APPENDIX A

GEOTECHNICAL ENGINEERING REPORT

GEOTECHNICAL INVESTIGATION REPORT

FOR

TOWN OF EMMITSBURG WATER TREATMENT PLANT

NEW CLARIFIER

8585 CRYSTAL FOUNTAIN ROAD, EMMITSBURG, MARYLAND

Findling Project No.: 21-1055

PREPARED FOR:

RK&K
700 EAST PRATT STREET, SUITE 500
BALTIMORE, MARYLAND 21202

December 1, 2021

FINDLING, INC.

Findling Inc.

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December 1, 2021

RK&K
700 East Pratt Street, Suite 500
Baltimore, Maryland 21202

Attention: Mr. John Moore, P.E.
Director, Water

Re: Geotechnical Investigation Report
Town of Emmitsburg Water Treatment Plant New Clarifier
8585 Crystal Fountain Road, Emmitsburg, Maryland
Findling Project No.: 21-1055

Dear Mr. Moore:

Findling, Inc. is pleased to submit this report containing the results of our geotechnical investigation for the Town of Emmitsburg Water Treatment Plant New Clarifier located at 8585 Crystal Fountain Road, Emmitsburg, Maryland. The work described within this report was performed in accordance with our Proposal No. 21093, dated May 19, 2021.

We wish to advise you that we will store the soil samples obtained from the soil test borings for a period of thirty (30) days from the date of this report, during which time the samples will be available for inspection. After that time, they will be discarded unless other disposition is requested.

We appreciate the opportunity to be of service to you during the design phase of this project. During the continuation of the design phase and the construction phase, we would like to provide our geotechnical analysis, design and review services, testing and inspections services, etc. so as to verify the assumptions made on both the subsurface conditions and the geotechnical design parameters. Should you have any questions or if we can be any further help to the project team, please call us.

Sincerely,

FINDLING, INC.

Amsalu Birhan, Ph.D., P.E.
Senior Geotechnical Engineer

M. Suri Surendra, Ph.D., P.E.
Chief Engineer

STATE OF MARYLAND
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APPENDIX

EXECUTIVE SUMMARY

A brief summary of the important geotechnical findings and recommendations contained within this report are provided below. The executive summary is not all inclusive and the entire report must be read for the proper use of this report.

Proposed Construction: (Section 1.1)	It is our understanding that a new Clarifier is planned at the Town of Emmitsburg Water Treatment Plant. The one-story building for the new clarifier is measuring approximately 32 ft. by 48 ft. We understand that the building will house two 8 ft. diameter circular flocculation tanks, and two 150-GPM DAFs (Dissolved Air Flotation).
Subsurface Conditions: (Section 3.0)	The subsurface explorations indicated that the site is underlain by a surface layer of Man-Placed Fill (7.5± to 9± ft. thick), which in turn is underlain by the Residual soils to depths of 20 to 30 ft. below the ground surface (i.e., to EL + 792± to EL + 806±). Disintegrated rock was encountered to the refusal depth for B-1 at 21 ft. below the ground surface, and to the bottom depth of 36.5 ft. below the ground surface for B-2.
Groundwater: (Section 3.3)	The groundwater depths vary from 1.1 ft. to 5 ft. below the existing ground surface (i.e., elevations from EL + 817± to EL + 824±. It should be noted that groundwater levels will fluctuate due to seasonal changes, precipitation, and construction activity.
Seismic Site Class: (Section 4.0)	The site is considered a Site Class D as per IBC 2015.
Foundation System: (Section 5.0)	Spread foundations installed as discussed in this report are recommended.
Floor Slab: (Section 6.0)	The floor slab subgrades are expected to consist of existing fill soils or newly placed compacted structural fill. Prior to placement of the floor slabs, the suitability of the slab subgrades should be determined by proofrolling under the supervision of a Geotechnical Engineer.

The slab on grade can be designed using a modulus of subgrade reaction (k) of 100 pci.

Earthwork:
(Section 7.0)

Excavation of this site is expected to be performed using conventional earthmoving equipment. However, cobbles and boulders are anticipated in the excavations and the contractor shall be prepared to excavate with the presence of these cobbles and boulders.

The visual classification and the laboratory tests conducted on the on-site fill materials indicated that the existing fill soils classify predominantly as Clayey SAND (SC) and Sandy SILTS (ML). These soils can be reused as site and structural backfill materials. Boulders and cobbles may be encountered in the site fill soils. This may require screening of soils. Boulders and cobbles are encountered in the existing fills soils, and the amount of required fill material for the project may not be that significant, and hence imported fill soils may be preferred.

At the time of our field investigation, groundwater was encountered within 5 ft. below existing grade. Therefore, dewatering during construction is generally anticipated. However, depending on the seasonal variations, water may not be encountered in shallow excavations. Therefore, provisions should be made in the project specifications for dewatering. Based on the observation from the test borings, rock excavation is not expected.

Construction Considerations:
(Section 7.0)

The area of proposed building site is currently a wooded area, with scattered boulders and large stones. Cobbles and boulders are anticipated in the excavations and the contractor shall be prepared to excavate with the presence of these cobbles and boulders as discussed in Section 7.5.

This report is based on information available to us on the proposed construction at the time of writing the report. If the project characteristics are changed from those indicated herein, our recommendations may require some modifications. Please advise us of any changes in the proposed construction. The report is prepared in accordance with contemporary geotechnical engineering practices and Findling makes no warranties, either expressed or implied, as to the professional services provided under the terms of our agreement and included in this report. In addition, it is recommended that the following statement be included in the project specification: "The geotechnical report has been prepared for this project by Findling, Inc. only for design purposes and may not be sufficient to prepare an accurate bid for construction. The report shall be used by the prospective bidders and/or contractors for informational purposes only."

FINDLING, INC.

GEOTECHNICAL INVESTIGATION REPORT

Town of Emmitsburg Water Treatment Plant New Clarifier
8585 Crystal Fountain Road, Emmitsburg, Maryland
Findling Project No.: 21-1055

1.0 INTRODUCTION

This report presents the results of the geotechnical investigation conducted for the Town of Emmitsburg Water Treatment Plant New Clarifier project located at 8585 Crystal Fountain Road, Emmitsburg, Maryland (see Figure 1: Site Vicinity Map, in the Appendix). This work was performed for RK&K pursuant to our Proposal No. 21093, dated May 19, 2021.

1.1 Project Description

It is our understanding that a new Clarifier is planned at the Town of Emmitsburg Water Treatment Plant. The one-story building for the new clarifier is measuring approximately 32 ft. by 48 ft. We understand that the building will house two 8 ft. diameter circular flocculation tanks, and two 150-GPM DAFs (Dissolved Air Flotation). A holding tank and a valve vault are also planned as shown in Figure 2: Project Location Plan, which is included in the Appendix.

1.2 Project Site Condition

The project site is located very close to the Hampton Valley Road. It is currently a wooded area, with scattered boulders and large stones. The existing ground surface elevations gently grades down going North. In the proposed building area, the existing ground surface slopes down from EL + 830± to EL + 822± (See Figure 2).

1.3 Purpose and Scope

The purpose of this study was to prepare a geotechnical report containing geotechnical related design and construction considerations for the proposed project. This report contains recommendations that pertain to the construction activities associated with the new building for the clarifier at the site. The report is based on the evaluation of two test borings performed on the project site, available geologic data and our experience in the area.

Two building borings (B-1 and B-2) were drilled at the site. The locations of these test borings are shown on the Boring Location Plan included as Figure 4 in the Appendix. The test borings were drilled to depths of 21 ft. to 36.5 ft. below the existing grade. The scope also included conducting laboratory tests in order to classify and establish engineering properties of the underlying materials.

2.0 SUBSURFACE EXPLORATION

2.1 Utility Clearance

Prior to the drilling operation, the public utilities were marked and cleared by "Miss Utility". The area of proposed borings was scanned for existing underground utility lines and the lines that were detected were marked. The boring locations were then offset from the detected underground utility lines.

2.2 Field Investigation

The subsurface investigation was performed on October 6 and October 7, 2021. Two building borings (B-1 and B-2) were drilled at the site. The boring locations were selected by RK&K and staked by Findling, Inc. as shown on Figure 4: Boring Location Plan, which is included in the Appendix. The borings were drilled using a CME Truck 45 drill rig (with automatic hammer to obtain SPT samples). The depth of the borings ranges from 21 ft. to 36.5 ft. below the existing grade. The test borings were monitored for groundwater level during the drilling operations and one of the test borings after 24 hrs.

2.3 Soil Test Borings

The borings were advanced using hollow-stem augers (3-¼ inch I.D. HSA) and soil samples were recovered from the borings at selected intervals by driving a 1-3/8-inch ID (2-inch OD) split-spoon sampler in accordance with ASTM D-1586 specifications. The sampler was first seated about 6 inches to penetrate through the loose cuttings and then driven an additional 1 foot with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler 1 foot after the initial 6 inches is typically designated as the Standard Penetration Test resistance (N) value. The penetration resistance is an index of the soil's strength, density and behavior under applied loads.

The test borings were backfilled with auger soil cuttings upon completion of drilling. Soils obtained from the sampling device were sealed in glass sample jars and transported to our soils testing laboratory. The recovered soil samples were identified by a Geotechnical Engineer using visual examination and manual tests in general accordance with techniques outlined in ASTM D-2488 and the Unified Soil Classification System (USCS), which is adopted by ASTM D-2487 for classification and identification of soils for general engineering purpose. A description of the soils and conditions encountered at each test boring location is presented on the Boring Logs included in the Appendix. The

USCS classifications indicated in the logs are based on the ASTM D-2488, and should be considered approximate.

2.4 Laboratory Testing

Soil samples recovered from the field explorations were transported to our soil testing laboratory and selected soil samples were tested to determine additional engineering characteristics of the existing on-site soils. The laboratory tests that were conducted on selected soil samples included natural moisture content test (ASTM D2216), Atterberg limits (ASTM D4318), sieve analysis (ASTM D422), Moisture vs. Density relations (ASTM D698/1557) and California Bearing Ratio (ASTM D1883). All tests were performed in general accordance with the ASTM procedures. The results of these laboratory tests are included in the Appendix, along with a results summary table (Table 2.1).

Note that the soil samples obtained from the soil test borings and which were not used for the soil laboratory testing will be stored for a period of thirty (30) days from the date of this report, during which time they will be available for inspection. After that time, the samples will be discarded unless other disposition is requested.

3.0 SUBSURFACE CONDITIONS

3.1 Stratification

The Boring Logs included in the Appendix contain details related to the subsurface conditions encountered at the various boring locations. It should be noted that stratification lines shown on the Boring Logs represent approximate transitions between material types. Strata changes can occur gradually or at different levels than those shown on the Boring Logs and depict conditions at the indicated locations and depths at the time of our subsurface exploration program. Groundwater levels are variable and are influenced by the existing soil conditions, seasonal and climatic changes.

The test boring data, visual and laboratory classification of the sampled soils, and our knowledge of local geology was used to separate the soils into the following generalized strata to the depths investigated. The specific subsurface conditions relating to the proposed structures are discussed under foundations and general consideration sections of this report.

3.1.1 Stratum A: Man-Placed Fill

Man-Placed Fill was encountered in all of the test borings. The fill material was observed to consist of Sandy CLAY and Clayey SAND with varying percentages of gravel, cobbles and rock fragments. The fill appears to have been placed during past construction and grading activities at the site. The fill stratum extended to depths ranging from 7.5± to 9± ft. below existing grade (i.e., elevations of EL + 813± to EL + 818.5±). The penetration resistance in the fill indicated medium dense to very dense density with standard penetration resistance (SPT) N-values ranging from 18 blows per foot (BPF) to 40 BPF. Higher blow counts of up to 59 BPF were observed, which probably resulted from encountering gravels, boulders, rock fragments, and cobbles.

3.1.2 Stratum B: Residual Soils

Residual soils were encountered below the Man-Placed Fill soils to depths of 20 ft. to 30 ft. below the ground surface (i.e., to EL + 792± to EL + 806±). The residual soils were predominantly classified as Clayey SAND (SC). Silty Poorly Graded SAND (SP-SM) were also encountered. The density of these soils varied significantly due to degree of weathering within the profile, with SPT values of 7 to 21 BPF.

3.1.3 Stratum E: Disintegrated Rock

The disintegrated rock is defined as residual material with SPT values of greater than 60 blows per foot. This rock like material was encountered to the refusal depth for B-1 at 21 ft. below the ground surface, and to the bottom depth of 36.5 ft. below the ground surface for B-2.

3.1.4 Stratum F: Bedrock

The bedrock surface was defined as where the SPT blow count exceeded 100/2 inches. and was encountered at a depth of 21 ft. below the ground surface on test boring B-1.

3.2 Site Geology

The site is located within the Blue Ridge Physiographic Province of Maryland, specifically in Northern Blue Ridge Section, Catoctin-South Mountain Region. The lithologies are quartzite, sandstone, siltstone, graywacke, phyllite, or shale, G*eologic Structures of l*arge, north-plunging anticline overturned to the west; several major faults, including Triassic Border Fault marking the eastern boundary. Available general geological information suggests that the soils below the site consist of the Catoctin Formation consisting of main rock type metabasalt (PCcb). Several textural varities of greenish gray, and grayish metabasalt are included, as shown on Figure 3, in the Appendix.

Based on the test borings a site-specific geology suggests that underlying the Man-Placed Fill (7.5± to 9± ft. deep) is a layer of Residual soil profile, predominantly classified as Clayey SAND (SC). Disintegrated rock and Bedrock were encountered below the Residual soils.

3.3 Groundwater Conditions

Groundwater levels were noted in the borings during drilling operations, immediately and after 24 hrs. of completion of drilling. Groundwater was observed on the drill rods and samples during drilling operations in most of the test borings. Groundwater readings at the end of drilling and after the HSA auger is pulled out were noted. One of the test borings was left open for the 24 hrs. stabilized groundwater reading. The groundwater depth and the corresponding groundwater reading time were recorded. These are included in the boring logs and are summarized in Table 3.1, which are included in the Appendix. The groundwater depths vary from 1.1 ft. to 5 ft. (i.e., elevations from EL + 817± to EL + 824.9±. It should be noted that groundwater levels will fluctuate due to seasonal changes, precipitation, and construction activity. In addition, the highest groundwater observations are normally encountered in late winter and early spring. Fluctuations of water table or the development of a perched water table at shallower depths above less permeable layers (within the Fill stratum) may occur depending upon the amount of precipitation and water runoff to the site from higher elevations, during wet season.

4.0 SEISMIC SITE CLASS

The seismic site class and design parameters are provided below for this project site per 2015 International Building Code (IBC). The U.S. Geological Survey Seismic Design Maps-Earthquake Hazards Program is used to get mapped acceleration parameters for the site with coordinates 39.696872°N, 77.386902°W. Table 4-1 has values of Risk-Targeted Maximum Considered Earthquake (MCE_R) Ground Motion Response Accelerations for Site Class B and 5% of Critical Damping. These values incorporate a target risk of structural collapse equal to 1% in 50 years.

Table 4-1: Mapped Spectral Response Acceleration Values for Soil Factors of 1.0

Description	Period (Sec)	Sa
Mapped Short Period Spectral Response Acceleration (S_S)	0.2	0.125 g
Mapped 1-Second Period Spectral Response Acceleration (S_1)	1.0	0.052 g

The Seismic Site Classification influences the determination of the Site Coefficients, the Design Spectral Response Acceleration values, and ultimately the Seismic Design Category. Note that the Seismic Site Classification is based on the characteristics of the upper 100-ft. of soils and rock below the site. The IBC requires the use of Standard Penetration Test Resistance (test borings), Shear Wave Velocity (geophysical methods), and/or Undrained Shear Strength (soil laboratory testing) to categorize the Seismic Site Classification.

Based on the explored soil properties in the test borings performed for this site, the Seismic Site Classification was determined to be Site Class D. For Site Class D and mapped spectral acceleration values obtained above, calculated Site Coefficient values and the Maximum and Design Spectral Response Acceleration values as per IBC Section 1613.5 are given in Table 4-2.

Table 4-2: Site Class, Site Coefficients, and Design Spectral Response Acceleration

Site Class	D
Soil Profile	Stiff Soil Profile
Site Coefficient (F_a)	1.6
Site Coefficient (F_v)	2.4
Short Period, Maximum Spectral Response Acceleration (S_{MS})	0.200 g
1 Second Period, Maximum Spectral Response Acceleration (S_{M1})	0.124 g
Short Period, Design Spectral Response Acceleration (S_{DS})	0.134 g
1 Second Period, Design Spectral Response Acceleration (S_{D1})	0.083 g

Design spectral response acceleration values are used with occupancy category (IBC 2015, Table 1604.5) of the building or structure to determine the Seismic Design Category. Additional seismic data can be obtained on the result summary provided in the Appendix.

5.0 FOUNDATION DESIGN CONSIDERATIONS

It is our understanding that a new Clarifier is planned at the Town of Emmitsburg Water Treatment Plant. The one-story building for the new clarifier is measuring approximately 32 ft. by 48 ft. The project site is located very close to the Hampton Valley Road. It is currently a wooded area, with scattered boulders and large stones. The existing ground surface elevations gently grades down going North. In the proposed building area, the existing ground surface slopes down from EL + 830± to EL + 822± (See Figure 2).

At the time of writing this report we do not have the foundation loads. We assumed a maximum column load of 100 kips per column and a maximum wall load of 6 kips per ft. to prepare the foundation recommendation presented in this report. We also assumed that the finish floor elevation of the building for the clarifier is at the existing ground surface elevation level.

The evaluations and recommendations presented in the subsequent sections of this report were based on our understanding of the proposed construction and on the general subsurface conditions indicated by the subsurface exploration program. Should the project characteristics be altered significantly from those discussed or should different subsurface conditions be encountered during construction, our office should be consulted, as the evaluations and recommendations presented herein may no longer be valid.

Shallow spread footings as discussed below are recommended for the support of the building structure.

5.1 Spread Footings founded on Natural soils or Compacted Soil Fill

With the ground finished floor elevation of the proposed structures at approximately the existing ground surface elevation, the foundation subgrade for spread footings is expected to be on the existing fill soils (i.e., Stratum A soils). The SPT blow counts observed on the fill soils appear to be good for the support of the spread footings at a footing depth of greater than or equal to 30 inches. The exposed foundation subgrades should be inspected by a Geotechnical Engineer using a dynamic cone penetrometer (DCP), or other methods to verify that the subgrade is capable of providing the recommended design bearing capacity to support the foundations of the proposed structure. If soft soils or otherwise unsuitable soils (such as wet soil or soils containing deleterious components) are encountered, then those soils should be undercut to a suitable subgrade to provide an adequate bearing subgrade (the maximum undercutting depths of 3 ft. below the proposed foundation subgrades) to establish a firm foundation subgrade. The undercut foundation subgrade can then be reestablished using compacted fill or lean concrete. Unit rates and an allowance should be established for undercutting of unsuitable soils. The undercut and backfill should be performed in accordance with the recommendations contained in Section 7.2. A design net soil bearing pressure of 2.0 ksf is recommended for footings founded on the natural residual soils or on new compacted fill, when installed as described herein.

5.2 Spread Footings - General

All exterior shallow spread footings (and footings in un-heated areas) should be located at a minimum depth of 30 inches below exterior finish grade for protection against frost penetration. Interior footings in heated areas can be located at nominal depths below the floor slab. In order to preclude punching type bearing capacity failures, wall footings shall have minimum widths of 24 inches, and any column footings shall have minimum widths of 36 inches. A maximum slope of 2H: 1V should be maintained between the bottom edges of adjacent footings where foundation grades are at different levels. It is also recommended that wall footings be provided with adequate reinforcement such that sufficient bending strength is available to span across isolated pockets of soft or loose soils (that may go undetected during construction).

The lateral load resistance for the spread foundation can be derived from the passive pressure on the side of footings (below the frost depth of 30 inches for exterior footings and on the total side area on interior footings), and the base friction. The passive earth pressure coefficient of $k_p = 2.0$ and coefficient of the base friction of 0.35 can be utilized.

5.3 Settlement

Based on the boring data and the anticipated structural loads, we estimate that total settlements for the foundations should not exceed one inch with differential settlement expected to be less than half the total settlement. The magnitude of differential settlements will be influenced by the distribution of loads and the variability of underlying materials. These settlement values are based on our engineering experience of the soil and the anticipated structural loading and are to guide the structural engineer with his design. Quality control during construction is considered to be extreme importance to ensure that subsequent settlements, following the construction process, are kept to a minimum.

6.0 FLOOR SLAB SUPPORT CONSIDERATIONS

6.1 Floor Slab Support

Assuming that the finished floor elevations of the building is at the existing ground surface level. We expect that slabs will be installed essentially at the existing grade. As such the slabs will be supported by existing fill soils or structural fill soils. Prior to placement of the floor slabs, the suitability of the slab subgrades should be determined by proofrolling. Proofrolling should be performed using the heaviest construction equipment, for example a loaded 20-ton dump truck or equivalent (at least a 3,000-lb. walk-behind roller), which can access the area and under the observation of a Geotechnical Engineer. Any additional loose or unsuitable soils found during proofrolling should be removed and replaced with compacted fill. Compacted structural fills under the slabs should be placed following the recommendations contained under Section 7.2 of this report.

Floor slabs on grade may be designed using a modulus of subgrade reaction, k equal to 100 pci. Groundwater is estimated to be within 5 ft. below the proposed finished floor grades and a special under-floor subdrainage system designed to collect groundwater around the perimeter walls and below the floor slab of the structure is required to maintain groundwater below the floor level. The proposed subdrainage system is discussed below.

A minimum 4-inch-thick granular drainage layer containing less than 5 percent by dry weight passing the No. 200 sieve size is recommended to be placed directly beneath the floor slab. In addition, a vapor barrier should be placed beneath the floor slab as discussed below.

6.2 Subdrainage System

The building structure will have a finished floor elevation approximately at the existing grade and the groundwater was encountered within 5 ft. depth below the existing grade at the time of our ground investigation. It is to be noted that groundwater levels will fluctuate due to seasonal changes, precipitation, and construction activity. The highest groundwater observations are normally encountered in late winter and early spring. Fluctuations of water table or the development of a perched water table at shallower depths above less permeable layers may occur depending upon the amount of precipitation and water runoff to the site, during wet season.

A subdrainage system designed to collect groundwater below the floor slab of the structure is required to maintain groundwater below the floor level. A typical subdrainage system sketch (Figure 6), intended to graphically depict our recommendations, is included in the Appendix. General requirements of the drainage system are outlined below. The use of both a waterproofing system and underfloor subdrainage system is recommended.

Underslab drain lines should consist of a minimum of 4-inch diameter, perforated, corrugated polyethylene tubing according to ASTM F405 with a maximum slot width of ¼ inch. Tubing should be placed with slots down using straight section and standard available connections. It should be noted that inspection of the subdrainage system should occur and the system may require flushing at periodic intervals if soil particles infiltrate the pipes. Clean out access should be installed at all sharp bends and at approximately every 100 ft. for straight runs to allow flushing of the system. A grit collection chamber should be installed upstream of the sump to reduce the amount of granular materials reaching the pumps.

Drainage lines may be placed without a slope, with inverts at least 6 inches below final floor grades. The subdrainage system may drain by gravity to daylight or to a storm drainage line provided that provisions are made to avoid back pressures from acting in the event storm sewers flow full. Preferably, underslab drain lines should be sloped at a minimum of 1% and be underlain by a minimum of 6 inches of bedding stone, with a minimum of 8 inches of cover. A maximum spacing of 20 ft. on center between the lateral subdrainage lines below the floor slab should be maintained. We recommend that the perimeter and under-slab drain system for the proposed structure be designed to flow to at least one permanent sump at a location to be determined by the design team.

A uniformly graded stone filter (washed gravel) or clean sand material having a gradation compatible with the size of the opening utilized in the drain lines and the surrounding soils to be retained, should be placed around the perforated drainage line. This stone filter should have a thickness of at least 6 inches at the bottom and sides and 2 inches of cover. The stone filter should have uniform gradation and AASHTO M43, Size No. 67 or 7 is recommended. The stone drainage filter should also be wrapped in geotextile. The geotextile (Mirafi® 140N or equivalent) shall have an apparent opening size of greater than an equivalent opening size of the No. 70 sieve. A minimum of 3-inch-thick stone drainage filter should be provided between the drain pipe and the geotextile wrap.

The use of a waterproofing membrane such as Paraseal®, which is a Bentonite HPDE composite (15 mils of HDPE and expandable, granular bentonite), or equivalent is recommended directly below the floor slab if a subdrainage system is installed. This membrane can be placed directly on the washed gravel drainage layer. All penetration and seals should be performed in accordance with the manufacturer's recommendations. This waterproofing membrane is to provide a seal that will minimize moisture vapor transmission through the floor slab. Alternatively, a "true" vapor barrier similar to 15-mils Stego Wrap Vapor Barrier can be used.

The subdrainage system should be placed shortly before slab construction to minimize damage to the piping from construction operations.

In most projects, there exists a significant lag time between the initial grading and the placement of the floor slab. Environmental conditions and construction traffic often disturb the soil subgrade during this lag time. The contractor should make provisions in the construction specifications for the restoration of the subgrade to a stable condition prior to the placement of the floor slab at no additional cost to the owner.

7.0 GENERAL GRADING CONSIDERATIONS

7.1 Site Preparation

Subgrade Preparation

Site preparation will consist of removal of any topsoil, etc. in the area of the proposed structures, usually extending horizontally up to 5 ft. beyond the footprint peripheral line of the structures. Some existing utilities that may interfere with the proposed grading scheme should be removed/relocated and the utility trenches should be backfilled with compacted select fill. Minimal cuts and fills are anticipated.

Inspection of Subgrades and Undercutting:

Following the excavation to establish the proposed subgrade level of the structures, the exposed subgrade should be inspected and tested for adequate support conditions. As discussed previously, undercutting of the soft or loose soils may be required in order to establish the suitable bearing surface.

Exposed subgrades must be sloped to facilitate surface runoff away from 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.

Proofrolling:

Following removal of topsoil and any unsuitable existing fill materials, the subgrade (for slabs, pavements, etc.) should be thoroughly proofrolled under the observation of a qualified Geotechnical Engineer. Proofrolling should be performed using a heavily loaded, rubber-tired piece of construction equipment, such as a fully loaded 20-ton tandem-axle dump truck or equivalent (at least a 3,000-lb. walk-behind roller), to detect any soft, loose or otherwise unstable deposits. The areas subject to proofrolling should be traversed by the equipment in two orthogonal directions with overlapping passes of the vehicle under the observation of the Geotechnical Engineer or authorized representative. Any unstable soils, manifesting significant pumping or rutting, should be removed and replaced with structural compacted fill. The approved subgrade should then be scarified and moisture conditioned to within 3 percent of the soil's optimum moisture content and re-compacted to 95% per ASTM D-1557 prior to placement of any new fill.

Excavations and low areas can then be raised to the proposed grades with structural compacted fill that is selected, placed and compacted in accordance with project specifications. Site preparation, placement and compaction of structural fill should be performed under engineering-controlled conditions in accordance with project specifications and approved by a qualified Geotechnical Engineer.

7.2 Fill Selection, Placement, and Compaction

All materials to be used as fill or backfill should be inspected, tested and approved by the Geotechnical Engineer. Earthwork is recommended to take place in the warmer, drier months between May and October. The use of scarification and drying techniques, or additives such as quick lime, kiln dust, fly ash, or Portland Cement may also be useful in expediting fill operations in inclement weather.

On-Site Materials:

The visual classification and the laboratory tests conducted on the on-site fill materials indicated that the existing fill soils classify predominantly as Clayey SAND (SC) and Sandy SILTS (ML). These soils can be reused as site and structural backfill materials. Boulders and cobbles may be encountered in the site fill soils. This may require screening of soils. Boulders and cobbles are encountered in the existing fills soils, and the amount of fill material required for the project may not be that significant, and hence imported fill soils may be preferred.

Borrow Material

Compacted structural fill and backfill for use below structures should consist of satisfactory soils classified as SM or better in accordance with the Unified Soil Classification System, ASTM D-2487. Soils meeting this requirement are classified as SM, SP, SW, GM, GP, GW and combinations of these groups. GC and SC materials may be utilized as compacted structural fill if they contain less than 35% passing the No. 200 sieve and a Plasticity Index (PI) of less than 15. Unsatisfactory soils are those classified as OL, OH, CH, CL, MH, and ML. The soils classified as CL, ML; and CH / MH with a maximum Liquid Limit of 60% and Plasticity Index of 30%, can be used as structural fills at depths greater than 4 ft. below pavement subgrades and within non-structural areas. In addition, these soils can be used as a fill for site grading.

Soils used for compacted fill should be free of unsuitable materials such as topsoil, debris and other organics, rubble, and rocks larger than 3 inches in diameter. Open graded materials, such as Gravels (GW and GP), which contain void space in their mass should not be used in structural fills unless properly encapsulated with filter fabric.

Fill Compaction:

Compacted structural fill should be placed in approximately horizontal layers, each layer having a loose thickness of not more than 8 inches. All structural fill should be compacted to 95% of the maximum dry density in accordance with ASTM D1557, Modified Proctor. The contractor should select appropriate compaction equipment to achieve the required compaction. Fill placement should commence at the toe of the proposed slopes and progress upwards as additional fill is placed in horizontal lifts.

Field moisture contents of the fill may have to be adjusted in order to obtain suitable degrees of compaction. It is anticipated that field moisture contents of fill materials will need to be controlled to the range of optimum moisture content, plus or minus 3 percent, if stable fills with adequate degrees of compaction are to be obtained.

We recommend that compacted structural fill be placed to at least 5 ft. beyond the edge of the building or pavement structure. All fill placement and compaction operations in critical areas (i.e., structural areas) should be monitored by an experienced Soils Inspector on a full-time basis to ensure that fill materials are being placed and compacted in compliance with the project specifications. Should any compaction problems develop during grading operations, the Geotechnical Engineer should be consulted for an evaluation of the problems. Findling, Inc. should be called on to inspect and document the fill compaction.

Fill Placement Considerations:

Fill materials should not be placed on frozen soils, on frost-heaved soils, and/or on excessively wet soils. Borrow fill materials should not contain frozen or frost-heaved materials at the time of placement. Excessively wet soils or aggregates should be scarified, aerated, and moisture conditioned. At the end of each work day, all fill areas should be graded to facilitate drainage of any precipitation and the surface should be sealed by use of a smooth-drum roller to limit infiltration of surface water. During placement and compaction of new fill at the beginning of each workday, the Contractor may need to scarify existing subgrades to a depth on the order of 4 inches so that a weak plane will not be formed between the new fill and the existing subgrade soils. Drying and compaction of wet soils is typically difficult during the cold, winter months. Accordingly, earthwork should be performed during the warmer, drier times of the year, if practical. Proper drainage should be maintained during the earthwork phases of construction to prevent ponding of water which has a tendency to degrade subgrade soils.

We recommend that the earthwork contractor have equipment on site for both drying and wetting fill soils. We do not anticipate significant problems in controlling moisture within the fill during dry weather, but moisture control may be difficult during winter months or extended periods of rain. The control of moisture content of higher plasticity soils is difficult when these soils become wet. Further, such soils are easily degraded by construction traffic when the moisture content is elevated.

7.3 Construction Dewatering

At the time of our field investigation, groundwater was encountered within 5 ft. below existing grade. Therefore, dewatering during construction is generally anticipated. However, depending on the seasonal variations, water may not be encountered in shallow excavations. Therefore, provisions should be made in the project specifications for dewatering.

The on-site soils could lose their in-situ strength with an increase in moisture content. Therefore, adequate drainage should be provided at the site to minimize any increase in moisture content of the foundation soils. All pavement or parking areas should be sloped away from the structure to prevent ponding of water around the structures and paved areas. The site drainage should also be such that the run-off onto adjacent properties is controlled properly.

7.4 Excavation Considerations

Excavation of this site is expected to be performed using conventional earthmoving equipment. However, cobbles and boulders are anticipated in the excavations and the contractor shall be prepared to excavate with the presence of these cobbles and boulders.

If a depth of excavation will be greater than 5 feet for the foundation installation, temporary excavations should be sloped at an angle of 1.5H:1V or flatter, where possible. Excavations deeper than 5 feet will require lateral support if the excavations cannot be laid back on a slope of 1.5 horizontal: 1 vertical, in accordance with applicable OSHA regulations. The temporary support can consist of methods such as sheeting and shoring. The actual stability of the excavations should be evaluated by the contractor in accordance with OSHA and MOSHA regulations, and excavation supports system(s) will require design by a Professional Engineer.

7.5 Boulders and Cobbles within the Fill Soils

The area of proposed building site is currently a wooded area, with scattered boulders and large stones. Cobbles and boulders are anticipated in the excavations and the contractor shall be prepared to excavate with the presence of these cobbles and boulders.

8.0 ENVIRONMENTAL CONSIDERATIONS

The scope of this work did not include an environmental investigation at the site. Health and Safety issues, if any, should be determined by others.

9.0 LIMITATIONS

This geotechnical study has been conducted in accordance with generally accepted geotechnical engineering practices. The geotechnical study report has been prepared to aid in the evaluation of the site for the proposed building project, in Emmitsburg, Maryland. It is intended for the exclusive use of RK&K for the design and construction of the proposed structure as described herein. This report includes both factual and interpreted information. It is considered that adequate recommendations have been provided to serve as a basis for design and preparation of plans and specifications. Additional recommendations can be provided as needed.

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.

These analyses and recommendations are based on information made available to us at the time of our investigation and the actual conditions encountered at the test boring locations at that time. General assumptions have been made that the limited exploratory test borings represent the site conditions in relation to the lateral extent and depths of the borings. It should be noted, however, that the actual subsurface conditions between the test boring locations might vary from the conditions indicated on the appended test boring logs. Should the actual conditions encountered during construction differ significantly from those indicated by the test boring logs, we should be notified immediately so that the analyses and recommendations can be reviewed and/or revised as necessary.

APPENDIX

Figures

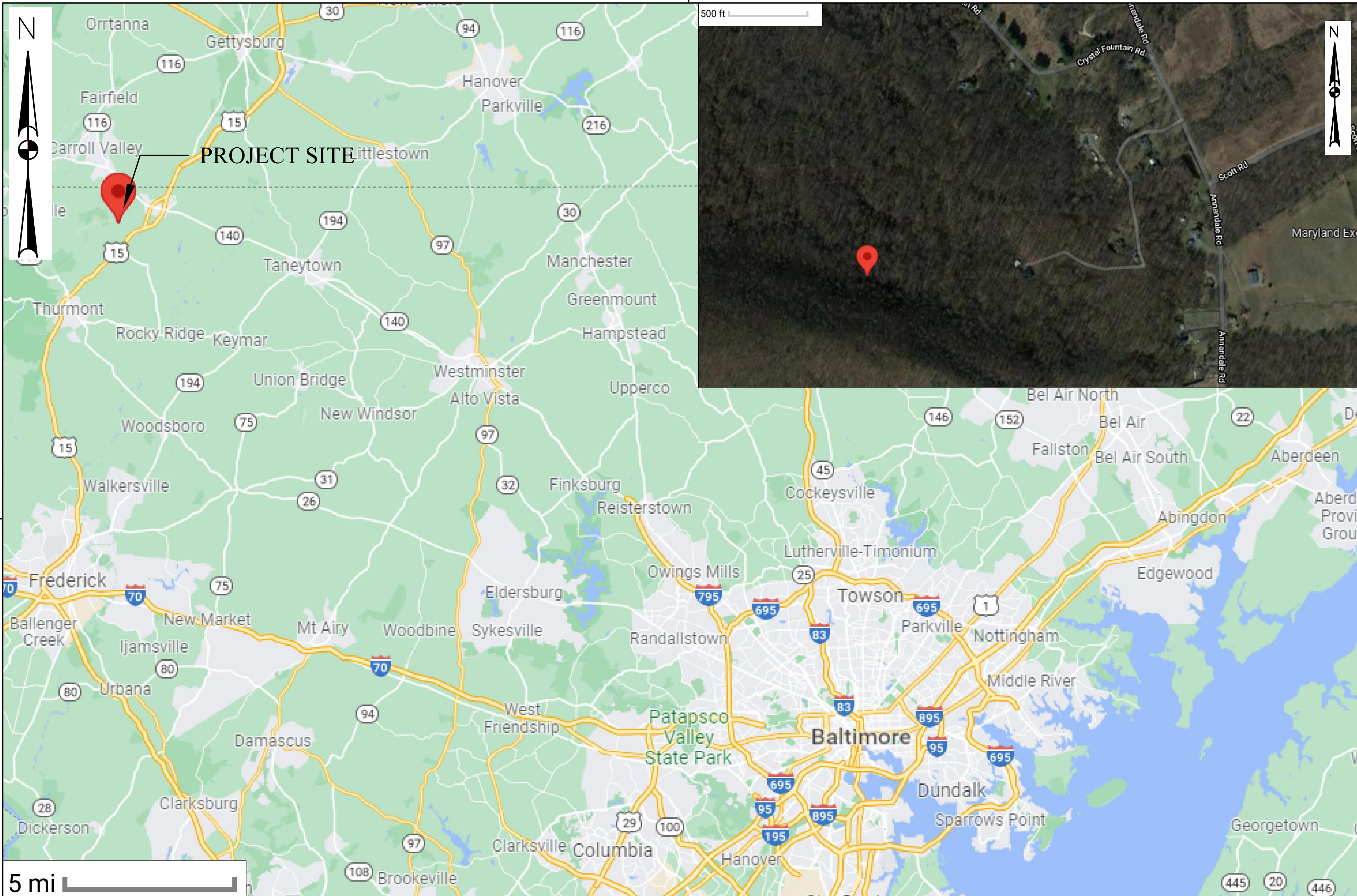
Tables

Laboratory Test Results

Seismic Site Classification

Boring Logs

Figures



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BALTIMORE, MD 21215 • 410.367.1400

NOTE:
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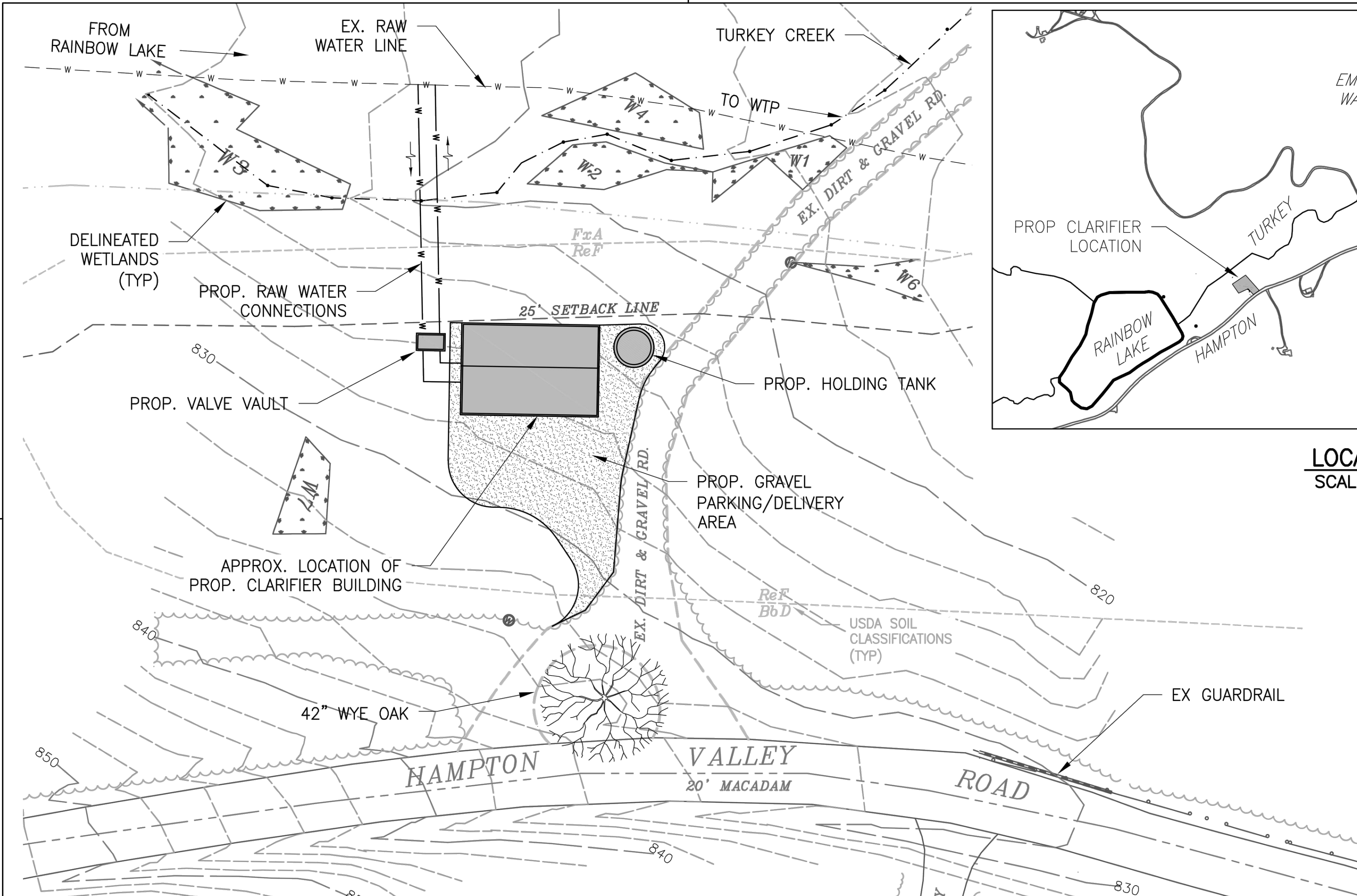
39.696872, -77.386902

SITE VICINITY MAP

TOWN OF EMMITSBURG WATER TREATMENT PLANT-NEW CLARIFIER
8585 CRYSTAL FOUNTAIN ROAD, EMMITSBURG, MARYLAND

PROJECT NUMBER: 21-1055	REVIEWED BY: MSS	SCALE: NOT TO SCALE
DATE: NOVEMBER 2021	DRAWN BY: AB	FIGURE: 1

FILE =>P:\FINDLING\PROJECTS\RK&K\21-1055 TOWN OF EMMITSBURG WTP\CAD\0-ALL IN ONE.DWG



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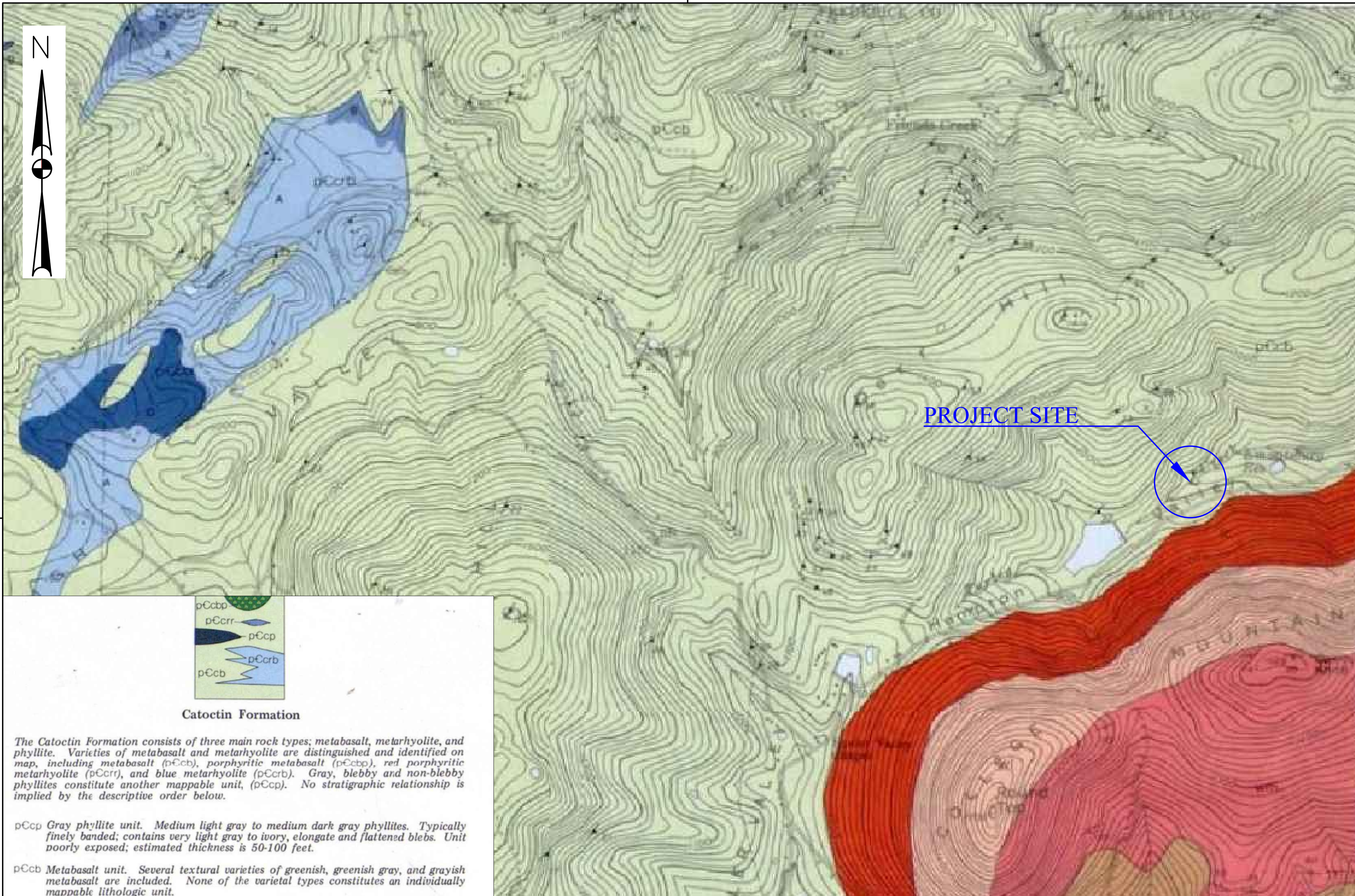
PROJECT LOCATION PLAN

TOWN OF EMMITSBURG WATER TREATMENT PLANT–NEW CLARIFIER
8585 CRYSTAL FOUNTAIN ROAD, EMMITSBURG, MARYLAND

PROJECT NUMBER: 21–1055	REVIEWED BY: MSS	SCALE: NOT TO SCALE
DATE: NOVEMBER 2021	DRAWN BY: AB	FIGURE: 2



Catoctin Formation

The Catoctin Formation consists of three main rock types; metabasalt, metarhyolite, and phyllite. Varieties of metabasalt and metarhyolite are distinguished and identified on map, including metabasalt (pЄcb), porphyritic metabasalt (pЄcbp), red porphyritic metarhyolite (pЄcrr), and blue metarhyolite (pЄcrb). Gray, blebby and non-blebby phyllites constitute another mappable unit, (pЄcp). No stratigraphic relationship is implied by the descriptive order below.

pЄcp *Gray phyllite unit. Medium light gray to medium dark gray phyllites. Typically finely banded; contains very light gray to ivory, elongate and flattened blebs. Unit poorly exposed; estimated thickness is 50-100 feet.*

pЄcb *Metabasalt unit. Several textural varieties of greenish, greenish gray, and grayish metabasalt are included. None of the varietal types constitutes an individually mappable lithologic unit.*

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39.696872, -77.386902

SOURCE: STATE OF MARYLAND DEPARTMENT OF NATURAL RESOURCES
MARYLAND GEOLOGICAL SURVEY
GEOLOGICAL MAP OF HOWARD COUNTY

SITE GEOLOGY

TOWN OF EMMITSBURG WATER TREATMENT PLANT–NEW CLARIFIER
8585 CRYSTAL FOUNTAIN ROAD, EMMITSBURG, MARYLAND

PROJECT NUMBER: 21–1055	REVIEWED BY: MSS	SCALE: NOT TO SCALE
DATE: NOVEMBER 2021	DRAWN BY: AB	FIGURE: 3

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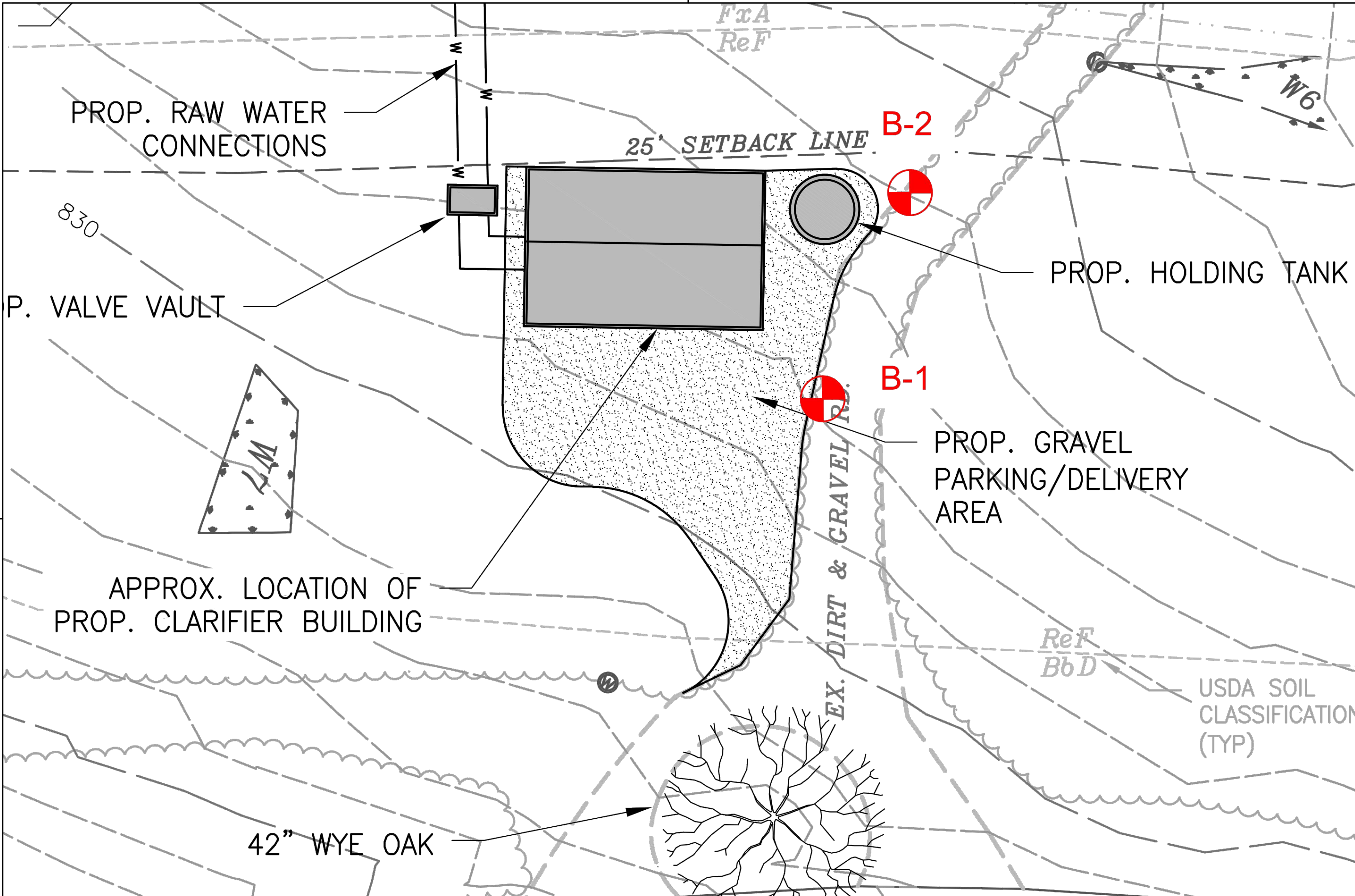

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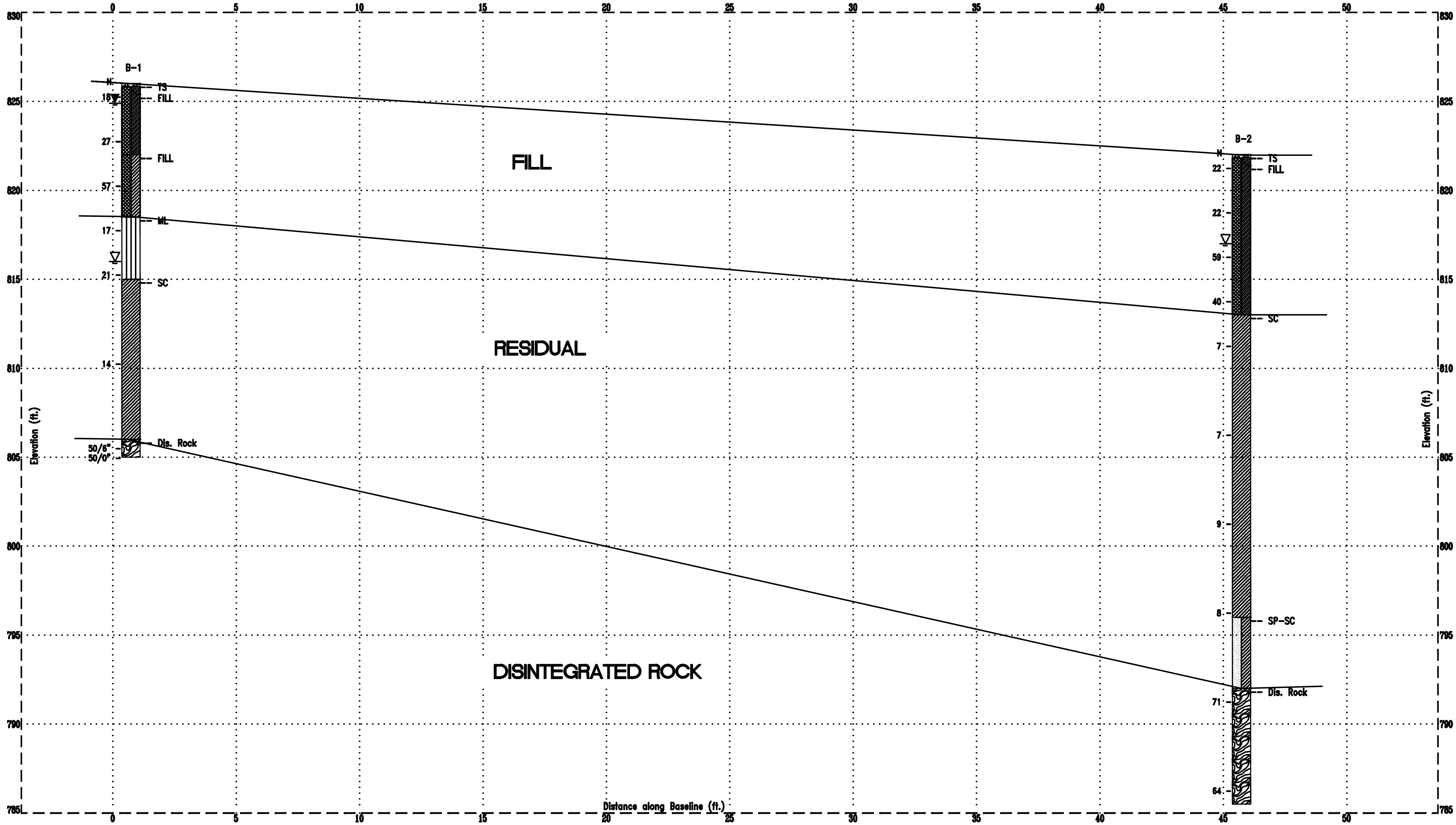
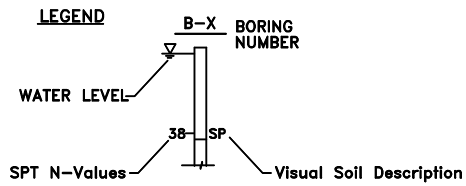
BORING LOCATION PLAN
TOWN OF EMMITSBURG WATER TREATMENT PLANT–NEW CLARIFIER
8585 CRYSTAL FOUNTAIN ROAD, EMMITSBURG, MARYLAND

PROJECT NUMBER: 21–1055	REVIEWED BY: MSS	SCALE: NOT TO SCALE
DATE: NOVEMBER 2021	DRAWN BY: AB	FIGURE: 4

FILE =>P:\FINDLING\PROJECTS\RK&K\21-1055 TOWN OF EMMITSBURG WTP\CAD\0-ALL IN ONE.DWG





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SUBSURFACE PROFILE

TOWN OF EMMITSBURG WATER TREATMENT PLANT–NEW CLARIFIER
8585 CRYSTAL FOUNTAIN ROAD, EMMITSBURG, MARYLAND

PROJECT NUMBER: 21–1055	REVIEWED BY: MSS	SCALE: NOT TO SCALE
DATE: NOVEMBER 2021	DRAWN BY: AB	FIGURE: 5 (a) SECTION A–A'

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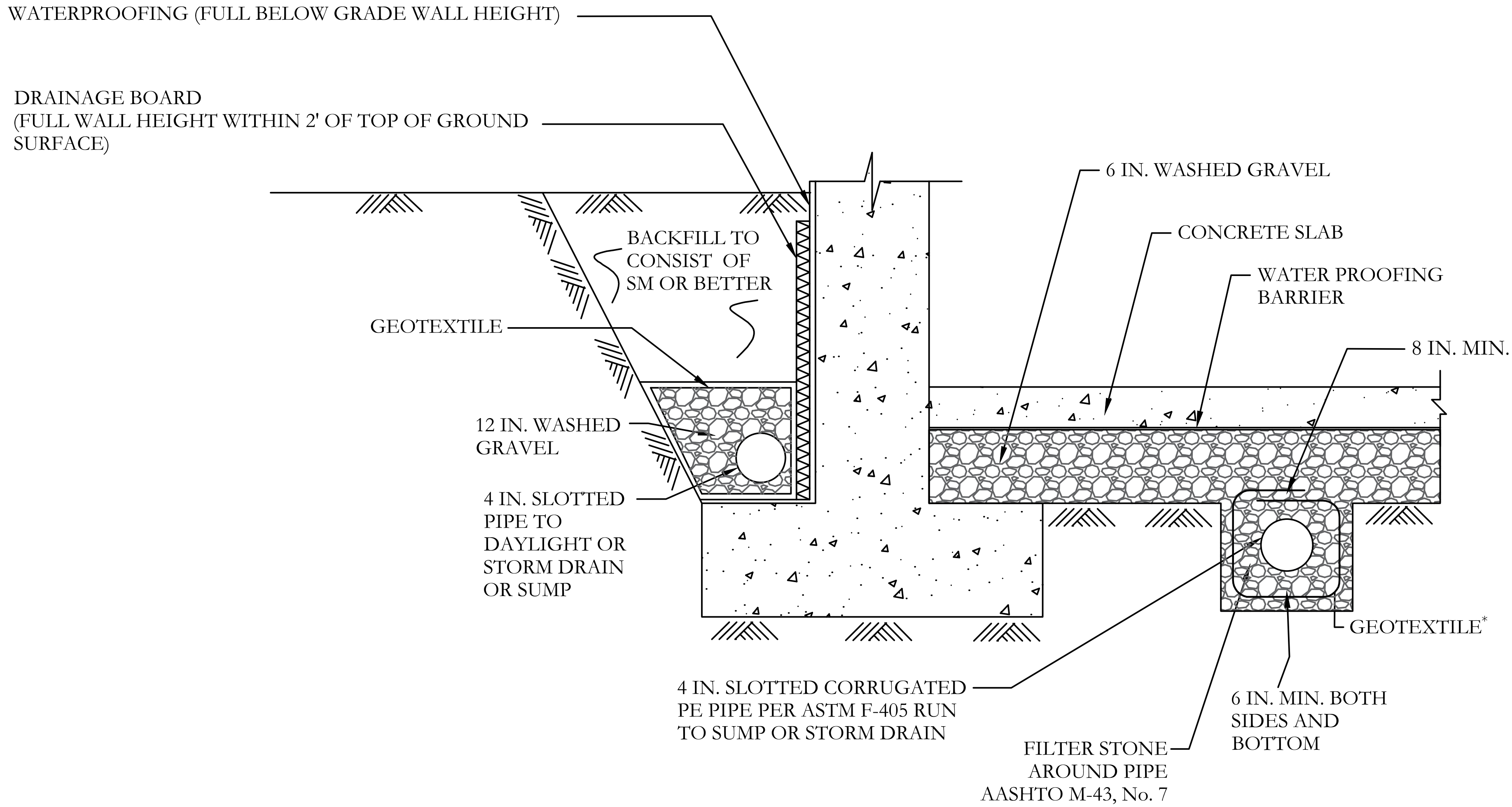

GEOTEXTILE* - MIRAFI 140N OR EQUIVALENT WITH 4" MINIMUM OVERLAP

PRODUCTS SPECIFIED MAY BE SUBSTITUTED WITH AN APPROVED EQUIVALENT PRODUCT

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NOTE:
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TYPICAL SUBDRAINAGE DETAIL–SLAB

TOWN OF EMMITSBURG WATER TREATMENT PLANT–NEW CLARIFIER
8585 CRYSTAL FOUNTAIN ROAD, EMMITSBURG, MARYLAND

PROJECT NUMBER:	REVIEWED BY:	SCALE:
21–1055	MSS	NOT TO SCALE
DATE: NOVEMBER 2021	DRAWN BY: AB	FIGURE: 7

FILE =>P:\FINDLING\PROJECTS\RK&K\21-1055 TOWN OF EMMITSBURG WTP\CAD\0-ALL IN ONE.DWG

Tables

Table 2.1: Summary of Laboratory Test Results

Project: Town of Emmitsburg Water Treatment Plant-New Clarifier
Location: 8585 Crystal Fountain Road, Emmitsburg, MD
Findling, Inc. Project No. : 21-1055

Boring No.	Sample ID	Sample Depth	Natural Moisture Content, %	Atterberg Limits			Grain Size Distribution			Modified Proctor (ASTM D1557) (AASHTO T-180)		California Bearing Ratio (CBR)	USCS Classification	AASHTO Classification
				LL	PL	PI	GRAVEL (%)	SAND (%)	FINES (%)	Max Dry Density, pcf	Optimum Moisture Content, %			
B-1	Bulk	0.0 - 10.0	14.0	33	16	17	7.3	42.3	50.4	128.3	10.1	5.6	CL	A-6(5)
B-1	S-1	0.0 - 1.5	10.3											
B-1	S-2	2.5 - 4.0	12.4	41	23	18	31.5	31.8	36.7				SC	A-7-6(2)
B-1	S-3	5.0 - 6.5	13.9											
B-1	S-4	7.5 - 9.0	13.0	33	18	15	13.0	44.9	42.1				SC	A-6(3)
B-1	S-5	10.0 - 11.5	18.1											
B-1	S-6	15.0 - 16.5	14.7											
B-1	S-7	20.0 - 21.0	13.6											
B-2	Bulk	0.0 - 10.0	10.2	39	20	19	9.8	36.7	53.5				CL	A-6(7)
B-2	S-1	0.0 - 1.5	8.6											
B-2	S-2	2.5 - 4.0	15.8											
B-2	S-3	5.0 - 6.5	9.0	35	19	16	40.1	31.7	28.2				GC	A-2-6(1)
B-2	S-4	7.5 - 9.0	12.9											
B-2	S-5	10.0 - 11.5	14.0											
B-2	S-6	15.0 - 16.5	9.9	25	16	9	29.1	52.7	18.2				SC	A-2-4(0)
B-2	S-7	20.0 - 21.5	13.8											
B-2	S-8	30.0 - 31.5	15.0											
B-2	S-9	35.0 - 36.5	7.3											

Note: NV = Non Viscous, NP = Non Plastic

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info@findlinginc.com

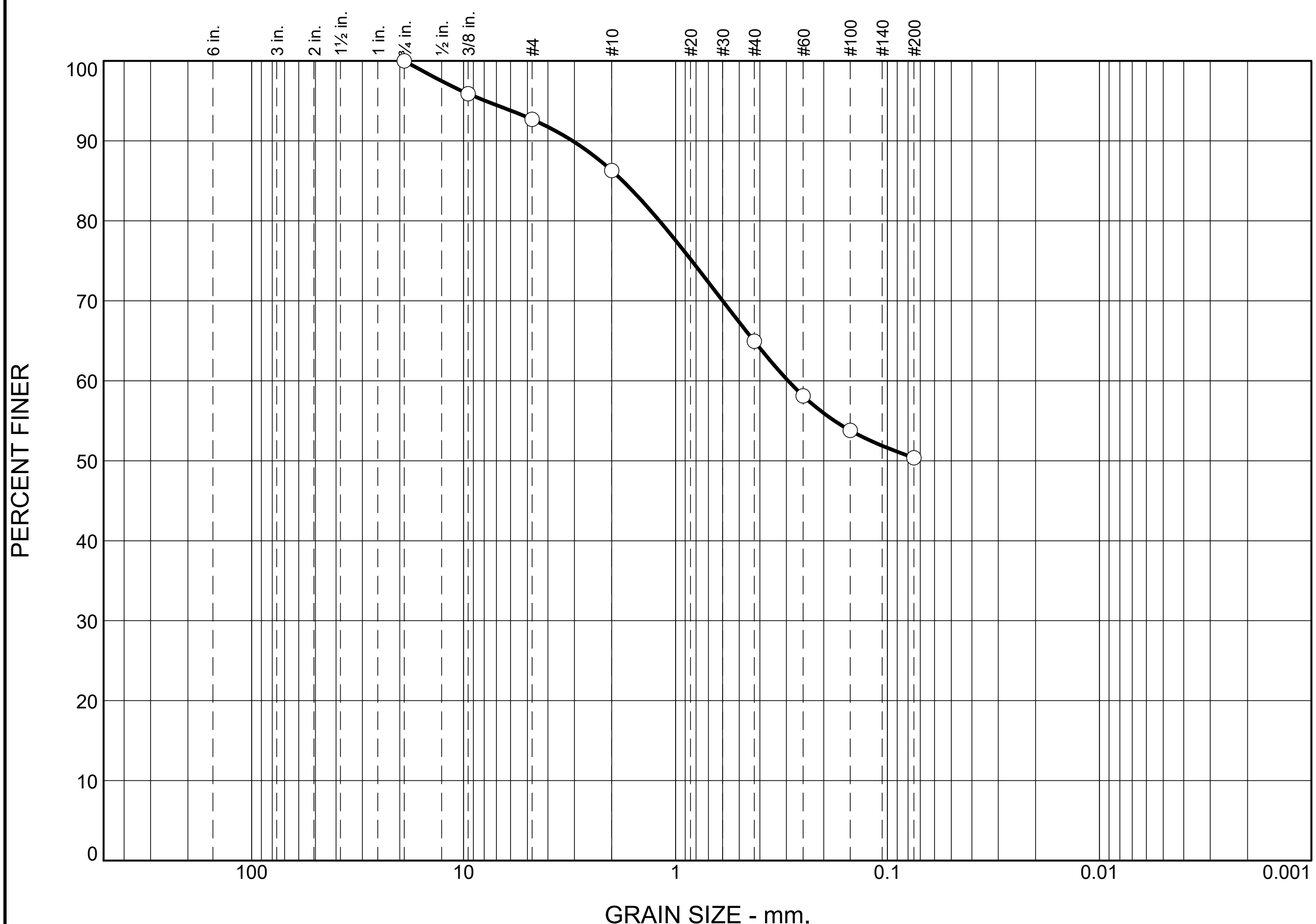
Table 3.1 : Summary of Boring Data
Towson University Union Expansion
Towson, Maryland 21252
Findling Contract No.: 16-1043

Boring No.	Ground Surface **Elev** (±ft.)	Bottom of Explored Strata						Groundwater Level **						Caved-in		Boring Depth (±ft.) *	Bottom of Boring **Elev** (±ft.)
		Stratum A Fill		Stratum B Residual		Disintegrated Rock		During Drilling		End of Drilling		After 24 hrs.					
		Depth (±ft.)*	**Elev (±ft.)**	Depth (±ft.)*	**Elev (±ft.)**	Depth (±ft.)*	**Elev (±ft.)**	Depth (±ft.)*	**Elev (±ft.)**	Depth (±ft.)*	**Elev (±ft.)**	Depth (±ft.)*	**Elev (±ft.)**	Depth (±ft.)*	**Elev (±ft.)**		
B-1	**826.0**	7.5	**818.5**	20.0	**806.0**	21.0	**805.0**	10.0	**816.0**	10	**816.0**	1.1	**824.9**	9.9	**816.1**	21.0	**805.0**
B-2	**822.0**	9.0	**813.0**	30.0	**792.0**	36.5	**785.5**	10.0	**812.0**	5	**817.0**	-	**-**	13.2	**808.8**	36.5	**785.5**

Key: * Below the existing ground surface.
* Groundwater elevation could fluctuate due to seasonal conditions.
NE : Not Encountered within depth of boring.
NA : Not Applicable.

Laboratory Test Results

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	7.3	6.4	21.4	14.5	50.4	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○		33	16	1.7765	0.2946						

Material Description	USCS	AASHTO
○ Light brown Sandy CLAY	CL	A-6(5)

Project No. 21-1055 **Client:** RK & K
Project: Town of Emmitsburg Water Treatment Plant-New Clarifier
○ **Source of Sample:** B-1 **Depth:** 0.0'-10.0' **Sample Number:** Bulk

Date: ○ 10/6/21

Remarks:
○ Natural Moisture Content= 14.0%

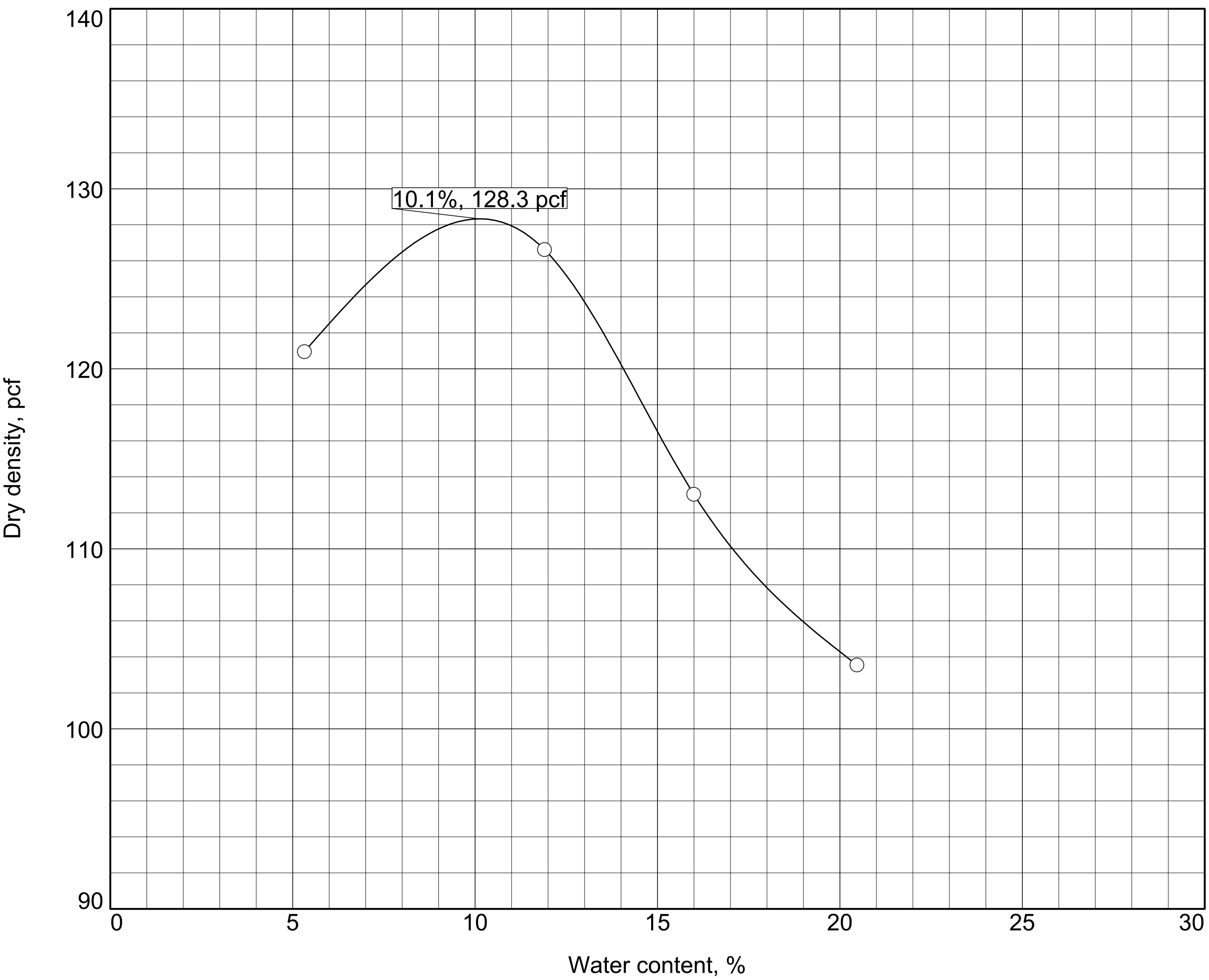
Findling, Inc.

Baltimore, Maryland

Figure

Tested By: BG **Checked By:** AB

COMPACTION TEST REPORT



Test specification: ASTM D 1557-12 Method A Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
0.0'-10.0'	CL	A-6(5)	14.0%		33	17	7.3	50.4

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 128.3 pcf Optimum moisture = 10.1 %	Light brown Sandy CLAY

Project No. 21-1055 **Client:** RK & K

Project: Town of Emmitsburg Water Treatment Plant-New Clarifier

○ **Source of Sample:** B-1 **Sample Number:** Bulk

Findling, Inc.

Baltimore, Maryland

Remarks:

Figure

Tested By: BG **Checked By:** AB

CALIFORNIA BEARING RATIO (CBR) TEST
(ASTM D 1883)

FINDLING, INC.

PROJECT NAME: Town of Emmitsburg Water Treatment Plant-New Clarifier
8585 Crystal Fountain Road, Emmitsburg, MD

PROJECT NO: 21-1055
BORING NUMBER: B-1
LAB SAMPLE ID: BULK
DEPTH, (FT): 0'-10'

SAMPLE DESCRIPTION: Light brown Sandy CLAY (CL)

CBR TEST METHOD: ASTM, D1883 (96 Hours Soaked)

WEIGHT DURING SOAKING: 25 lbs. (~127 psf)

MAX. DRY DENSITY (pcf): 128.3
(Modified Proctor, D-1557)

OPT. MOISTURE CONTENT: 10.1%

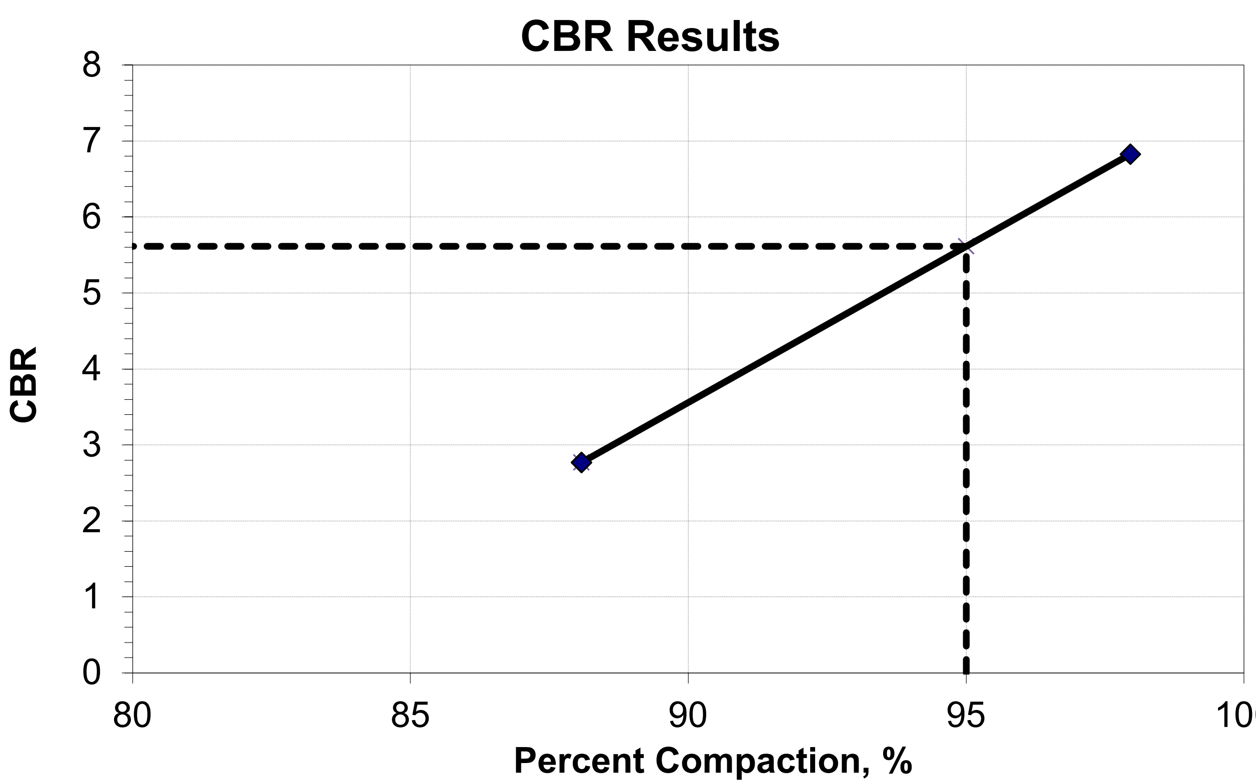
TEST-1 (56 BLOWS PER LAYER)

MOLDED		SOAKED	
DRY DENSITY (pcf):	125.7	DRY DENSITY- SOAKED (pcf):	123.7
MOISTURE CONTENT:	11.2%	MOISTURE CONTENT(SOAKED):	13.0%
% COMPACTION OF MAX. DENSITY:	98.0%	% COMPACTION OF MAX. DENSITY:	96.4%
CBR @ 0.1": 6.8	CBR @ 0.2": 12.5	% SWELL:	0.9%

TEST-2 (10 BLOWS PER LAYER)

MOLDED		SOAKED	
DRY DENSITY (pcf):	113.0	DRY DENSITY- SOAKED (pcf):	107.2
MOISTURE CONTENT:	10.9%	MOISTURE CONTENT(SOAKED):	16.9%
% COMPACTION OF MAX. DENSITY:	88.1%	% COMPACTION OF MAX. DENSITY:	83.6%
CBR @ 0.1": 2.8	CBR @ 0.2": 3.0	% SWELL:	-0.1%

CBR at 95% Compaction = 5.6



CALIFORNIA BEARING RATIO (CBR) TEST
(ASTM D 1883)

FINDLING, INC.

PROJECT NAME: Town of Emmitsburg Water Treatment Plant-New Clarifier
8585 Crystal Fountain Road, Emmitsburg, MD

PROJECT NO: 21-1055
BORING NUMBER: **B-1**
LAB SAMPLE ID: BULK

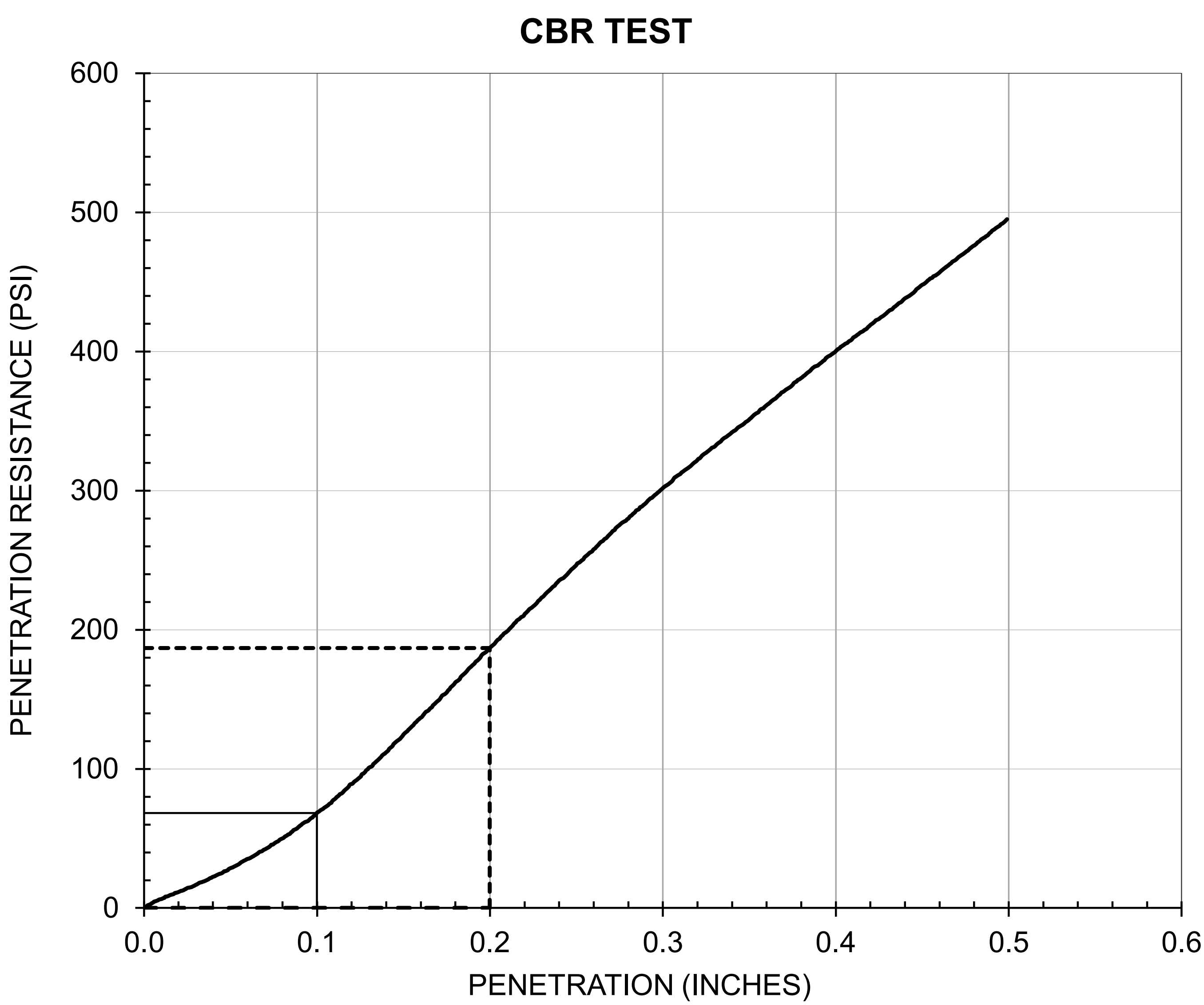
SAMPLE DESCRIPTION: Light brown Sandy CLAY (CL)
WEIGHT DURING SOAKING: 25 lbs. (~127 psf)

MAX. DRY DENSITY (pcf): 128.3
(Modified Proctor, ASTM D 1557)
OPT. MOISTURE CONTENT: 10.1%
DEPTH, (FT): 0'-10'

DRY DENSITY (pcf): 125.7
MOISTURE CONTENT: 11.2%
% SWELL: 0.9%

CBR @ 0.1: 6.8
CBR @ 0.2: 12.5
Blows/layer: 56

METHOD: ASTM, D1883 (96 Hours Soaked)
% COMPACTION OF MODIFIED PROCTOR (T-180): 98.0%



CALIFORNIA BEARING RATIO (CBR) TEST

(ASTM D 1883)

FINDLING, INC.

PROJECT NAME: Town of Emmitsburg Water Treatment Plant-New Clarifier
8585 Crystal Fountain Road, Emmitsburg, MD

PROJECT NO: 21-1055
BORING NUMBER: B-1
LAB SAMPLE ID: BULK

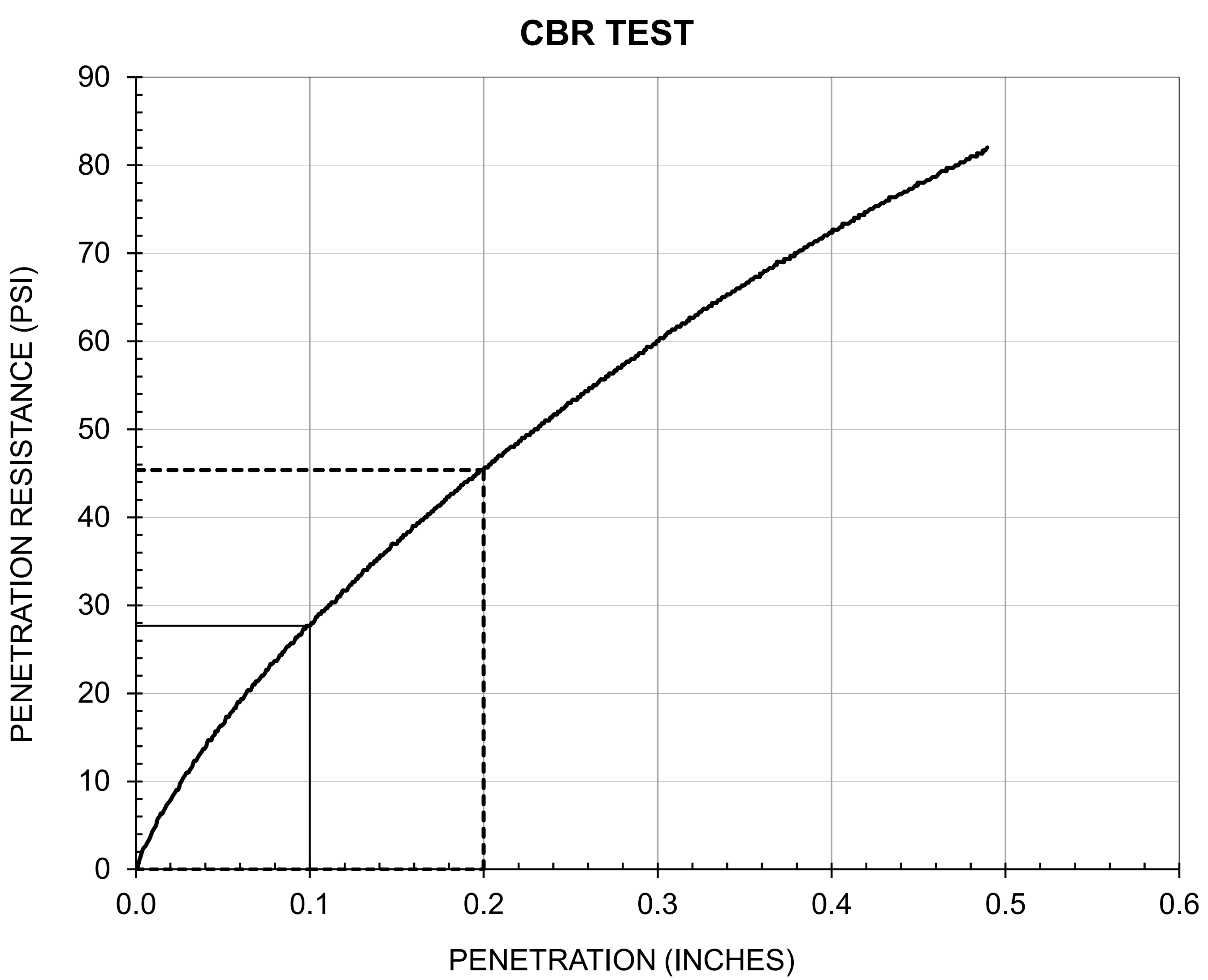
SAMPLE DESCRIPTION: Light brown Sandy CLAY (CL)
WEIGHT DURING SOAKING: 25 lbs. (~127 psf)

MAX. DRY DENSITY (pcf): 128.3
(Modified Proctor, ASTM D 1557)
OPT. MOISTURE CONTENT: 10.1%
DEPTH, (FT): 0'-10'

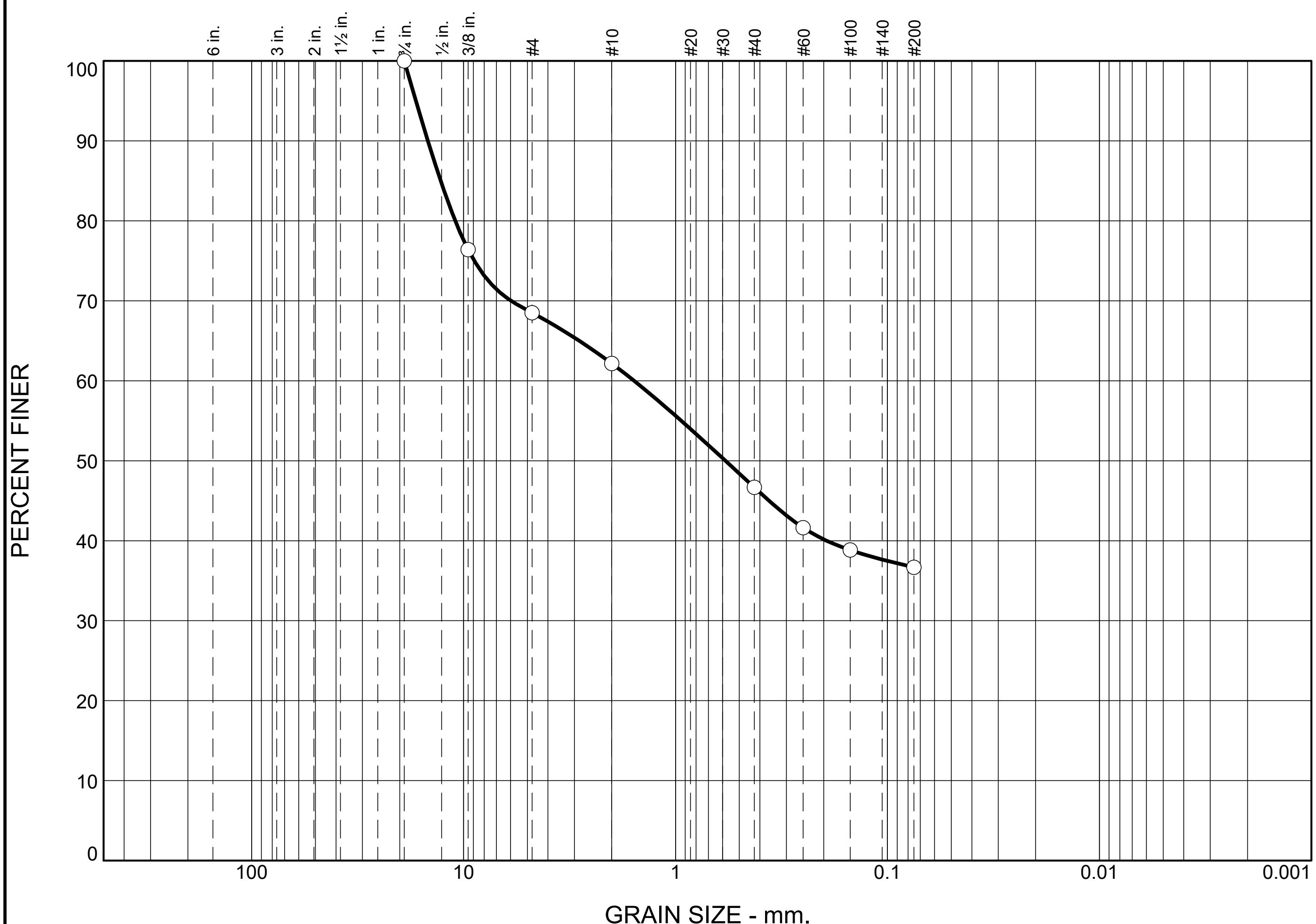
DRY DENSITY (pcf): 113.0
MOISTURE CONTENT: 10.9%
% SWELL: -0.1%

CBR @ 0.1: 2.8
CBR @ 0.2: 3.0
Blows/layer: 10

METHOD: ASTM D1883, 96 Hours Soaked
% COMPACTION OF MODIFIED PROCTOR (T-180): 88.1%



Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	31.5	6.3	15.5	10.0	36.7	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○		41	23	12.8240	1.5692	0.5818					

Material Description	USCS	AASHTO
○ Light gray Clayey SAND	SC	A-7-6(2)

Project No. 21-1055 **Client:** RK & K

Project: Town of Emmitsburg Water Treatment Plant-New Clarifier

○ **Source of Sample:** B-1 **Depth:** 2.5'-4.0' **Sample Number:** S-2

Date: ○ 10/6/21

Findling, Inc.

Baltimore, Maryland

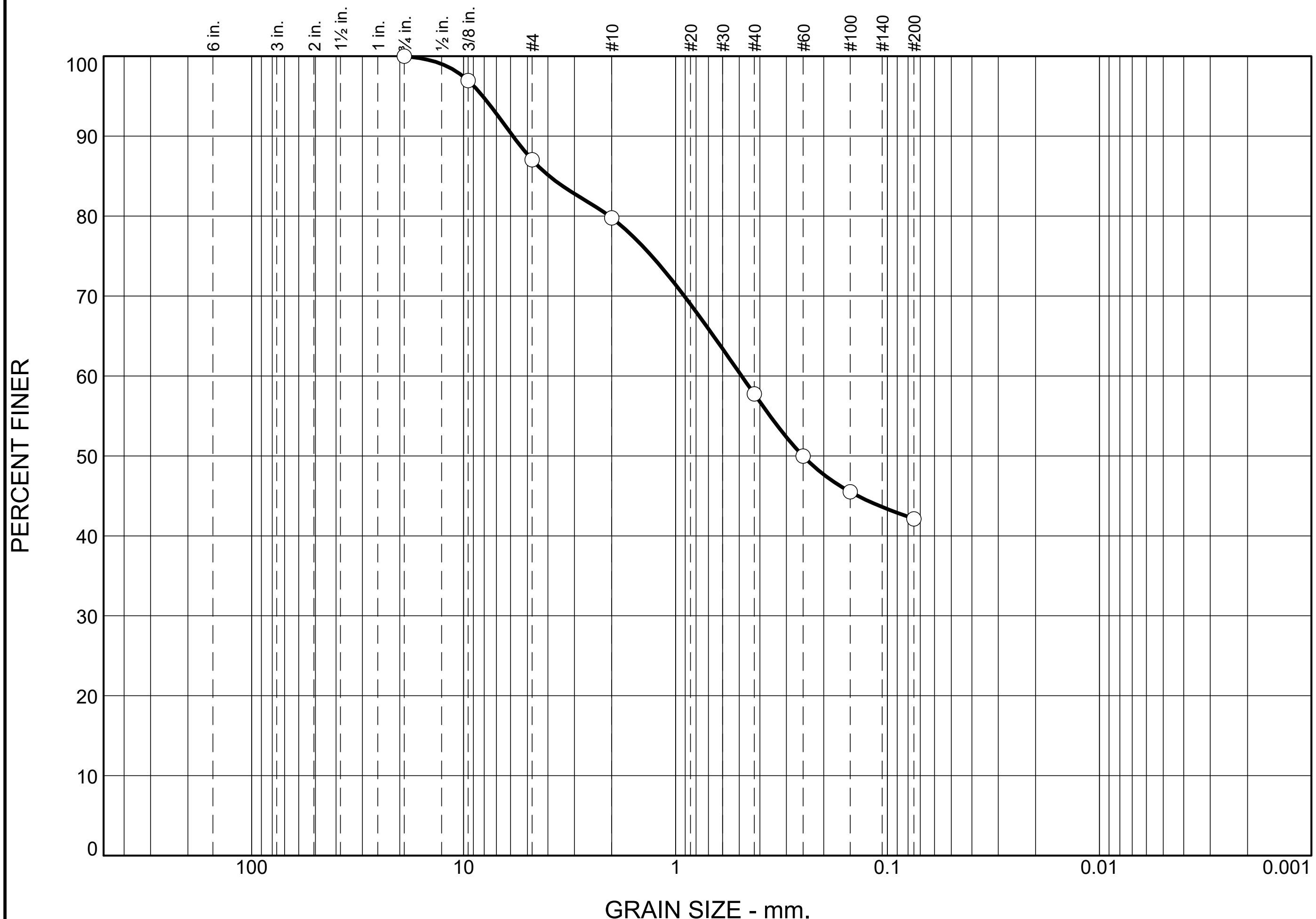
Remarks:

○ Natural Moisture Content= 12.4%

Figure

Tested By: BG **Checked By:** AB

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	13.0	7.2	22.1	15.6	42.1	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○		33	18	3.9427	0.4879	0.2507					

Material Description	USCS	AASHTO
○ Light gray Clayey SAND	SC	A-6(3)

Project No. 21-1055 **Client:** RK & K

Project: Town of Emmitsburg Water Treatment Plant-New Clarifier

○ **Source of Sample:** B-1 **Depth:** 7.5'-9.0' **Sample Number:** S-4

Date: ○ 10/6/21

Remarks:

○ Natural Moisture Content= 13.0%

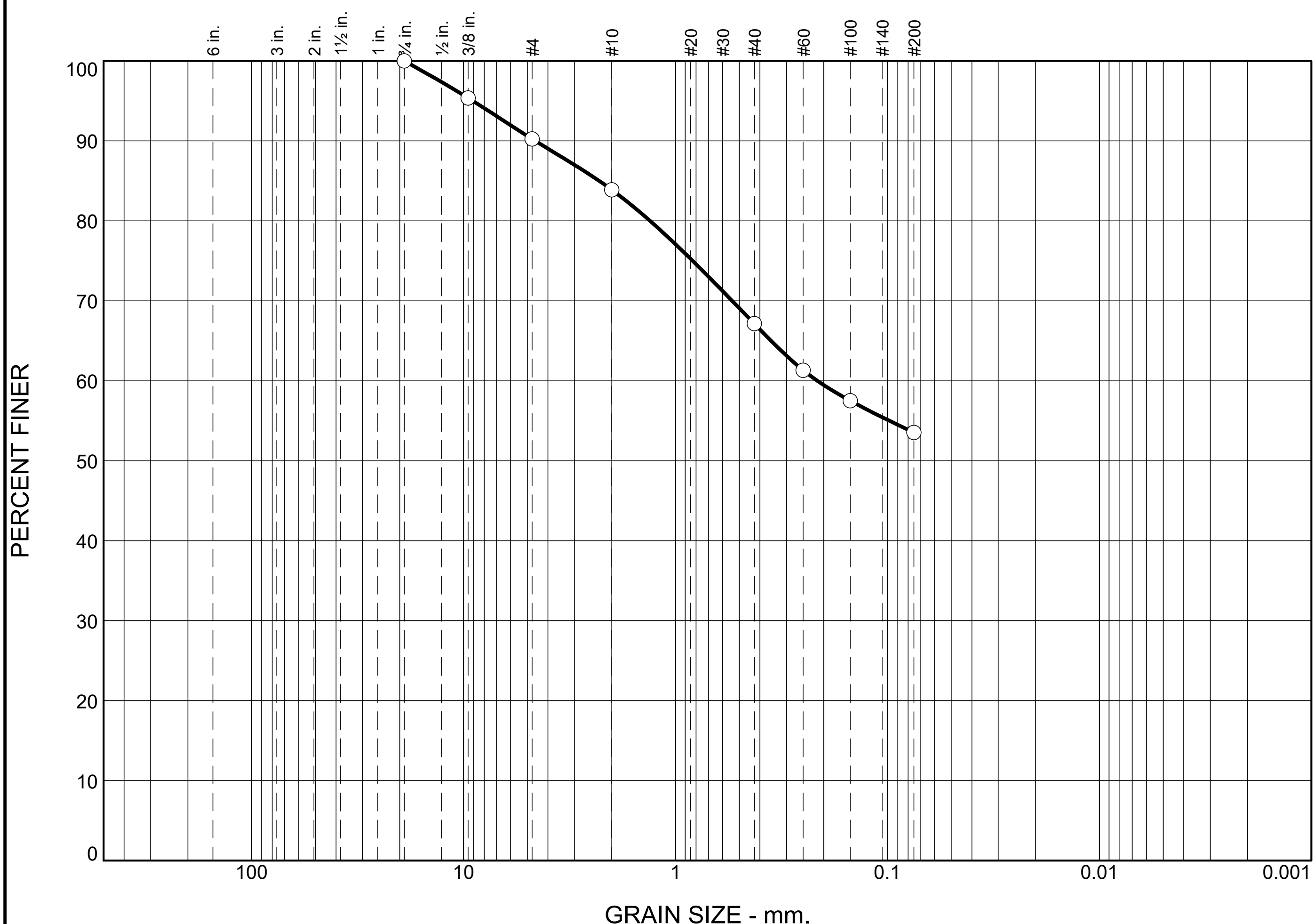
Findling, Inc.

Baltimore, Maryland

Figure

Tested By: BG **Checked By:** AB

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	9.8	6.3	16.8	13.6	53.5	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○		39	20	2.2956	0.2144						

Material Description	USCS	AASHTO
○ Light brown Sandy CLAY	CL	A-6(7)

Project No. 21-1055 **Client:** RK & K

Project: Town of Emmitsburg Water Treatment Plant-New Clarifier

○ **Source of Sample:** B-2 **Depth:** 0.0'-10.0' **Sample Number:** Bulk

Date: ○ 10/6/21

Findling, Inc.

Baltimore, Maryland

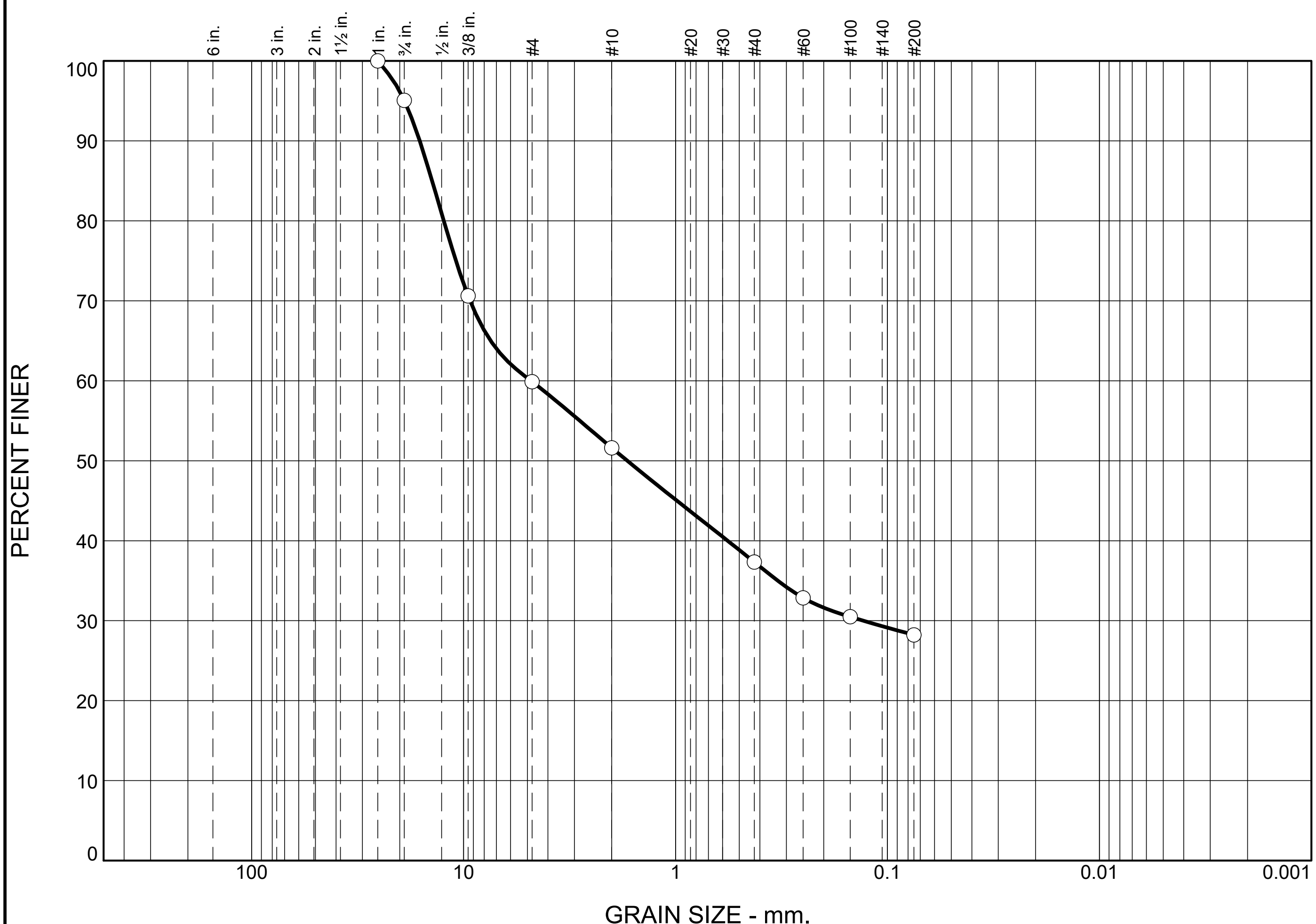
Remarks:

○ Natural Moisture Content= 10.2%

Figure

Tested By: BG **Checked By:** AB

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	4.9	35.2	8.3	14.3	9.1	28.2	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○		35	19	14.0788	4.8112	1.6896	0.1301				

Material Description	USCS	AASHTO
○ Light brown Clayey GRAVEL	GC	A-2-6(1)

Project No. 21-1055 **Client:** RK & K

Project: Town of Emmitsburg Water Treatment Plant-New Clarifier

○ **Source of Sample:** B-2 **Depth:** 5.0'-6.5' **Sample Number:** S-3

Date: ○ 10/6/21

Remarks:

○Natural Moisture Content=9.0%

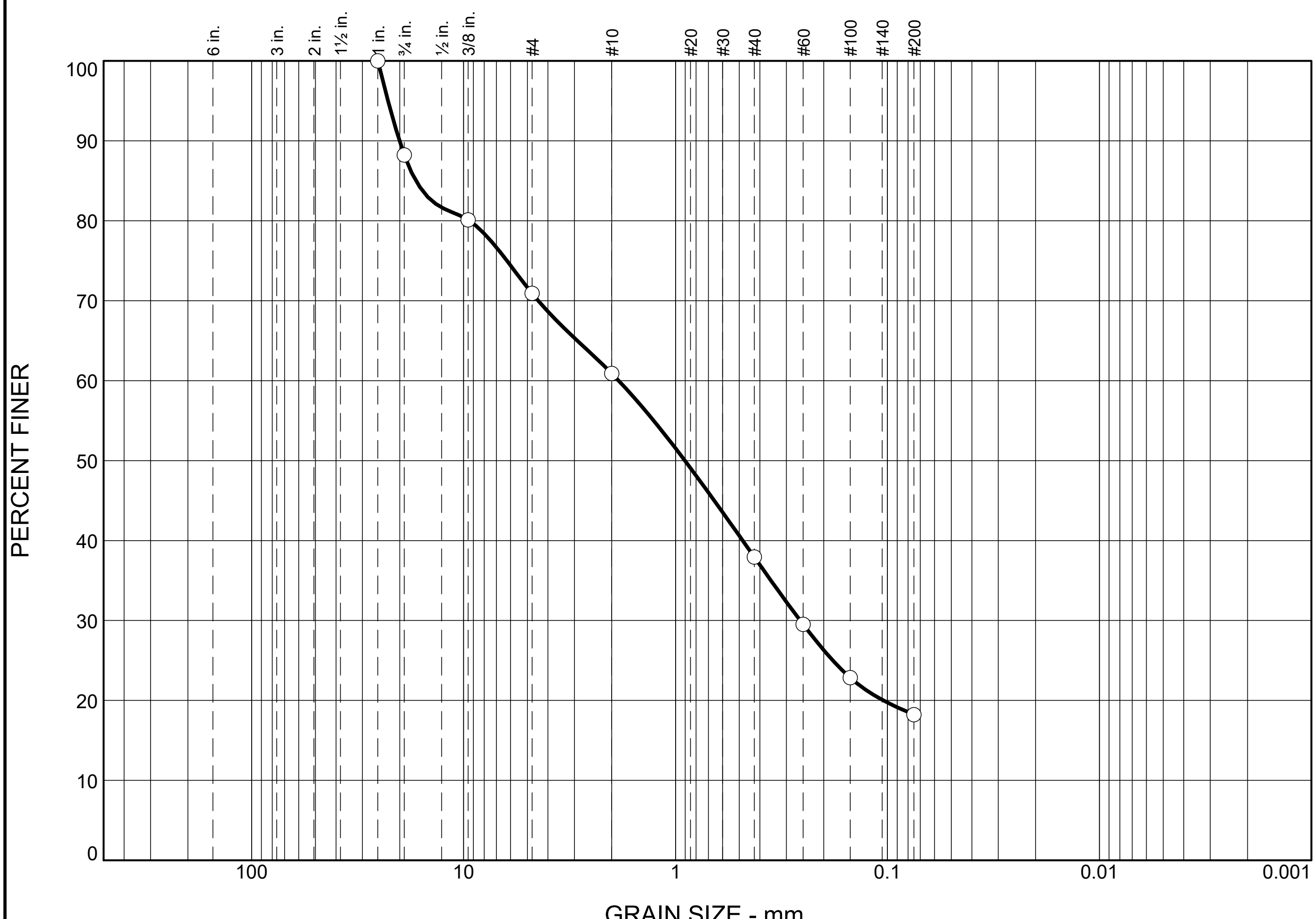
Findling, Inc.

Baltimore, Maryland

Figure

Tested By: BG **Checked By:** AB

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	11.8	17.3	10.0	23.0	19.7	18.2	

	Colloids	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○		25	16	16.7858	1.8554	0.9033	0.2580				

Material Description	USCS	AASHTO
○ Light brown Clayey SAND	SC	A-2-4(0)

Project No. 21-1055 **Client:** RK & K

Project: Town of Emmitsburg Water Treatment Plant-New Clarifier

○ **Source of Sample:** B-2 **Depth:** 15.0'-16.5' **Sample Number:** S-6

Date: ○ 10/6/21

Remarks:

○Natural Moisture Content=9.9%

Findling, Inc.

Baltimore, Maryland

Figure

Tested By: BG **Checked By:** AB

Seismic Site Classification

Town of Emmitsburg Water Treatment Plant New Clarifier

Latitude, Longitude: 39.696872, -77.386902

Date	11/19/2021, 12:31:41 PM
Design Code Reference Document	IBC-2015
Risk Category	III
Site Class	D - Stiff Soil

Type	Value	Description
S_S	0.125	MCE_R ground motion. (for 0.2 second period)
S_1	0.052	MCE_R ground motion. (for 1.0s period)
S_{MS}	0.2	Site-modified spectral acceleration value
S_{M1}	0.124	Site-modified spectral acceleration value
S_{DS}	0.134	Numeric seismic design value at 0.2 second SA
S_{D1}	0.083	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	0.06	MCE_G peak ground acceleration
F_{PGA}	1.6	Site amplification factor at PGA
PGA_M	0.096	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
SsRT	0.125	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	0.14	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.052	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.057	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.6	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.895	Mapped value of the risk coefficient at short periods
C_{R1}	0.908	Mapped value of the risk coefficient at a period of 1 s

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Boring Logs

FINDLING, INC.

BORING LOG

Sheet 1 of 1

Boring ___ of 2

Project No.: 21-1055 **Project Description:** Town of Emimitsburg WTP - New Clarifier

Boring No. B-1 **Station:** , ' **Ground Surface Elevation:** 826.0 ft

Easting: **Northing:** **Logged by:**

Date Started: 10/6/21 **Date Completed:** 10/7/21

Inspector: **Driller:** D. Pryor

Rig Type	CME Truck 45	
Rig No.	R-2	
Drive Hammer Weight	140	LB
Auger Size	3.25	IN
Size of Core		IN
Size of Bit OD		IN
Hammer Energy Ratio		%
Auger Depth	20.5	FT

WATER TABLE

Depth Below Surface		Time (hours)	Date
Depth (ft)	Elev (ft)		
▼ 10.00	816.00	END	10/6/21
▽ 1.10	824.90	24 hrs.	10/7/21

CAVE-IN TABLE

Depth Below Surface		Time (hours)	Date
Depth (ft)	Elev (ft)		
17.30	808.70	END	10/6/21
9.90	816.10	24 hrs.	10/7/21

DEPTH IN FEET	ELEV. IN FEET	MATL	MATERIAL DESCRIPTION	SPT SPOON/ROCK CORE SAMPLE NO.	BLOWS/ RQD	SAMPLE DEPTH	REC. SPT(in) or Core (%)	LAB. INDEX TESTS NMC (%)	LL (%)	PI (%)	REMARKS
0.2	825.83		Topsoil = 2" thick	1	6-13-5	0.0-1.5	5				Bulk Sample 0'-10'. Due to cobbles enough soil was not collected from 0'-5'.
4.0	822.00		Brown, gray, mosit, medium stiff to stiff Sandy Clay, little to some Silt, some Gravel, cobbels (FILL)	2	2-5-22	2.5-4.0	9				
7.5	818.50		Brown, gray, mosit, medium dense Clayey SAND, some Gravel and cobbels (Probable Fill)	3	9-16-41	5.0-6.5	13				
11.0	815.00		Brown, gray, mosit, medium stiif Sandy Silt, some Clay and Gravel	4	4-8-9	7.5-9.0	10				
				5	8-9-12	10.0-11.5	8				Water on rods@10'
20.0	806.00		Brown, wet, medium dense Clayey SAND, some Silt and stone fragments	6	8-7-7	15.0-16.5	18				
21.0	805.00		Brown, wet, very dense, Clayey Sand (Disintegrated Rock)	7	5-50/6"	20.0-21.0	11				
			Bottom of Boring @ 21 '	8	50/0"	21.0-21.0	0				

21-1055 RK&K TOWN OF EMIMITSBURG WTP NEW CLARIFIER FOR WATER TREATMENT PLANT.GPJ-10/29/21

Legend: NMC - Natural Moisture Content, RQD - Rock Quality Designation, PI - Plasticity Index, LL - Liquid Limit, REC - Recovery, Elev - Elevation, MATL- Material Graphics, Geotech - Geotechnical, SPT- Standard Penetration Test, OD - Outside Diameter

Boring and Sampling Conforms to ASTM/AASHTO:

FINDLING, INC.

BORING LOG

Sheet 1 of 1

Boring of 2

Project No.: 21-1055 **Project Description:** Town of Emimitsburg WTP - New Clarifier

Boring No. B-2 **Station:** , ' **Ground Surface Elevation:** 822.0 ft

Easting: **Northing:** **Logged by:**

Date Started: 10/6/21 **Date Completed:** 10/7/21

Inspector: **Driller:** D. Pryor

Rig Type	CME Truck 45
Rig No.	R-2
Drive Hammer Weight	140 LB
Auger Size	3.25 IN
Size of Core	IN
Size of Bit OD	IN
Hammer Energy Ratio	%
Auger Depth	36 FT

WATER TABLE

Depth Below Surface		Time (hours)	Date
Depth (ft)	Elev (ft)		
▼ 5.00	817.00	END	10/6/21
▽			

CAVE-IN TABLE

Depth Below Surface		Time (hours)	Date
Depth (ft)	Elev (ft)		
13.20	808.80	END	10/6/21

DEPTH IN FEET	ELEV. IN FEET	MATL	MATERIAL DESCRIPTION	SAMPLE NO.	BLOWS/ RQD	SAMPLE DEPTH	REC. SPT(in) or Core (%)	NMC (%)	LL (%)	PI (%)	REMARKS
0.2	821.83		Topsoil = 2" thick	1	5-15-7	0.0-1.5	8				Bulk Sample 0'-7'. Due to cobbles enough soil was not collected from 0'-5'.
			Brown, gray, mosit, medium stiff to stiff Sandy Clay, little to some Silt and Gravel, some cobbels (FILL) ▼	2	9-12-10	2.5-4.0	7				
				3	7-13-46	5.0-6.5	18				
9.0	813.00			4	3-28-12	7.5-9.0	6				
			Brown, wet, medium dense Clayey SAND (SC), some Silt and stone fragments	5	2-2-5	10.0-11.5	16				Water on rods@10'
				6	5-4-3	15.0-16.5	16				
				7	4-5-4	20.0-21.5	18				
26.0	796.00			8	2-3-5	25.0-26.5	11				
30.0	792.00		Brown, wet, medium dense Poorly Graded SAND with Clay (SP-SM), stone fragments								
			Brown, wet, very dense, Clayey Sand (Disintegrated Rock)	9	21-24-47	30.0-31.5	12				
36.5	785.50			10	18-38-26	35.0-36.5	18				
			Bottom of Boring @ 36.5 '								

21-1055 RK&K TOWN OF EMIMITSBURG WTP NEW CLARIFIER FOR WATER TREATMENT PLANT.GPJ-10/29/21

Legend: NMC - Natural Moisture Content; RQD - Rock Quality Designation; PI - Plasticity Index; LL - Liquid Limit; REC - Recovery; Elev - Elevation; MATL- Material Graphics; Geotech - Geotechnical; SPT- Standard Penetration Test; OD - Outside Diameter

Boring and Sampling Conforms to ASTM/AASHTO:

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