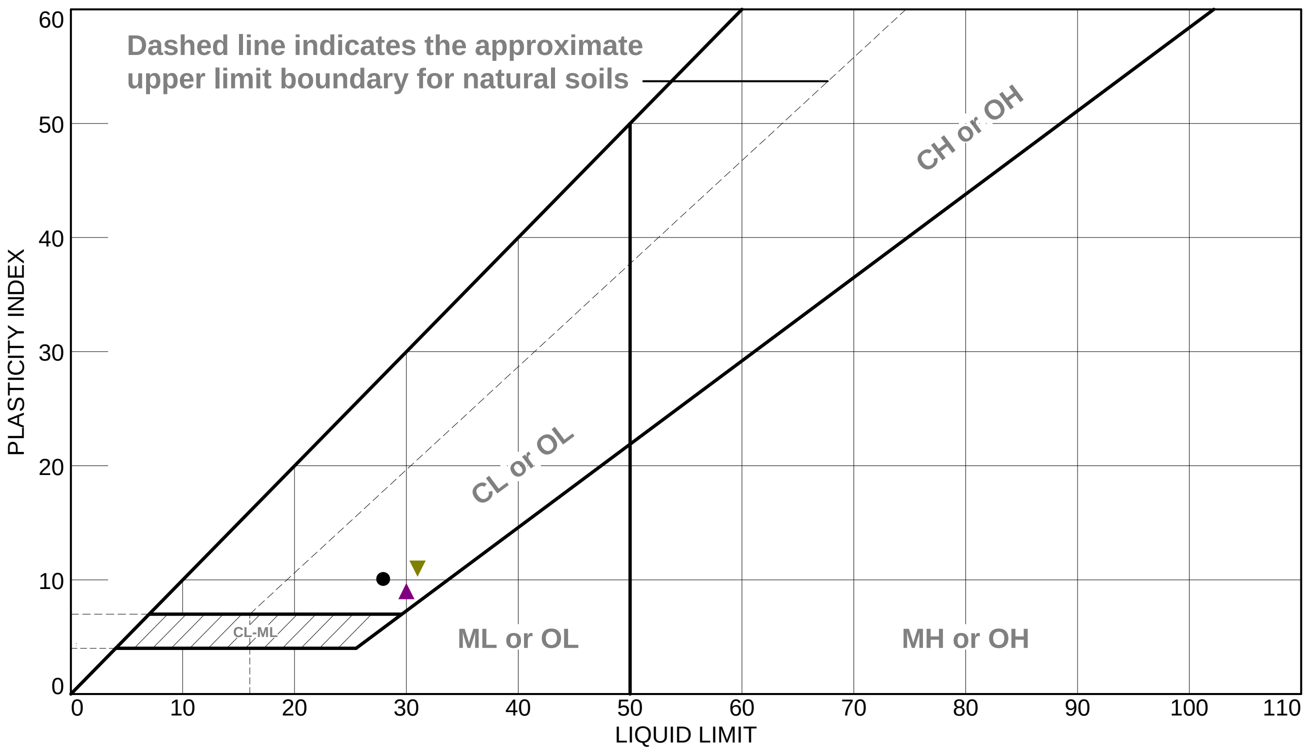
Beltsville, Maryland

Client: AMT
Project: UMBC Harbor Hall Courtyard Renovations

Project No: G23048 **Figure**

Liquid Limit and Plastic Limit Report

LIQUID AND PLASTIC LIMITS TEST REPORT



	SOIL DATA								
	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	LIQUIDITY INDEX	USCS
●	SB-1	S-5	10.0-11.5	22.0	18	28	10	0.4	CL
■	SB-2	S-5	10.0-11.5	10.7	NP	NV	NP		SM
▲	SB-3	S-5	10.0-11.5	15.3	21	30	9	-0.6	SC
◆	SB-4	S-5	10.0-11.5	9.3	NP	NV	NP		SM
▼	SB-5	S-5	10.0-11.5	10.8	20	31	11	-0.8	SC

KIM ENGINEERING, INC.

Beltsville, Maryland

Client: AMT

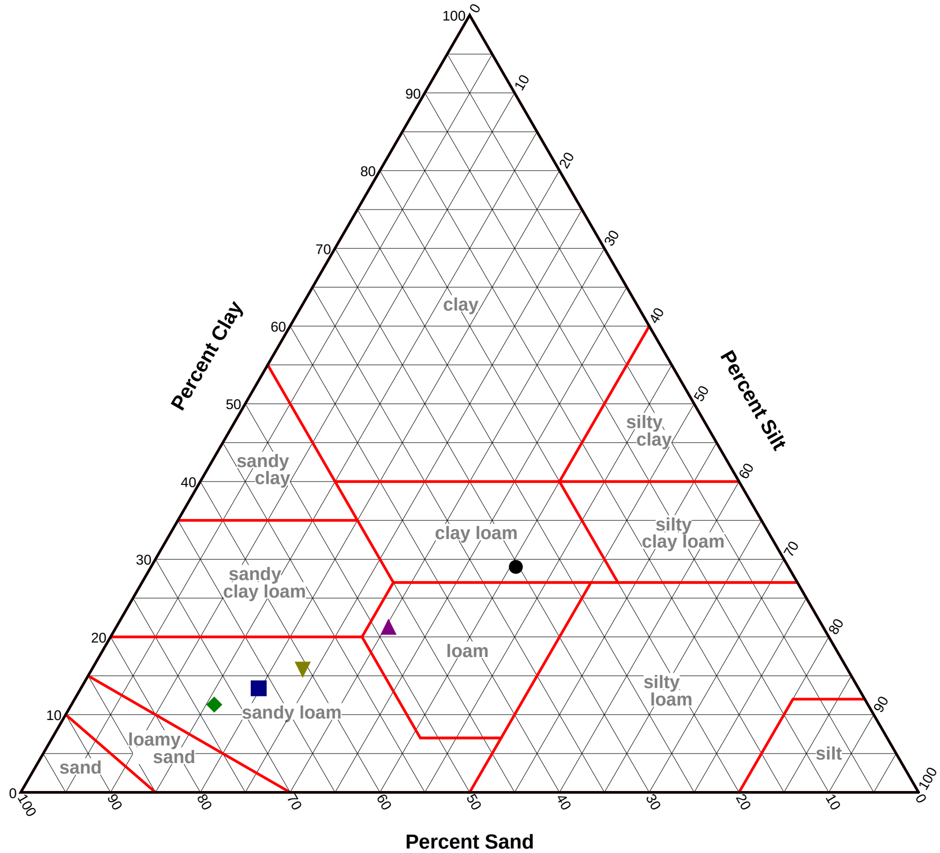
Project: UMBC Harbor Hall Courtyard Renovations

Project No.: G23048 **Figure**

Tested By: SE **Checked By:** TL

USDA Classification

USDA Soil Classification



SOIL DATA

	Source	Sample No.	Depth	Percentages From Material Passing a #10 Sieve			Classification
				Sand	Silt	Clay	
●	SB-1	S-5	10.0-11.5	30.3	40.8	28.9	Clay loam
■	SB-2	S-5	10.0-11.5	66.8	19.8	13.4	Sandy loam
▲	SB-3	S-5	10.0-11.5	48.4	30.3	21.3	Loam
◆	SB-4	S-5	10.0-11.5	72.8	16.0	11.3	Sandy loam
▼	SB-5	S-5	10.0-11.5	60.7	23.5	15.8	Sandy loam

KIM ENGINEERING, INC.

Beltsville, Maryland

Client: AMT

Project: UMBC Harbor Hall Courtyard Renovations

Project No.: G23048 **Figure**

Checked By: TL

APPENDIX D

SEISMIC SITE CLASSIFICATION

USGS web services were down for some period of time and as a result this tool wasn't operational, resulting in *timeout* error.
USGS web services are now operational so this tool should work as expected.

UMBC Harbor Hall Courtyard Renovation

Latitude, Longitude: 39.25712357, -76.70809602

Date	9/5/2023, 1:48:07 PM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Default (See Section 11.4.3)

Type	Value	Description
S_S	0.139	MCE_R ground motion. (for 0.2 second period)
S_1	0.043	MCE_R ground motion. (for 1.0s period)
S_{MS}	0.222	Site-modified spectral acceleration value
S_{M1}	0.103	Site-modified spectral acceleration value
S_{DS}	0.148	Numeric seismic design value at 0.2 second SA
S_{D1}	0.069	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	B	Seismic design category
F_a	1.6	Site amplification factor at 0.2 second
F_v	2.4	Site amplification factor at 1.0 second
PGA	0.073	MCE_G peak ground acceleration
F_{PGA}	1.6	Site amplification factor at PGA
PGA_M	0.116	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
SsRT	0.139	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	0.147	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.043	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.046	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.5	Factored deterministic acceleration value. (Peak Ground Acceleration)
PGA_{UH}	0.073	Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration
C_{RS}	0.943	Mapped value of the risk coefficient at short periods
C_{R1}	0.927	Mapped value of the risk coefficient at a period of 1 s
C_V	0.7	Vertical coefficient

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