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Old Myers Solar Project Geotechnical Engineering Report

TRC Project No. 488729.2163.0000

Date: January 20, 2023

Prepared For:

Lightstar Renewables LLC

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January 20, 2023

Mr. Sam Bailey, Director of Acquisitions
Lightstar Renewables LLC
501 Boylston Street, 10th Floor
Boston, MA 02116

Re: Geotechnical Engineering Services
Proposed Old Myers Solar Project
Myers Corner Road
Wappingers Falls, NY
TRC Project #: 488729.2163.0000

Dear Mr. Bailey:

TRC Engineers, Inc. (TRC) is pleased to present our Geotechnical Engineering Report for this project. Our work was initiated in accordance with your Purchase Order 2163, dated October 28, 2022, and completed in general accordance with our agreed scope of work presented in our revised proposal, submitted May 5, 2022. A summary of our geotechnical exploration activities, findings and recommendations is summarized below.

1.0 INTRODUCTION

This report presents the results of our geotechnical exploration for the proposed photovoltaic (PV) solar array structures to be constructed at the Old Myers project site located along Myers Corners Road near its intersection with Old Myers Corners Road in Wappingers Falls, New York. The geotechnical exploration aimed at evaluating the geologic and subsurface conditions to reduce uncertainty with respect to anticipated foundation and site construction, and to provide geotechnical recommendations for design of the proposed project.

1.1 Project Description

The site consists of one parcel of farmland, tax parcel, 6258-03-376432, and is located at along Myers Corners Road, which borders the site to the southeast. The site is bordered to by a combination of open fields and wooded areas. An existing substation is located to the west side of the project near the site access road. Based on our experience with similar projects, we assume that the proposed photovoltaic arrays would preferably be mounted on posts driven into the ground. The anticipated post loads have not been provided but are assumed to be typical for such construction. It is assumed that existing grades will remain relatively unchanged.

1.2 Scope of Services

Our scope of services was presented in our Proposal dated May 5, 2022. To accomplish this work, we have provided the following services:

- Exploration of subsurface conditions by drilling six (6) exploratory borings onsite within proposed solar array areas to depths of 15 feet or refusal to earth drilling tools and retrieving soil samples for classification & laboratory testing.
- Evaluation of the physical conditions and engineering properties of the subsurface soils and formations based on visually classifying the samples by a member of our geotechnical staff.
- Engineering analysis to evaluate the proposed foundation systems for the support of the ground-mounted PV solar array.
- Preparation of this report to summarize our findings and to present our conclusions and recommendations regarding the following:
    - Foundation support for the proposed solar array structures assuming post foundations, or alternative system as applicable based on subsurface conditions.
    - Bearing capacity and other parameters for use in foundation design by others.
    - Recommendations for excavations, anticipated excavation conditions and presence of potential rock or other refusal conditions, if applicable.
    - Suitability of on-site soils for reuse in backfills and requirements for imported fills.
    - Recommendations for placement, compaction, and testing of fills, if applicable.
    - Soil parameters (both above and below ground water table) for active, at rest and passive conditions and L-Pile soil parameters for use in foundation design by others
    - Anticipated ground water conditions and impacts on the design and construction.
    - Frost penetration depth.
    - Corrosivity potential on buried steel and concrete.
    - Field electrical resistivity results.
    - Laboratory thermal resistivity test results.
    - Preliminary Seismic Site Class parameters in accordance with ASCE 7-16.
    - Recommendations for utility trenching and backfill.
    - Recommendations for Gravel Access Roads.
    - Other construction-related concerns, as applicable based on available site subsurface information and any available preliminary design information.

2.0 SITE CONDITIONS

2.1 Site Reconnaissance, Boring Stakeout, and Investigation

TRC's geotechnical engineer performed a site reconnaissance in conjunction with test boring stakeout. Test boring locations were staked in the field using a cellphone-based GPS app at the approximate locations selected by TRC and approved by Lightstar Renewables as shown on the attached Figure 1, Approximate Test Boring Location Plan. The site consists of farmland for which harvesting within the array field had already been completed at the time of the field exploration and other open parcels of land. TRC's drilling subcontractor made all reasonable efforts to limit the travel paths through the fields to minimize ground surface disturbance. Prior to drilling, the Dig Safely NY notification system was contacted to check the presence of public utilities in the area of the proposed testing borings. No observed subsurface utility conflicts were identified.

The test boring work was performed on November 10, 2022 by TRC's drilling subcontractor, Land, Air, Water Environmental Services, Inc. (LAWES). Drilling and sampling were performed using an ATV mounted drill rig. Split spoon sampling was performed continuously through the upper 10 ft bgs and at 5-ft intervals thereafter to the completion depths using the Standard Penetration Test (SPT) Method (American Society of Testing and Materials [ASTM] D1586). The soil samples were obtained by driving the split spoon sampler 24 inches into the soil with a 140-pound automatic hammer free-falling 30 inches. The number of blows required for each 6 inches of penetration was recorded separately. The SPT blow count ("N-value") of the soil was calculated as the number of blows required for the middle 12 inches (6-inch to 18-inch interval) of penetration or fraction thereof The SPT N-value serves as an indicator of relative consistency for cohesive soils and relative density of granular soils. Borings were terminated at the borings' target depths or at auger refusal ranging from approximately 2.6 ft to 15 ft below existing ground surface (bgs). Upon completion, all test borings were backfilled to the approximate existing ground surface with the auger cuttings. Copies of the test boring logs are attached along with a copy of the approximate test boring location plan.

2.2 Geology

According to available geological data, the surficial geology at the project site consists of glacial and alluvial deposits of the Quaternary period. Locally the site is underlain by a contact between two geologic formations, the Austin Glen Formation of the Middle Ordovician Age and the Mount Merino and Indian River Formations or the Ordovician Age. The Austin Glen Formation is predominately made up of shale and graywacke, while the Mount Merino and Indian River Formations are predominately made up of argillite and shale with incidental occurrences of chert.

2.3 Subsurface Conditions

The test borings revealed a surficial layer of topsoil to an approximate depth of 3 inches to 5 inches below the existing ground surface (bgs). The cultivated surficial soils generally consist of SAND and SILT mixture. Below the surficial cultivated topsoil layer, the surficial soils generally consist of a fine to coarse grained SAND and SILT/SILTY SAND mixture with varying amounts of gravel with extending to depths ranging from approximately 1 ft to 14.8 ft bgs. SPT N-values indicate that the relative density of these soils ranges from "loose" to "very dense", typically increasing with depth.

Laboratory test results performed on representative samples indicate that the fine grained (silt) content of the materials tested ranges from approximately 15% to 50%. The silt material has low plasticity with a plastic limit of 23%, a liquid limit of 26%, and plasticity index of 3% based on a composite soil sample from all boring. Natural moisture contents as received by the laboratory range from approximately 7% to 19%. Maximum laboratory compacted dry density of the composite bulk sample as determined by ASTM D 698 was 115.3 pounds per cubic foot (pcf) at an optimum moisture content of 13.1%.

Below the surficial sandy soils, each test boring encountered a stratum consisting of DECOMPOSED ROCK which represents the partial weathering of the underlying parent bedrock. This material retains the relic structure of the parent bedrock with a strength reduced to that of a strong soil. The decomposed rock encountered consists of Gravel-sized rock fragments with sand and silt. Refusal to the split spoon sampling tool, defined as less than 6 inches of penetration after 50 blows, was encountered within the decomposed rock stratum in each test boring at depths ranging from approximately 2.5 ft to 14.5 ft bgs.

Auger refusal, which typically represents the apparent top of weathered rock, was encountered in each test boring with the exceptions of B-4 and B-5 at depths ranging from approximately 1.5 ft to 10.5 ft bgs. Test borings B-1, B-2, and B-3 were offset multiple times to identify the presence of weathered rock rather than possible boulders or other subsurface obstructions. Very dense soil conditions and/or decomposed rock were also encountered at each of the six test boring locations. The depths and locations where very dense soils and auger refusal were encountered are summarized in Table 1, below.

Table 1. Summary of Difficult Drilling and Auger Refusal Depths

Test Boring Location	Depth to Very Dense Soils/SPT-Refusal/Difficult Drilling (ft, bgs)*	Depth to Auger Refusal (ft, bgs)
B-1	2	2.6 & 1.5
B-2	5.5	4.2 & 5.8
B-3	4	4.3 & 2.7
B-4	13	>13.1
B-5	14.5	>14.8
B-6	10	10.5

** ft, bgs = feet below existing ground surface*

2.4 Ground Water

Groundwater was encountered during drilling at the time of the field exploration in test boring B-4 at an approximate depth of 2.5 ft bgs. This water is likely related to developed of perched rain/surface water infiltration after rain event. Groundwater was not encountered in any of the test borings in measurements performed immediately after completion of each boring. Groundwater is not anticipated to be encountered during standard excavations. However, the development of perched water conditions may be encountered within anticipated excavation depths for foundations or utilities, particularly during wet periods at shallower depths than those encountered during the test boring investigation, particularly in low-lying areas. Groundwater conditions are representative of the conditions at the date and time of this study and are not representative of daily, seasonal, long-term fluctuations, development of perched conditions, or ponding of water in low lying areas during wet periods.

3.0 CORROSION EVALUATION AND THERMAL RESTIVITY

3.1 Corrosion Evaluation

To evaluate the corrosion potential of the subsurface soils at the site, we submitted a representative bulk soil sample of soils at depth from approximately 1 ft to 5 ft bgs, composited from test boring locations during our subsurface exploration to an analytical laboratory for pH, resistivity, soluble sulfate, and chloride content testing. The results are summarized in Table 2, below.

Table 2. Results of Corrosivity Testing

Sample	pH in (H20)	pH in (CaCl2)	Chlorides (mg/kg)*	Sulfates (mg/kg)*	Sulfides (mg/kg)*	Oxidation Reduction	Resistivity (ohm-cm)**
Composite	7.90	7.03	25	33	Nil	+643	8,600

* *mg/kg = milligrams per kilogram*
** *ohm-cm = ohm-centimeter*

Many factors can affect the corrosion potential of soil including soil moisture content, resistivity, permeability, and pH, as well as chloride and sulfate concentration. In general, soil resistivity, which is a measure of how easily electrical current flows through soils, is the most influential factor. Based on classification developed by William J. Ellis (1978), the approximate relationship between soil corrosiveness was developed as shown in Table 3 below.

Table 3. Relationship Between Soil Resistivity and Soil Corrosivity

Soil Resistivity (ohm-cm)*	Classification of Soil Corrosiveness
0 to 900	Very Severely Corrosive
900 to 2,300	Severely Corrosive
2,300 to 5,000	Moderately Corrosive
5,000 to 10,000	Mildly Corrosive
10,000 to >100,000	Very Mildly Corrosive

* *ohm-cm = ohm-centimeter*

Chloride and sulfate ion concentrations and pH appear to play secondary roles in affecting corrosion potential. High chloride levels tend to reduce soil resistivity and break down otherwise protective surface deposits, which can result in corrosion of buried metallic improvements or reinforced concrete structures. Sulfate ions in the soil can lower the soil resistivity and can be highly aggressive to Portland cement concrete (PCC) by combining chemically with certain constituents of the concrete, principally tricalcium aluminate. This reaction is accompanied by expansion and eventual disruption of the concrete matrix. Soils containing high sulfate content could also cause corrosion of the reinforcing steel in concrete. Table 4.2.1 of the American Concrete Institute (ACI, 2008) provides requirements for concrete exposed to sulfate-containing solutions as summarized in Table 4.

Table 4. Relationship Between Sulfate Concentration and Sulfate Exposure (Table 4.2.1 of ACI)

Water-Soluble Sulfate (SO4) in soil (ppm)*	Sulfate Exposure
0 to 1,000	Negligible
1,000 to 2,000	Moderate
2,000 to 20,000	Severe
over 20,000	Very Severe

* *ppm = parts per million*

Acidity is an important factor of soil corrosivity. The lower the pH (the more acidic the environment), the higher will the soil corrosivity be with respect to buried metallic structures. As soil pH increases above 7 (the neutral value), the soil is increasingly more alkaline and less corrosive to buried steel structures due to protective surface films which form on steel in high pH environments. A pH between 5 and 8.5 is generally considered relatively passive from a corrosion standpoint.

The laboratory electrical resistivity test completed on the composite samples of surficial soils indicates values of 8,600 ohm-centimeters, which would be indicative of mildly corrosive potential to buried metallic improvements. Based on the field resistivity testing results the electrical resistivity values for the existing subsoils range from approximately 31,827 ohm-centimeters to 267,143 ohm-centimeters . Based on this result and the resistivity correlations presented in Table 3, the corrosion potential to buried metallic improvements may be characterized a ranging from very mildly corrosive to mildly corrosive.

Based on our previous experience and Table 4.2.1 of the ACI, it is our opinion that sulfate exposure to PCC may be considered negligible for the native subsurface materials sampled.

3.2 Thermal Resistivity

Laboratory thermal resistivity test results with the thermal dryout curves, are attached to this report. Thermal Resistivity testing was performed in general accordance with ASTM 5334 on a representative composite sample compacted to a density equivalent to approximately 90% of the maximum dry density per ASTM D 698 and at the approximate optimum moisture content. The sample was then oven dried, and multiple thermal resistivity readings were obtained at various moisture contents. The thermal resistivity decreases with increasing moisture content and varies from 187.2 ^{o}C-cm/W when fully dry to 46.6 ^{o}C-cm/W at optimum moisture.

4.0 FOUNDATIONS AND EARTHWORK

4.1 Site Seismic Coefficients

According to the ASCE 7-16, the site class is within "Site Class C" based on the soil profiles. The maximum considered earthquake ground motions in this area for 0.2 sec. and 1.0 sec. spectral responses are approximately 21.4% g and 5.6% g, respectively. For Site Class C, the corresponding 0.2 and 1.0 sec. design spectral response acceleration parameters S_{DS} and S_{D1} are 18.5 % g and 5.6 % g, respectively.

4.2 Foundations

Based on the results of this investigation and our experience with similar structures, a foundation system consisting of driven posts is assumed for support of the proposed ground-mounted photovoltaic arrays. Based on the results of the test borings, driven posts are feasible and could be supported in the natural soils encountered at this project in the southern portion of the development area. The use of driven posts in the northern portion of the site will be problematic where shallow refusal conditions were encountered.

As noted in Table 1, test borings B-1 through B-3 in the northern area of the site encountered refusal to earth drilling equipment at depths ranging from approximately 2 ft to 5.5 feet bgs. Therefore, shallow refusal conditions should be anticipated within these areas and potentially other portions of the proposed solar array area when attempting to drive posts.

Since the use of a driven post system is limited for use on this project where refusal to drilling and sampling tools is encountered, the designer and contractor should be prepared to implement alternative installation methods (or alternative foundation support systems) for achieving sufficient foundation embedment to provide sufficient resistance for uplift and lateral loading condition, if necessary. The following alternatives will need to be considered at the project site because subsurface obstructions due to highly decomposed rock or possible weathered rock are anticipated at relatively shallow depths (i.e. less than 6 ft bgs) at three (3) out of six (6) test boring locations:

- The use of predrilling to break up the dense highly decomposed rock or other obstructions to increase post embedment for vertical and lateral support.
- The use of larger sized, heavier grade posts that will allow harder driving and could provide increased embedment and sufficient lateral capacity and uplift.
- The use of helical screw piles to achieve uplift and lateral capacities at shallower depths.

- The use of shallow spread footings or ballast foundations where adequate embedment with other foundation or installation methods cannot be achieved.

4.2.1 Driven Post Support System

As mentioned above, driving post beyond depths where very dense soils and highly decomposed rock were encountered is potentially difficult and pre-drilling will likely be needed to achieve sufficient post depth to resist the required lateral and uplift loads wherever similar conditions are encountered (anticipated in the northern area of the site). All posts should be driven to bear at sufficient depths required to provide adequate axial uplift, and lateral resistances. The pre-drilled holes shall be backfilled with granular fill or grouted in-place after installation of the piles/posts.

4.2.2 Helical Screw Support System

A helical pile system, such as that manufactured by IDEAL Manufacturing, AB Chance, Magnum Piering, or similar, having a minimum 3-inch diameter or low-displacement ground screws, such as those manufactured by TerraSmart, or similar, could be considered as an alternative to driven posts in areas where dense overburden depths are encountered less than 8 ft for support of the proposed arrays. Lateral and uplift capacities of helical piles, as well as the ability of the shaft to withstand anticipated installation torque based on subsurface conditions, should be verified by the pile manufacturer or installer. Generally speaking, additional capacities can be developed using larger diameters and helix combinations Since these piles offer little lateral resistance due to their small cross section, these piles can be installed by grouting on the exterior of the pile during the installation to provide increased lateral and uplift capacity, if required or the use of larger dimeter (2-inch to 3-inch diameter helical piles). Installation of helical piles below the auger refusal depths, where encountered, will not be feasible. Embedment into the very dense/difficult augering material may be possible, but as stated previously, will be dependent on the ability of the central shaft to withstand installation torque required to advance helices. Depths of very dense soils and auger refusal are as presented in Table 1 above and piles will not be able to penetrate below these depths Alternative to a conventional small shaft diameter helical pile, the use of a continuous flight helical pile, could be considered that generally can be drilled deeper into very dense soil conditions as compared to a conventional helical pile with larger diameter helices.

The final design should be verified by the helical pile manufacturer prior to implementation at the site. Also, the type and diameter of helix plates to be used, as well as the central bar or round pipe characteristics or that of a continuous flight helical pile should be verified by the product manufacturer based on this design capacity and anticipated torque value required for installation of the helical piles. If subsurface obstructions are encountered during installation, pre-drilling or pre-excavation will be required. If predrilling or pre-excavating, then all piles should be grouted to ensure intimate contact with surrounding soils and so not to negatively impact lateral stability.

Allowable design bearing capacities and recommended geotechnical parameters for use in design analysis, included in Tables 5 and 6 below, can be utilized for evaluation of posts or piles for support of the PV solar array, or other design analysis, as required. We recommend that lateral and uplift resistance of soils be neglected within the upper two (2) ft beneath the existing ground surface for the cultivated/topsoil soil. From a depth of 2 ft to 4 ft bgs lateral and uplift resistance of soils should be reduced by 50% to account for disturbance resulting from construction as well as to account for the negative impacts due to frost and thaw action. Allowable capacities assume a factor of safety of 2 for compression loads; a factor of safety equal to 3 was used for determining allowable uplift capacity of piles; a factor of safety equal to 1.5 should be used for transient (wind/seismic) loading conditions. The factor of safety for uplift capacity can be reduced to 2 in conjunction with pile load testing. The use of lower factors of safety is at the sole discretion and risk of the designing engineer.

Table 5. Summary of Allowable Soil Bearing Capacities (below 2 ft)

Soil Description	Relative Density	Downward Skin Friction (psf/ft*) for steel/soil	Upward Skin Friction (psf/ft *) for steel/soil	Allowable Bearing Capacity (ksf**)
SAND and SILT	"Medium Dense" to "Dense"	120	60	4
DECOMPOSED ROCK	"Very Dense"	150	75	5

* *psf/ft – pounds per square foot per foot (triangular distribution over pile length)*
** *ksf – kips per square foot*

Table 6. Summary of Unfactored Soil Parameters for Lateral Design (reduce by 50% for 2 ft to 4 ft)

Soil Description	LPILE Soil Type	Relative Density/ Consistency	Total (Submerged) Unit Weight (pcf*)	Friction Angle (degrees)	Soil Modulus Above Water Table, k (pci**)
SAND and SILT	Sand	"Medium Dense" to "Dense"	125 (NA)	32	125
DECOMPOSED ROCK	Sand	"Very Dense"	130 (NA)	34	225

* *pcf – pounds per cubic foot*
** *pci – pounds per cubic inch*

Prior to or during construction, we recommend that tension and lateral load tests be conducted on a minimum of two (2) to three (3) piles for each size or system to verify the adequacy of the design. Testing should be performed in general accordance with ASTM 3689 and ASTM 3966 or in accordance with standard practice in the industry. The test locations should coincide with the test boring locations based on the variability of the subsurface conditions. The test piles should be installed with the same means and methods used to install production piles. In the event that the means and methods or embedment depths of pile installation are revised following initial pile testing, additional pile tests should be performed to verify that sufficient resistance can be achieved with the revised means, methods, and embedment. The results should be reviewed and approved by a qualified geotechnical engineer.

4.2.3 Shallow Foundations

Shallow foundation systems such as rigid mats can be considered for support of electrical equipment or other ancillary equipment. Additionally, ballasted foundations may need to be considered for support of the proposed solar arrays where installation of helical or driven post foundations cannot achieve sufficient embedment due to shallow refusal conditions due to the presence of weathered rock. Ballast foundations for solar array support and mats supporting light equipment can be designed for an allowable bearing capacity of 3,000 psf when constructed in accordance with the general recommendations presented in the *Earthwork* section of this report. A vertical subgrade modulus of 125 pci may be used in foundation mat design. A typical allowable interface friction coefficient of 0.35 may be used for design of cast in place concrete foundations assuming that they are constructed on grade overlying the densified natural soils or for ballasted foundations constructed on-grade. Foundation subgrades for supporting electrical equipment or other ancillary structures subjected to freezing temperatures during construction and/or the life of the structure should be established at least 4 ft below adjacent grades or otherwise protected against frost action. Alternatively, to resist frost heave, light loaded mat slabs constructed at grade should be provided a coarse aggregate similar to AASHTO #57 or NYSDOT Type 2 aggregate layer (minimum 36 inches thick) below the mat foundation to reduce frost impacts. To guard against a punching type shear failure, minimum widths of continuous footings should be 24 inches.

Shallow excavations for foundation slabs and construction of utilities may encounter perched groundwater in low lying areas or during wet periods. If perched groundwater or surface runoff are encountered, sumps and pumps will be sufficient to control groundwater and provide stable working conditions.

4.3 Earthwork

Based on our understanding of the proposed construction, significant grading and earthwork operations are not anticipated unless material removal and replacement would be considered for support of equipment foundations. The following recommendations are provided based on the site soils encountered.

Any existing subsurface utilities, which conflict with the proposed development should be removed or relocated, where applicable. In areas of backfill placement and/or construction of shallow foundations, all topsoil and organic or otherwise deleterious material should be removed before foundation construction or new fill placement Any obstructions that would interfere with new foundation construction must be removed in their entirety from a foundation location. After stripping residual topsoil and excavation to the proposed bearing elevations for shallow mat foundations, the exposed subgrade areas should be vigorously densified with as large a vibratory compactor as is practical to improve overall performance and reduce impacts of settlements within the disturbed surficial soil. Loose or unstable areas identified during the course of excavation should be densified in-place or excavated and replaced with compacted load bearing fill.

The natural surficial soils are suitable for re-use as compacted fill and backfill. However, these soils contain varying fine-grained (silt) content and will be sensitive to moisture and disturbance. Therefore, they may lose considerable strength when wet or disturbed by construction equipment and could be difficult to work with during cold or wet weather. The presence of low-lying areas will be highly sensitive to disturbance when wet. Laboratory testing of representative samples indicates that the near surface in-situ soils are near their optimum moisture contents. However, some moisture conditioning of these soils should be anticipated before reuse in compacted backfills, particularly during dry or wet seasons. Once a subgrade has been prepared, construction traffic should be controlled in such a fashion as to minimize subgrade disturbance.

Imported load-bearing fill, if required, should consist of well-graded granular material similar to SW-GW as identified by the Unified Soil Classification System (USCS) which is not excessively moist and is free from ice and snow, roots, surface coatings, sod, loam, clay, rubbish, other deleterious or organic matter, and any particles larger than 4 inches in diameter. Alternatively, an AASHTO No. 57 or NYSDOT Type 2 coarse aggregate layer (minimum 24 inches thick) could be considered.

All backfills fills should be placed in layers not exceeding 8 inches loose thickness. This criterion may be modified in the field depending on the conditions present at the time of construction and on the compaction equipment used. Load-bearing fills for the support of foundations should be compacted to not less than 98% of maximum dry density (ASTM D 698). All newly placed fills and backfills, if utilized for areas of the solar array posts or piles, should be compacted to not less the 95% of maximum dry density. Fills in paved areas, if planned, or areas supporting access roads should be compacted to not less than 95% of maximum dry density. Fills in landscaped areas, including the general array area, should be compacted to at least 90% of maximum dry density.

The sidewalls of any confined excavations deeper than four (4) ft must be sloped, benched, or adequately shored per OSHA 29 CFR 1926 regulations. Trench boxes and/or sheeting could be used in conjunction with open cut slopes to permit access to confined excavations. The onsite soils are predominantly classified as Type C soils according to OSHA 29 CFR 1926. Open excavations in the natural silty and clayey soils should not be steeper than 1.5H: 1V if dry and 2H: 1V if submerged or where considerable wetness or perched water is observed.

4.4 Trench Backfill

Bedding and pipe embedment materials to be used around underground utility or electrical conduit pipes should be well graded sand or gravel conforming to the pipe manufacturer's recommendations and should be placed and compacted in accordance with project specifications, local requirements, or governing jurisdiction. General fill to be used above pipe embedment materials should be placed and compacted in accordance with the recommendations contained in this section. Shallow refusal, which infers the presence of weathered rock, was encountered onsite during the field investigation, particularly in test borings B-1 through B-3 (refer to Table 1).

These obstructions should be anticipated and, where encountered during utility excavation, must be removed entirely from within the bedding zone of all trenches prior to utility construction. Excavation of rock beyond the depth range noted will require the use of larger equipment, including, but not limited to large heavy-duty excavators, hydraulic rams, and dozers with ripper blade attachments. Trench excavations should be over-excavated to provide at least 3 to 4 inches of bedding material to provide a uniform support for utilities and electrical conduits. Where direct bury of utilities will occur, a layer of clean sand, or similar material free of rock fragments should be placed immediately over the cables to prevent damage during compaction of backfill.

Utility trenches located adjacent to footings or foundations should not extend below an imaginary 1:1 (horizontal:vertical) plane projected downward from the foundation bearing surface to the bottom edge of the trench. Where utility trenches will cross beneath footing bearing planes, the footing concrete should be deepened to encase the pipe, or the utility trench should be backfilled with sand/cement slurry or lean concrete within the foundation-bearing plane.

4.5 Gravel Access Roadways

After stripping of the existing topsoil, proposed access roads should be proof-rolled with a heavily loaded pneumatic-tired vehicle such as a loaded water truck, tri-axle dump truck, or minimum 20-ton roller in static mode, or equivalent. Loose or unstable areas, identified by significant pumping, rutting or similar deformation under wheel loads must be removed and replaced with compacted fill or aggregate material to achieve a stable subgrade prior to placing common fill for site grading, if required, or fill aggregate surfacing. A layer of a medium duty non-woven geotextile fabric meeting the requirements of NYSDOT Table 737-01E or a triaxial geogrid should be installed directly over the subgrade with adjacent rolls lapped in accordance with manufacturer's recommendations. A layer of aggregate similar in gradation to AASHTO #2 stone material should be placed directly over the geotextile/geogrid in a single 12-inch thick layer and densified using a vibratory roller until stability beneath compaction equipment is observed. To mitigate lateral displacement and reduce rutting due to continuous truck traffic during construction, it would be beneficial to place approximately one (1) inch of screenings ($^{1}/_{8}$ to ¼ inch crushed aggregate) at the surface of the AASHTO #2 layer. During construction, the access road will likely need to be occasionally re-graded and re-densified. Any electric cables crossing below the roadway should be installed in heavy duty rigid steel conduits or installed a minimum three (3) ft below finished grade to prevent damage to the cables.

4.6 Surface Drainage

Positive surface water drainage gradients at least 2% should be provided to direct surface water away from foundations and mat slabs towards suitable discharge facilities. Ponding of surface water should not be allowed on or adjacent to structures, slabs-on-grade, or pavements. Any rain runoff should be directed away from foundation and slabs-on-grade such as equipment pads, as applicable.

In addition, a sufficiently thick velocity dissipater, such as layer of coarse drainage aggregate of at least 3 inches to 4 inches in size, should be placed along water flow paths to dissipate concentrated flow of runoff water in order to minimize surface erosion.

4.7 Plans, Specifications, and Construction Review

We recommend that TRC perform a plan review of the geotechnical aspects of the project design for general conformance with our recommendations. In addition, subsurface materials encountered in the relatively small diameter, widely spaced borings may vary significantly from other subsurface materials on the site. Therefore, we also recommend that a representative of our firm observe and confirm the geotechnical specifications of the project construction. This will allow us to form an opinion about the general conformance of the project plans and construction with our recommendations. In addition, our observations during construction will enable us to note subsurface conditions that may vary from the conditions encountered during our investigation and, if needed, provide supplemental recommendations. For the above reasons, the recommendations provided in this report are based on the assumption that TRC will be retained to provide observation and testing services during construction to confirm that conditions are similar to that assumed for design and to form an opinion as to whether the work has been performed in general accordance with the project plans and specifications. If we are not retained for these services, TRC cannot assume any responsibility for any potential claims that may arise during or after construction as a result of misuse or misinterpretation of TRC's report by others. These services are not included as part of TRC's current scope of work.

4.8 Construction Observation

TRC recommends that a qualified geotechnical professional should observe the geotechnical aspects of the earthwork for general conformance with our recommendations including site preparation, selection of fill materials, pile installation, and the placement and compaction of fill. To facilitate your construction schedule and if you wish TRC to perform these services, we request sufficient notification (72 hours) for site visits. The project plans and specifications should incorporate all recommendations contained in the text of this report. These services are not included as part of TRC's current scope of work.

5.0 LIMITATIONS

This report has been prepared for Lightstar Renewables LLC, specifically for design of the proposed solar array and associated development to be constructed at the Old Myers Solar Project site located in Wappinger Falls, NY as identified herein. Transfer of this report or included information is at the sole discretion of Lightstar Renewables LLC. TRC's contractual relationship remains with Lightstar Renewables LLC and limitations stated herein remain applicable regardless of end user. The opinions, conclusions, and recommendations presented in this report have been formulated in accordance with accepted geotechnical engineering practices that exist in the area at the time this report was written. No other warranty, expressed or implied, is made or should be inferred.

The opinions, conclusions and recommendations contained in this report are based upon the information obtained from our investigation, which includes data from a limited number of widely separated discrete locations, visual observations from our site reconnaissance, and review of other geotechnical data provided to us, along with local experience and engineering judgment. An attempt has been made to provide for normal contingencies; however, the possibility remains that differing or unexpected conditions may be encountered during construction. If this should occur, or if additional or contradictory data are revealed in the future, TRC should be notified so that modifications to this report can be made, if necessary. TRC is not responsible for any conclusions or opinions drawn from the data included herein, other than those specifically stated, nor are the recommendations presented in this report intended for direct use as construction specifications.

TRC should be retained to review the geotechnical aspects of the final plans and specifications for conformance with our recommendations. The recommendations provided in this report are based on the assumption that TRC will be retained to provide observation and testing services during construction to confirm that conditions are similar to that assumed for design and to form an opinion as to whether the work has been performed in accordance with the project plans and specifications. If we are not retained for these services, TRC cannot assume any responsibility for any potential claims that may arise during or after construction as a result of misuse or misinterpretation of TRC's report by others. Furthermore, TRC will cease to be the Geotechnical Engineer-of-Record at the time another consultant is retained for follow up service to this report, if applicable.

The opinions presented in this report are valid as of the present date for the property evaluated. Changes in the condition of the property will likely occur with the passage of time due to natural processes and/or the works of man. In addition, changes in applicable standards of practice can occur as a result of legislation and/or the broadening of knowledge. Furthermore, geotechnical issues may arise that were not apparent at the time of our investigation. Accordingly, the opinions presented in this report may be invalidated, wholly or partially, by changes outside of our control. Therefore, this report is subject to review and should not be relied upon after a period of three (3) years. Similarly, this report should not be used, nor are its recommendation applicable, for any other properties or alternate developments.

We trust this report contains the information you require and thank you for the opportunity to work on this project. Please consider our firm for future geotechnical services as needed.

Sincerely,

TRC Engineers, Inc.

James P. Benjamin

James P. Benjamin, PE*
Geotechnical Project Manager
*NJ, PA

Wyatt McCart

Wyatt McCart
Geotechnical Engineer

almohd

Izzaldin Al Mohd, PhD, PE
Chief Geotechnical Engineer
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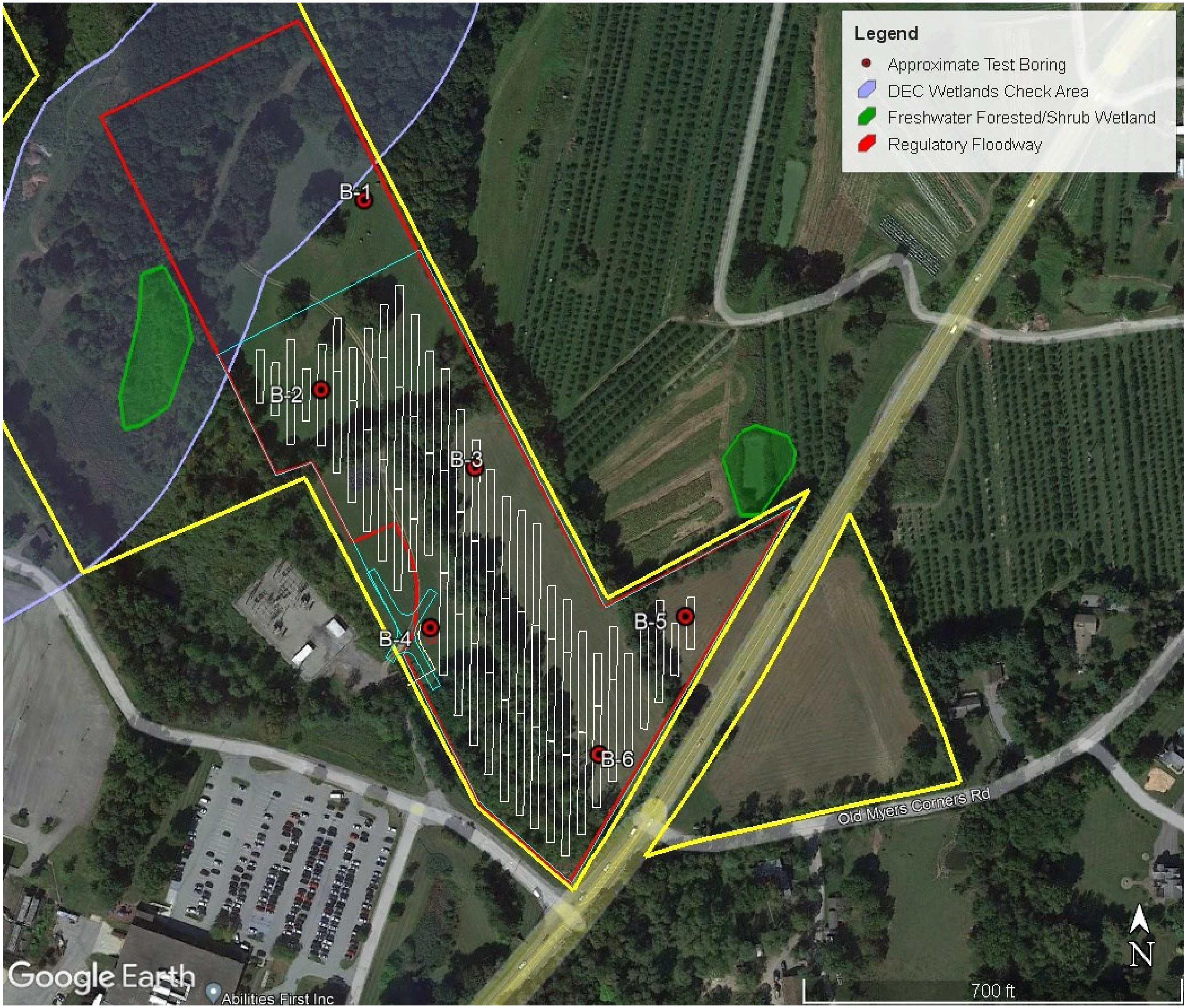
cc: J. Lazarus, TRC

FIGURES



Project No.	488729.2163
Date:	January 19, 2023
For:	Lightstar Renewables LLC

TRC
16000 Commerce Parkway, Mt. Laurel, New Jersey 08054
PH. (856) 273-1224 FAX. (856) 273-9244

APPROXIMATE TEST BORING LOCATIONS

Old Myers Solar Project

Wappinger Falls, New York

FIGURE 1

FIELD DATA

TEST BORING LOGS

TEST BORING LOG

PROJECT: OLD MYERS SOLAR
LOCATION: WAPPINGERS FALLS, NY

BORING	**B-1**
G.S. ELEV.	
FILE	488729.2163.0000
SHEET	1 OF 1

GROUNDWATER DATA			
FIRST ENCOUNTERED NE			
DEPTH	HOUR	DATE	ELAPSED TIME

METHOD OF ADVANCING BOREHOLE	
a	FROM 0.0 ' TO 2.6 '

DRILLER	C. PEDERSON
HELPER	E. MCGAURTY
INSPECTOR	W. MCCART
DATE STARTED	11/10/2022
DATE COMPLETED	11/10/2022

DEPTH	A	B	C	DESCRIPTION	REC	REMARKS
				0.2 ***TOPSOIL***		
				1.0 ***BROWN F/M/C SAND AND SILT***		DIFFICULT AUGERING 1 FT-2.1 FT
	S-1	1 1 10 32		***GRAY DRY F//M/C SAND AND SILT, SM***		
	S-2	63 50/0.1'		2.6 ***GRAVEL-SIZED ROCK FRAGMENTS (DECOMPOSED ROCK)***		
				END OF BORING AT 2.6'		
5						AUGER REFUSAL AT 2.1 FT; BORING OFFSET WITH REFUSAL AT 1.5 FT
10						
15						
20						
25						
30						
35						

OFFSET 60° NE BY 10 FT; NE=NOT ENCOUNTERED

DRN.	JJM
CKD.	JPB

NEW PROJECTS TEST BORING LOG 488729 OLD MYERS RD.GPJ SITE BLAUVELT.GDT 1/20/23

TEST BORING LOG

PROJECT: OLD MYERS SOLAR
LOCATION: WAPPINGERS FALLS, NY

BORING	B-2
G.S. ELEV.	
FILE	488729.2163.0000
SHEET	1 OF 1

GROUNDWATER DATA			
FIRST ENCOUNTERED NE			
DEPTH	HOUR	DATE	ELAPSED TIME

METHOD OF ADVANCING BOREHOLE				
a	FROM	0.0 '	TO	5.8 '

DRILLER	C. PEDERSON
HELPER	E. MCGAURTY
INSPECTOR	W. MCCART
DATE STARTED	11/10/2022
DATE COMPLETED	11/10/2022

DEPTH	A	B	C	DESCRIPTION	REC	REMARKS
				0.3 ***TOPSOIL***		
	S-1	1 2 4 4		***BROWN F/M/C SAND AND SILT, TR TO SM F/ GRAVEL***		DECOMPOSED BEDROCK ENCOUNTERED AT 5.5 FT
	S-2	6 11 13 14		4.0		
5				***BROWN F/M/C SAND, SM SILT***		BORING OFFSET 10 FT W - AUGER REFUSAL AT 4.2 FT
	S-3	10 12 11 50/0.3'		5.5		
				5.8 ***GRAY F/M SAND AND SILT (DECOMPOSED ROCK)***		
				END OF BORING AT 5.8'		
10						
15						
20						
25						
30						
35						

OFFSET 250° NE BY 10 FT; NE=NOT ENCOUNTERED

DRN.	JJM
CKD.	JPB

NEW PROJECTS TEST BORING LOG 488729 OLD MYERS RD.GPJ SITE BLAUVELT.GDT 1/20/23

TEST BORING LOG

BORING	B-3
G.S. ELEV.	
FILE	488729.2163.0000
SHEET	1 OF 1

PROJECT: OLD MYERS SOLAR

LOCATION: WAPPINGERS FALLS, NY

GROUNDWATER DATA			
FIRST ENCOUNTERED NE			
DEPTH	HOUR	DATE	ELAPSED TIME

METHOD OF ADVANCING BOREHOLE	
a	FROM 0.0 ' TO 4.3 '

DRILLER	C. PEDERSON
HELPER	E. MCGAURTY
INSPECTOR	W. MCCART
DATE STARTED	11/10/2022
DATE COMPLETED	11/10/2022

DEPTH	A	B	C	DESCRIPTION	REC	REMARKS
				0.3 ***TOPSOIL***		
	S-1	1 1 2 2		***BROWN F/M/C SAND AND SILT***		AUGER REFUSAL AT 1.5 FT- PROBABLE BOULDER
	S-2	5 8 13 25		3.5 ***GRAY F/M/C SAND AND SILT, TR TO SM GRAVEL-SIZED ROCK FRAGMENTS (DECOMPOSED ROCK)***		AUGER REFUSAL AT 3.8 FT-OFFSET 180° S BY 10 FT
5	S-3	50/0.3'		4.3		AUGER REFUSAL AT 2.7 FT-OFFSET 240° SW BY 10 FT
				END OF BORING AT 4.3'		
10						
15						
20						
25						
30						
35						

NE=NOT ENCOUNTERED

DRN.	JJM
CKD.	JPB

TEST BORING LOG

PROJECT: OLD MYERS SOLAR

LOCATION: WAPPINGERS FALLS, NY

BORING	B-4
G.S. ELEV.	
FILE	488729.2163.0000
SHEET	1 OF 1

GROUNDWATER DATA

FIRST ENCOUNTERED 2.5 '

DEPTH	HOUR	DATE	ELAPSED TIME
NE	NR	11/10	0 HR

METHOD OF ADVANCING BOREHOLE

a	FROM	0.0 '	TO	10.0 '
d	FROM	10.0 '	TO	13.1 '

DRILLER	C. PEDERSON
HELPER	E. MCGAURTY
INSPECTOR	W. MCCART
DATE STARTED	11/10/2022
DATE COMPLETED	11/10/2022

DEPTH	A	B	C	DESCRIPTION	REC	REMARKS
				0.3 ***TOPSOIL***		
	S-1	1 2 2 3		***BROWN TO ORANGE BROWN F/MC SAND AND SILT, TR TO SM GRAVEL***		
	S-2	6 2 9 10		4.0		
5	S-3	8 9 9 7		***DARK BROWN F/M/C SAND, SM SILT, TR TO SM F/C GRAVEL (DRY TO MOIST)***		
	S-4	7 8 10 10		8.5		
10	S-5	8 20 25 22		***BROWN F/M/C SAND AND SILT, SM F/C GRAVEL (MOIST)***		
	S-6	50/0.1'		13.0		
				13.1 ***GRAY GRAVEL-SIZED ROCK FRAGMENTS (DECOMPOSED BEDROCK)***		
15				***END OF BORING AT 13.1'***		
20						
25						
30						
35						

NE=NOT ENCOUNTERED

DRN.	JJM
CKD.	JPB

TEST BORING LOG

PROJECT: OLD MYERS SOLAR
LOCATION: WAPPINGERS FALLS, NY

BORING	**B-5**
G.S. ELEV.	
FILE	488729.2163.0000
SHEET	1 OF 1

GROUNDWATER DATA

FIRST ENCOUNTERED NE

DEPTH	HOUR	DATE	ELAPSED TIME

METHOD OF ADVANCING BOREHOLE

a	FROM	0.0 '	TO	10.0 '
d	FROM	10.0 '	TO	14.8 '

DRILLER	C. PEDERSON
HELPER	E. MCGAURTY
INSPECTOR	W. MCCART
DATE STARTED	11/10/2022
DATE COMPLETED	11/10/2022

DEPTH	A	B	C	DESCRIPTION	REC	REMARKS
			0.2	***TOPSOIL***		
	S-1	3 5 5 8		***BROWN GRAVELY F/M/C SAND, SM SILT (MOIST)***		
	S-2	9 14 10 16	4.0			
5	S-3	20 36 29 20				
	S-4	19 21 31 30				
10	S-5	26 30 145 61		***BROWN GRAVELLY F/M/C SAND, SM SILT (MOIST)***		
15	S-6	19 20 30 50/0.3'	14.8			
				END OF BORING AT 14.8'		
20						
25						
30						
35						

NE=NOT ENCOUNTERED

DRN.	JJM
CKD.	JPB

NEW PROJECTS TEST BORING LOG 488729 OLD MYERS RD.GPJ SITE BLAUVELT.GDT 1/20/23

TEST BORING LOG

PROJECT: OLD MYERS SOLAR
LOCATION: WAPPINGERS FALLS, NY

BORING	**B-6**
G.S. ELEV.	
FILE	488729.2163.0000
SHEET	1 OF 1

GROUNDWATER DATA			
FIRST ENCOUNTERED NE			
DEPTH	HOUR	DATE	ELAPSED TIME

METHOD OF ADVANCING BOREHOLE				
a	FROM	0.0 '	TO	10.0 '
d	FROM	10.0 '	TO	10.5 '

DRILLER	C. PEDERSON
HELPER	E. MCGAURTY
INSPECTOR	W. MCCART
DATE STARTED	11/10/2022
DATE COMPLETED	11/10/2022

DEPTH	A	B	C	DESCRIPTION	REC	REMARKS
				0.4 ***TOPSOIL***		
	S-1	1 1 2 1		***BROWN GRAVELLY F/M/C SAND, SM SILT*** 2.0		
	S-2	4 6 8 11				
5				***BROWN F/M/C SAND, SM SILT, SM F/C GRAVEL (MOIST TO WET)***		
	S-3	10 13 12 9		7.3		
	S-4	7 6 6 8		***BROWN F/M/C SAND AND SILT, SM GRAVEL (MOIST TO WET)*** 9.4		
10	S-5	5 6 7 9		***GRAY F/M SAND AND SILT, SM F/C GRAVEL-SIZED ROCK FRAGMENTS***		
	S-6	50/0'		10.5		AUGER REFUSAL AT 10.5 FT
				END OF BORING AT 10.5'		
15						
20						
25						
30						
35						

NE=NOT ENCOUNTERED

DRN.	JJM
CKD.	JPB

NEW PROJECTS TEST BORING LOG 488729 OLD MYERS RD.GPJ SITE BLAUVELT.GDT 1/20/23

KEY TO SYMBOLS

Symbol Description

Strata symbols

Symbol	Description
	Highly Weathered or Decomposed Rock
	Silty Sand
	Topsoil

Symbol Description

Misc. Symbols

Symbol	Description
	Water table first encountered
	Water table first reading after drilling
	Water table second reading after drilling
	Water table third reading after drilling
NR	Not Recorded
MH	Moh's Hardness

Sample Type

Symbol	Description
	Split Barrel

Lab Symbols

FINES = Fines %

LL = Liquid Limit %

PI = Plasticity Index %

U_c = Unconfined Compressive Strength

W/V = Unit Weight

Notes:

COLUMN A) Soil sample number.

COLUMN B) FOR SOIL SAMPLE (ASTM D 1586): indicates number of blows obtained for each 6 ins. penetration of the standard split-barrel sampler. FOR ROCK CORING (ASTM D2113): indicates percent recovery (REC) per run and rock quality designation (RQD). RQD is the % of rock pieces that are 4 ins. or greater in length in a core run.

COLUMN C) Strata symbol as assigned by the geotechnical engineer.

DESCRIPTION) Description including color, texture and classification of subsurface material as applicable (see Descriptive Terms). Estimated depths to bottom of strata as interpolated from the borings are also shown.

DESCRIPTIVE TERMS: F = fine M = medium C = coarse

RELATIVE PROPORTIONS:

-Descriptive Term-	-Symbol-	-Est. Percentages-
Trace	TR	1-10
Trace to Some	TR to SM	10-15
Some	SM	15-30
Silty, Sandy, Clayey, Gravelly	-	30-40
And	and	40-50

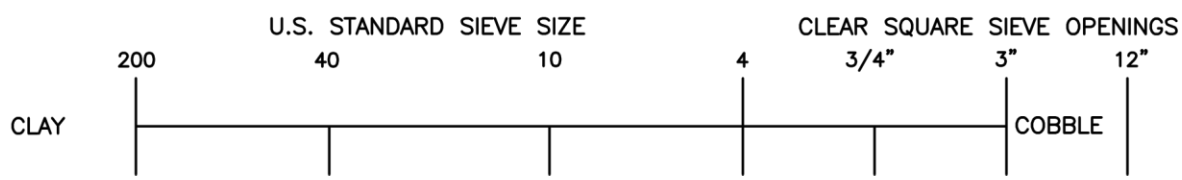
REMARKS) Special conditions or test data as noted during investigation. Note that W.O.P. indicates water observation pipes.

* Free water level as noted may not be indicative of daily, seasonal, tidal, flood, and/or long term fluctuations.

SILTS AND CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

PRIMARY DIVISIONS			SOIL TYPE	SECONDARY DIVISIONS
COARSE GRAINED SOILS MORE THAN HALF OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVELS MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS (Less than 5% Fines)	GW	Well graded gravels, gravel–sand mixtures, little or no fines
			GP	Poorly graded gravels or gravel–sand mixtures, little or no fines
		GRAVEL WITH FINES	GM	Silty gravels, gravel–sand–silt mixtures, plastic fines
			GC	Clayey gravels, gravel–sand–clay mixtures, plastic fines
	SANDS MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS (Less than 5% Fines)	SW	Well graded sands, gravelly sands, little or no fines
			SP	Poorly graded sands or gravelly sands, little or no fines
		SANDS WITH FINES	SM	Silty sands, sand–silt–mixtures, non–plastic fines
			SC	Clayey sands, sand–clay mixtures, plastic fines
FINE GRAINED SOILS MORE THAN HALF OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT IS LESS THAN 50 %		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	Organic silts and organic silty clays of low plasticity
	SILTS AND CLAYS LIQUID LIMIT IS GREATER THAN 50 %		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS			PT	Peat and other highly organic soils

DEFINITION OF TERMS



METHODS AND TOOLS FOR **ADVANCING BOREHOLES**

a - Continuous Sampling

b - Finger type rotary cutter head 6 in. diameter (open hole)

d - Drilled in casing 3 3/8 in. ID; 8 in. OD (hollow-stem auger)

e - Drilled in casing 2 1/2 in. ID; 6 1/4 in. OD (hollow-stem auger)

f - Driven flush joint casing (BW) - 2 3/8 in. ID; 2 7/8 in. OD (300 lb. hammer, 18 in. drop)

g - Driven flush joint casing (NW) - 3 in. ID; 3 1/2 in. OD (300 lb. hammer, 18 in. drop)

h - Tricone Roller Bit - 2 3/8 in. or 2 7/8 in.

i - Drilling Mud (Slurry Method)

c_1 - Double tube diamond core barrel (BX) : core size: 1.6 in.
hole size: 2.36 in.

c_2 - Double tube diamond core barrel (NX) : core size: 2.0 in.
hole size: 2.98 in.

c_3 - 4 in. thin walled diamond bit

c_4 - 6 in. thin walled diamond bit

METHODS AND TOOLS FOR **TESTING AND SAMPLING SOILS AND/OR ROCKS**

Penetration test and split-barrel sampling of soils, ASTM D1586

140 lb. hammer, 30 in. drop. recording number of blows obtained for each 6 in. penetration usually for a total of 18 in. penetration of the standard 2 in. O.D. and 1 3/8 in. I.D. split-barrel sampler. Penetration resistance (N) is the total number of blows required for the second and third 6 in. penetration.

Thin walled tube sampling, ASTM D1587

Samples are obtained by pressing thin-walled steel, brass or aluminum tubes into soil. Standard thin-walled steel tubes:

O.D. in.	2	3
I.D. in.	1.94	2.87

Diamond core drilling, ASTM D2113

Diamond core drilling is used to recover intact samples of rock and some hard soils generally with the use of a:

BWM double tube core barrel
NWM double tube core barrel

FIELD RESISTIVITY DATA

TRC Engineers, Inc.
Field Resistivity Testing
Wenner Method

Project:	Old MyersSolar	Project No.:	488729.2163
Location:	Wappinger Falls, NY	Client:	Lightstar Renewbles
Site Conditions:	_X_ Dry ___Wet __ Ideal	Date Completed:	11/8/2022
Ambient Temperature:	54° F	Operator:	W. McCart
Rain storms previous day- No		Helper:	NA

Test	Electrode Spacing (ft)	Resistance ф (Ohms)	Apparent Resistivity (Ohm-cm)	Remarks
Line 1	2.5	173	82,824	
	5.0	61.7	59,078	
	10.0	21.2	40,598	
	20.0	9.19	35,198	
	25.0	7.99	38,252	

Line 1 Direction:

	N-S
X	NE_SW
	E-W
	NW-SE

Test Location B-4

TRC Engineers, Inc.
Field Resistivity Testing
Wenner Method

Project:	Old Myers Solar	Project No.:	488729.2163
Location:	Wappinger Falls, NY	Client:	Lightstar Renewbles
Site Conditions:	_X_ Dry ___Wet __ Ideal	Date Completed:	11/8/2022
Ambient Temperature:	54° F	Operator:	W. McCart
Rain storms previous day- No		Helper:	NA

Test	Electrode Spacing (ft)	Resistance ф (Ohms)	Apparent Resistivity (Ohm-cm)	Remarks
Line 2	2.5	169	80,909	
	5.0	64.1	61,376	
	10.0	21.2	40,598	
	20.0	8.31	31,827	
	25.0	7.01	33,560	

Line 2 Direction:

	N-S
	NE_SW
	E-W
X	NW-SE

Test Location B-4

TRC Engineers, Inc.
Field Resistivity Testing
Wenner Method

Project:	Old Myers Solar	Project No.:	488729.2163
Location:	Wappinger Falls, NY	Client:	Lightstar Renewbles
Site Conditions:	_X_ Dry ___Wet __ Ideal	Date Completed:	11/8/2022
Ambient Temperature:	55° F	Operator:	W. McCart
Rain storms previous day- No		Helper:	NA

Test	Electrode Spacing (ft)	Resistance Φ (Ohms)	Apparent Resistivity (Ohm-cm)	Remarks
Line 1	2.5	458	219,268	
	5.0	242	231,715	
	10.0	96.0	183,840	
	20.0	27.9	106,857	
	25.0	19.2	91,920	

Line 1 Direction:
- ______ N-S
- X NE_SW
- ______ E-W
- ______ NW-SE

Test Location B-1

TRC Engineers, Inc.
Field Resistivity Testing
Wenner Method

Project:	Old MyersSolar	Project No.:	488729.2163
Location:	Wappinger Falls, NY	Client:	Lightstar Renewbles
Site Conditions:	_X_ Dry ___Wet __ Ideal	Date Completed:	11/8/2022
Ambient Temperature:	55° F	Operator:	W. McCart
Rain storms previous day- No		Helper:	NA

Test	Electrode Spacing (ft)	Resistance Φ (Ohms)	Apparent Resistivity (Ohm-cm)	Remarks
Line 2	2.5	557	266,664	
	5.0	279	267,143	
	10.0	109	208,735	
	20.0	36.0	137,880	
	25.0	28.2	135,008	

Line 2 Direction:
- ______ N-S
- ______ NE_SW
- ______ E-W
- X NW-SE

Test Location B-1

LABORATORY DATA

SUMMARY OF LABORATORY TEST DATA

Project Name: Old Meyers Solar
Wappinger Falls, NY
Client Name: Lightstar Renewables, LLC
TRC Project #: 488729.2163

SAMPLE IDENTIFICATION			Soil Group (USCS System)	Moisture Content (%)	GRAIN SIZE DISTRIBUTION				PLASTICITY			
Source#	Sample #	Depth (ft)			Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)
Composite	BULK	0.0-5.0	ML	19.0	14.3	35.1	50.6		26	23	3	-1.3
B-2	S-2	2.0-4.0	SM	10.1	13.2	37.1	49.7		-	-	-	-
B-4	S-2	2.0-4.0	SM	12.8	12.0	39.7	48.3		-	-	-	-
B-4	S-5	8.0-10.0	SM	10.9	20.7	37.1	42.2		-	-	-	-
B-5	S-2	2.0-4.0	SM	10.4	30.0	44.2	25.8		-	-	-	-
B-5	S-5	8.0-10.0	SM	6.9	32.2	52.1	15.7		-	-	-	-
B-6	S-2	2.0-4.0	SM	8.7	34.0	48.9	17.1		-	-	-	-

DRAWN BY: TBT 01/03/23

CHECKED BY: JPB 01/03/23

SUMMARY OF LABORATORY TEST DATA

Project Name: Old Meyers Solar
Wappinger Falls, NY
Client Name: Lightstar Renewables, LLC
TRC Project #: 488729.2163

SAMPLE IDENTIFICATION			Soil Group (USCS System)	Moisture Content (%)	GRAIN SIZE DISTRIBUTION				PLASTICITY			
Source#	Sample #	Depth (ft)			Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index (%)
B-6	S-5	8.0-10.0	SM	9.7	21.5	38.5	40.0		-	-	-	-

DRAWN BY: TBT 01/03/23

CHECKED BY: JPB 01/03/23

SUMMARY OF LABORATORY TEST DATA

Project Name: Old Meyers Solar
Wappinger Falls, NY
Client Name: Lightstar Renewables, LLC
TRC Project #: 488729.2163

COMPACTION & THERMAL RESISTIVITY RESULTS										
Specimen Identification			**Compaction Characteristics**			**Thermal Resistivity (°C-cm/W)**				
Source #	Sample #	Depth (ft)	Type of Test	Maximum Density (PCF)	Optimum Moisture Content (%)	Wet	Dry	Moisture Content (%)	Dry Density (pcf)
Composite	BULK	0.0-5.0	D698	115.3(1)	13.1(1)	46.6	187.2	16.3(2)	101.1(2)

Notes:

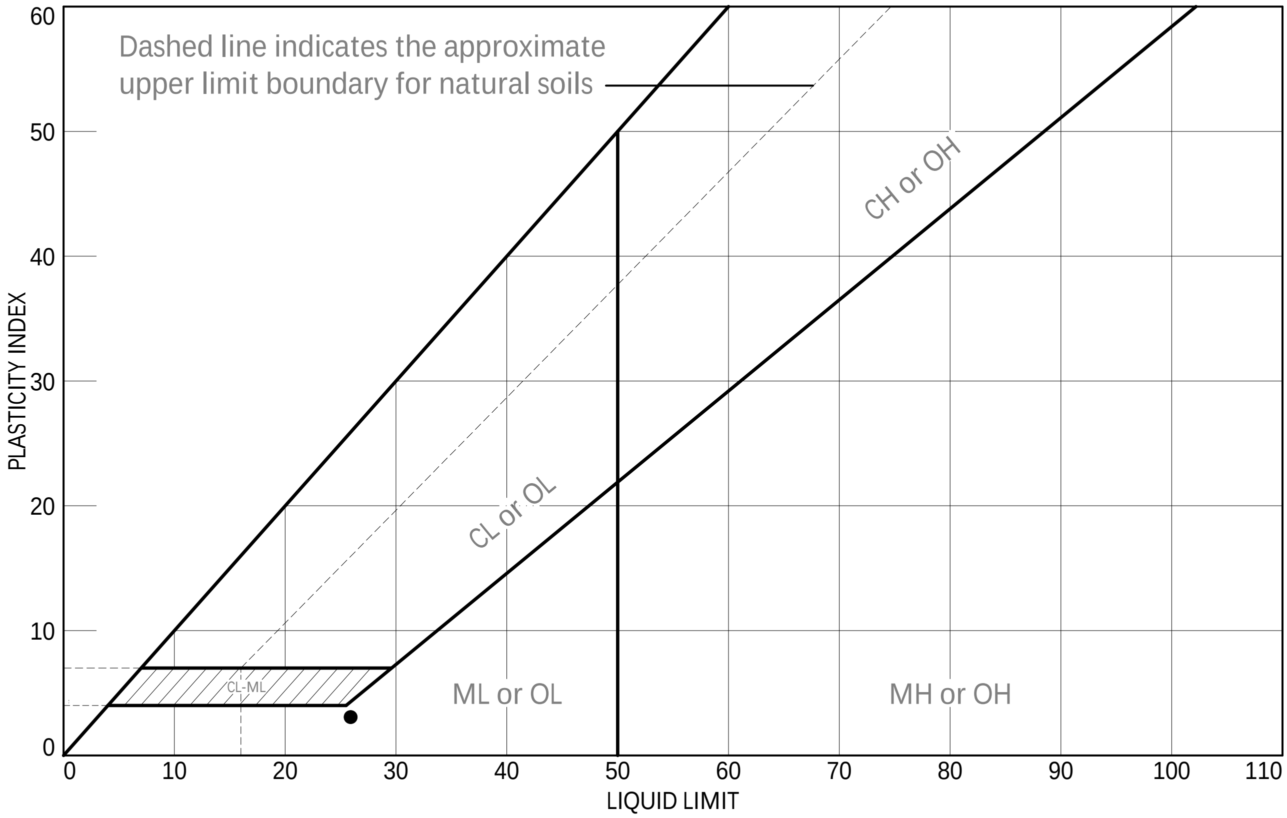
(1) Rock Corrected Value

(2) Sample was remolded at approximately 2% above the optimum moisture content and approximately 90% of the maximum dry density before the rock corrected value was applied due to the high percentage of gravel larger than 1/6th of the diameter of the cylinder (6 in.) used for testing.

DRAWN BY: TBT 01/03/23

CHECKED BY: JPB 01/03/23

LIQUID AND PLASTIC LIMITS TEST REPORT

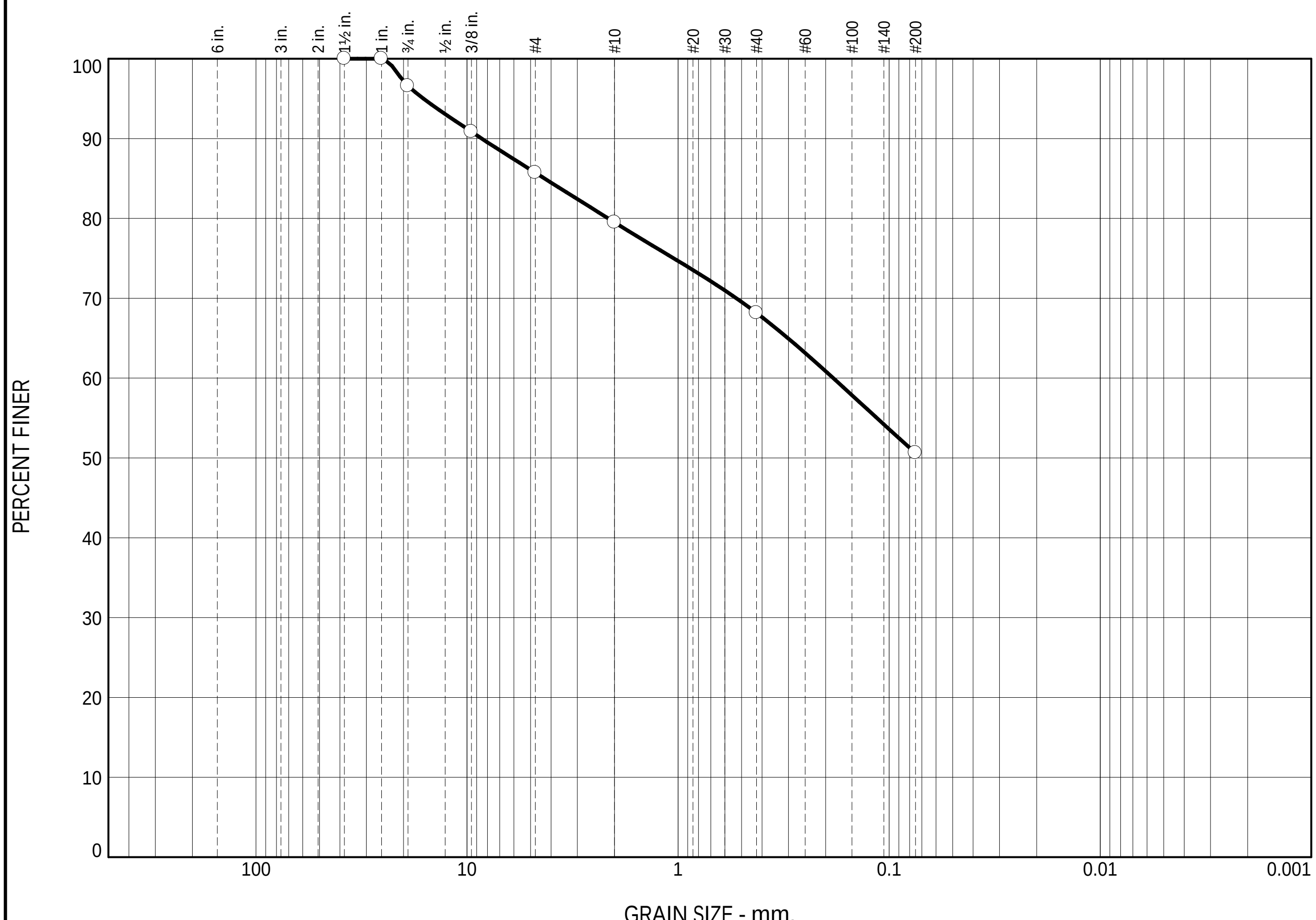


SOIL DATA									
	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	LIQUIDITY INDEX	USCS
●	COMPOSITE	BULK	0.0-5.0 FT	19.0	23	26	3	-1.3	ML

TRC
Engineers, Inc.
Mt. Laurel, NJ

Client: LIGHTSTAR RENEWABLES, LLC
Project: OLD MEYERS SOLAR
WAPPINGER FALLS, NY
Project No.: 488729.2163
Figure 1

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	3.4	10.9	6.2	11.3	17.6	50.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	26	23	4.2956	0.1838						

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ BROWN SANDY SILT	12/23/22	ML	19.0

Project No. 488729.2163 Client: LIGHTSTAR RENEWABLES, LLC
Project: OLD MEYERS SOLAR
WAPPINGER FALLS, NY
○ Source of Sample: COMPOSITE Depth: 0.0-5.0 FT Sample Number: BULK

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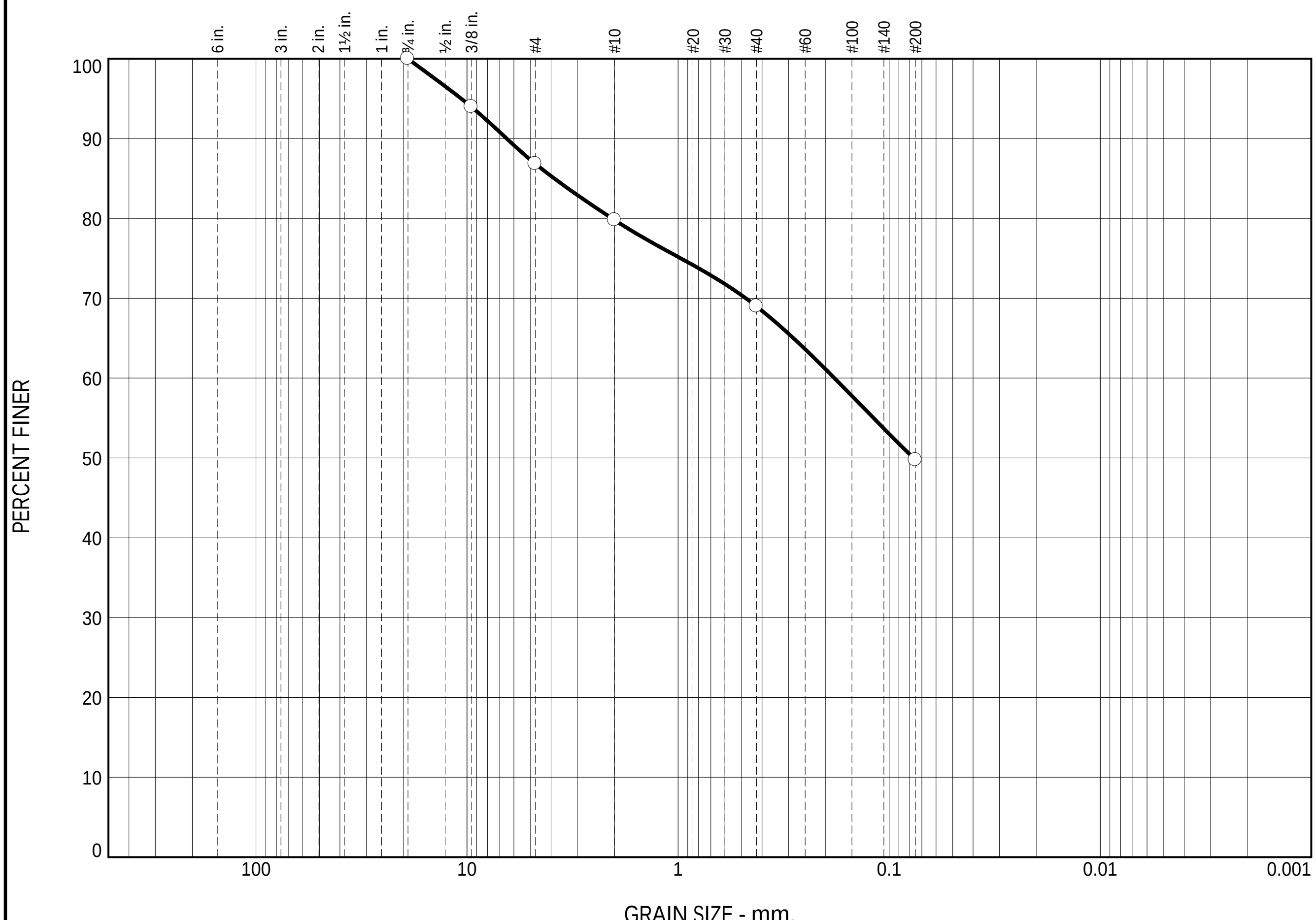
Remarks:
○SAMPLE DESCRIPTION
BASED ON USCS
F.M.=1.77

Figure 2

Tested By: OA 12/23/22 Checked By: JPB 01/03/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	13.2	7.0	10.8	19.3	49.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			3.8569	0.1815	0.0768					

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ BROWN SILTY SAND	12/22/22	SM	10.1

Project No. 488729.2163 Client: LIGHTSTAR RENEWABLES, LLC
Project: OLD MEYERS SOLAR
WAPPINGER FALLS, NY
○ Source of Sample: B-2 Depth: 2.0-4.0 FT Sample Number: S-2

Remarks:
○SAMPLE DESCRIPTION BASED ON USCS & VISUAL CLASSIFICATION
F.M.=1.67

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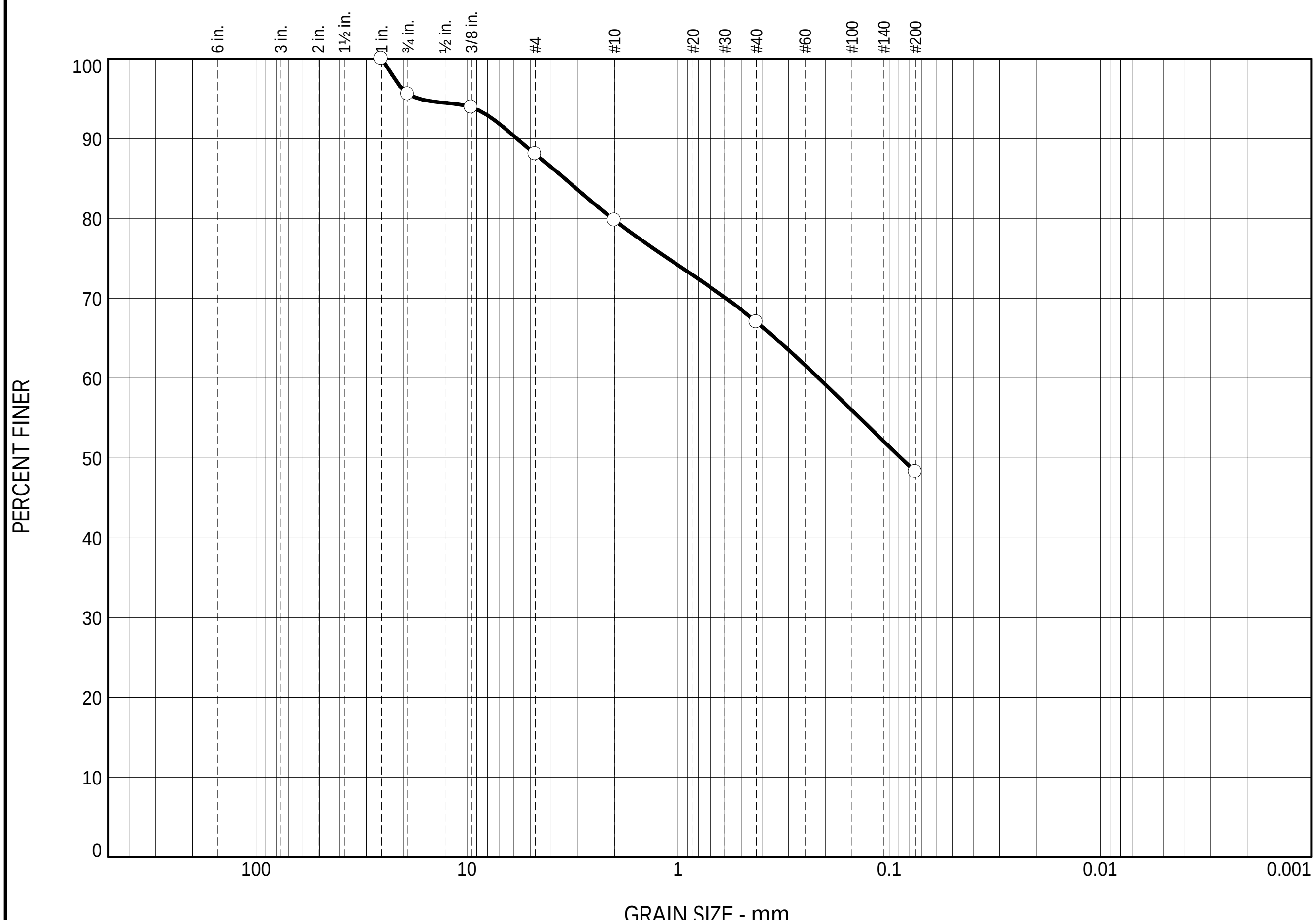
Figure 3

Tested By: JC 12/22/22 Checked By: JPB 01/03/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	4.4	7.6	8.2	12.8	18.7	48.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			3.4476	0.2155	0.0880					

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ BROWN SILTY SAND	12/22/22	SM	12.8

Project No. 488729.2163 Client: LIGHTSTAR RENEWABLES, LLC
Project: OLD MEYERS SOLAR
WAPPINGER FALLS, NY
○ Source of Sample: B-4 Depth: 2.0-4.0 FT Sample Number: S-2

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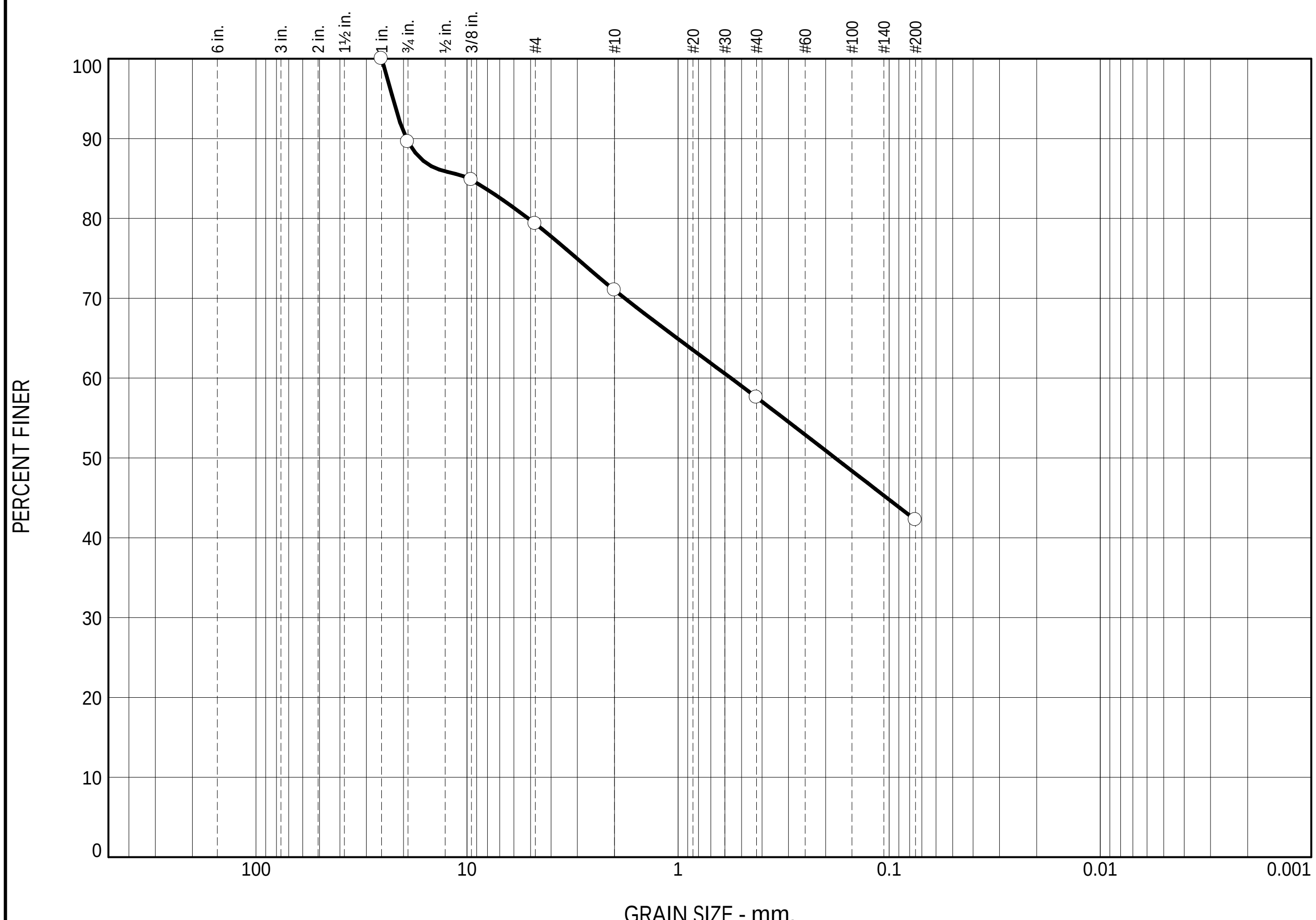
Remarks:
○SAMPLE DESCRIPTION BASED ON USCS & VISUAL CLASSIFICATION
F.M.=1.76

Figure 4

Tested By: JC 12/22/22 Checked By: JPB 01/03/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	10.4	10.3	8.3	13.4	15.4	42.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			9.7972	0.5622	0.1801					

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ BROWN SILTY SAND WITH GRAVEL	12/23/22	SM	10.9

Project No. 488729.2163 Client: LIGHTSTAR RENEWABLES, LLC
Project: OLD MEYERS SOLAR
WAPPINGER FALLS, NY
○ Source of Sample: B-4 Depth: 8.0-10.0 FT Sample Number: S-5

Remarks:
○SAMPLE DESCRIPTION BASED ON USCS & VISUAL CLASSIFICATION
F.M.=2.44

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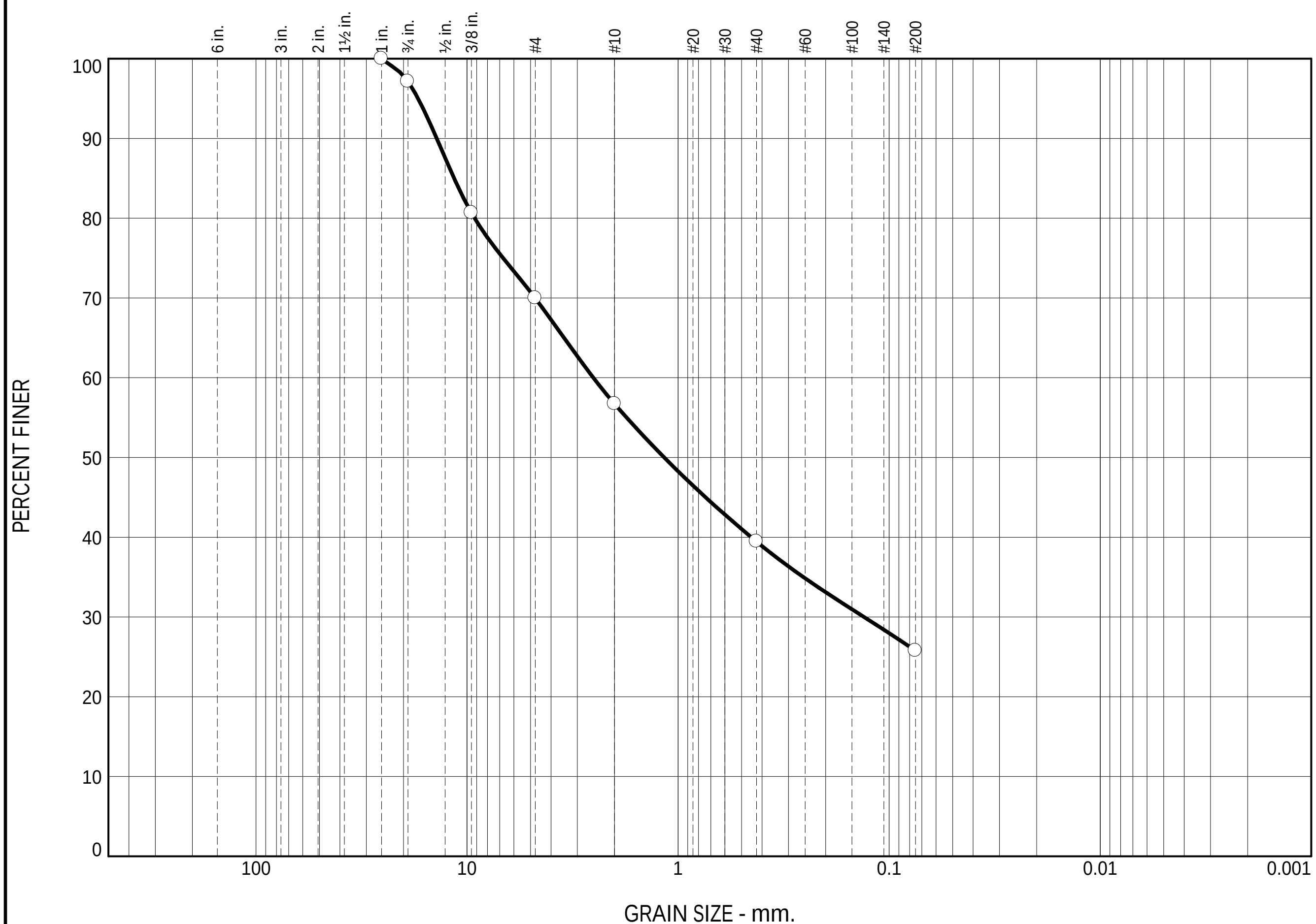
Figure 5

Tested By: JC 12/23/22 Checked By: JPB 01/03/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	2.8	27.2	13.3	17.2	13.7	25.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			11.5060	2.5201	1.1632	0.1315				

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ BROWN SILTY SAND WITH GRAVEL	12/23/22	SM	10.4

Project No. 488729.2163 Client: LIGHTSTAR RENEWABLES, LLC

Project: OLD MEYERS SOLAR

WAPPINGER FALLS, NY

○ Source of Sample: B-5 Depth: 2.0-4.0 FT Sample Number: S-2

Remarks:

○SAMPLE DESCRIPTION BASED ON USCS & VISUAL CLASSIFICATION

F.M.=3.33

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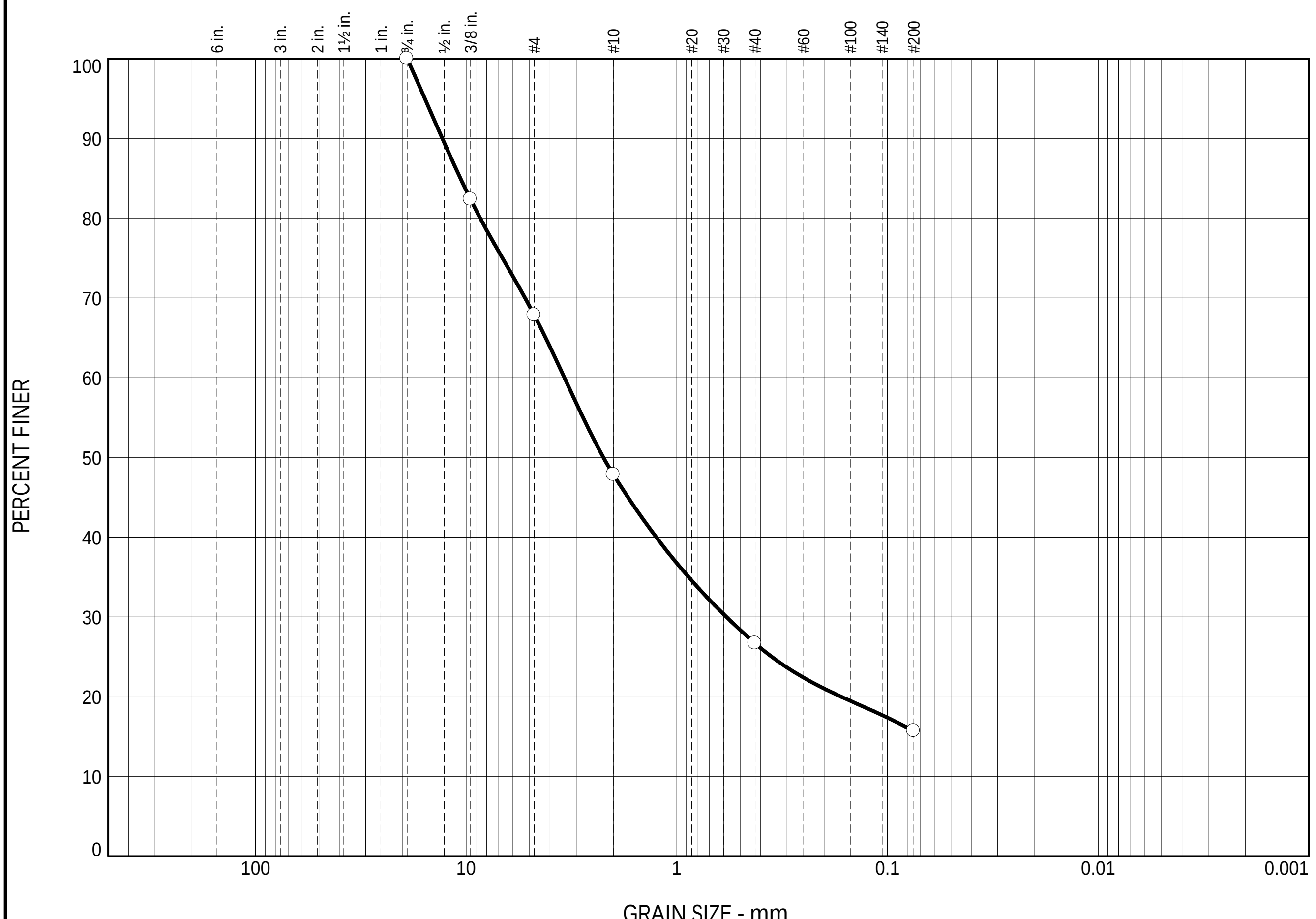
Figure 6

Tested By: JC 12/23/22 Checked By: JPB 01/03/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	32.2	20.0	21.1	11.0	15.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			10.6434	3.4163	2.2323	0.5817				

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ BROWN SILTY SAND WITH GRAVEL	12/23/22	SM	6.9

Project No. 488729.2163 Client: LIGHTSTAR RENEWABLES, LLC
Project: OLD MEYERS SOLAR
WAPPINGER FALLS, NY
○ Source of Sample: B-5 Depth: 8.0-10.0 FT Sample Number: S-5

Remarks:
○SAMPLE DESCRIPTION BASED ON USCS & VISUAL CLASSIFICATION
F.M.=3.86

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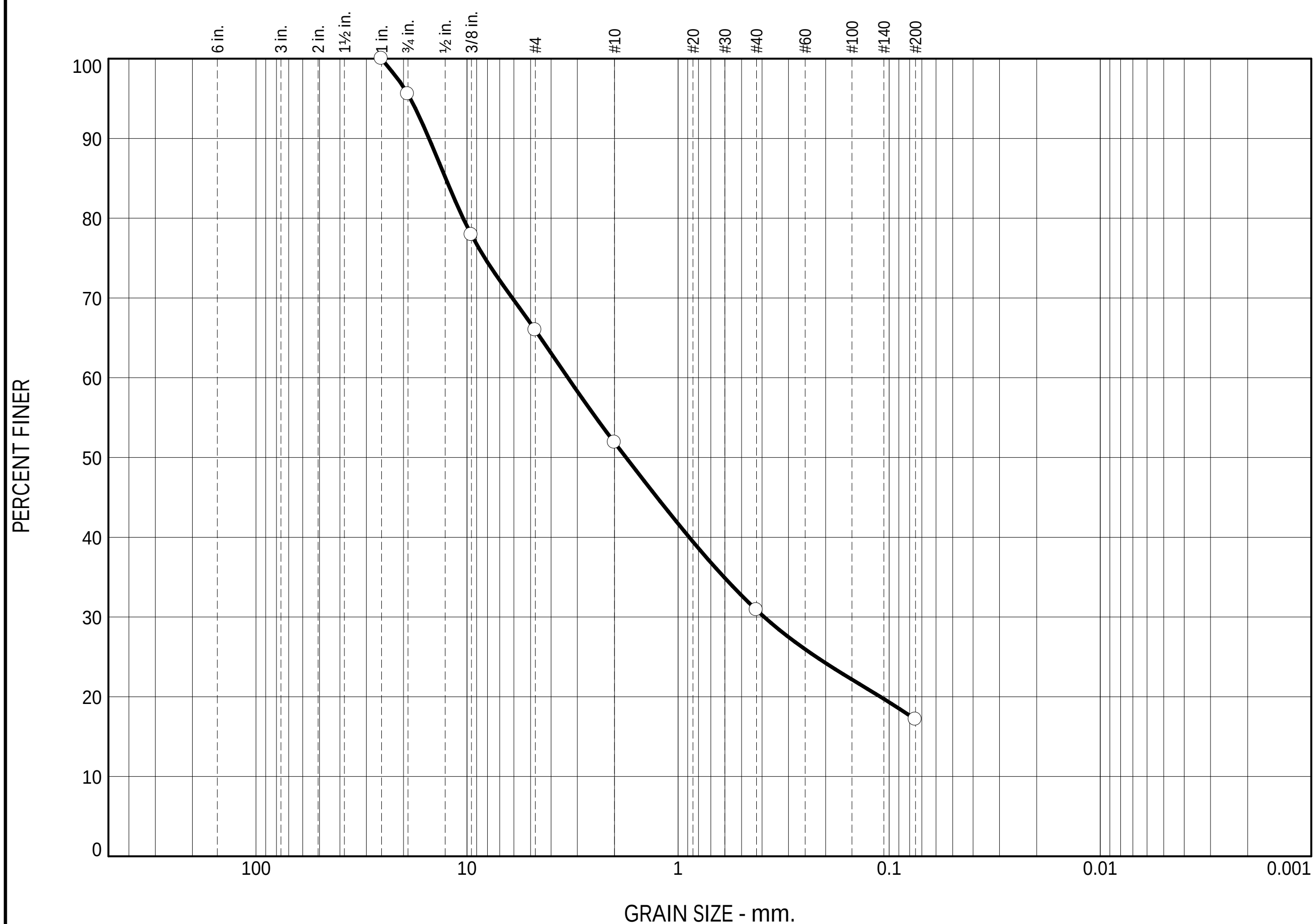
Figure 7

Tested By: JC 12/23/22 Checked By: JPB 01/03/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	4.5	29.5	14.1	21.0	13.8	17.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			12.6223	3.3279	1.7641	0.3908				

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ BROWN SILTY SAND WITH GRAVEL	12/22/22	SM	8.7

Project No. 488729.2163 Client: LIGHTSTAR RENEWABLES, LLC
Project: OLD MEYERS SOLAR
WAPPINGER FALLS, NY
○ Source of Sample: B-6 Depth: 2.0-4.0 FT Sample Number: S-2

Remarks:
○SAMPLE DESCRIPTION BASED ON USCS & VISUAL CLASSIFICATION
F.M.=3.78

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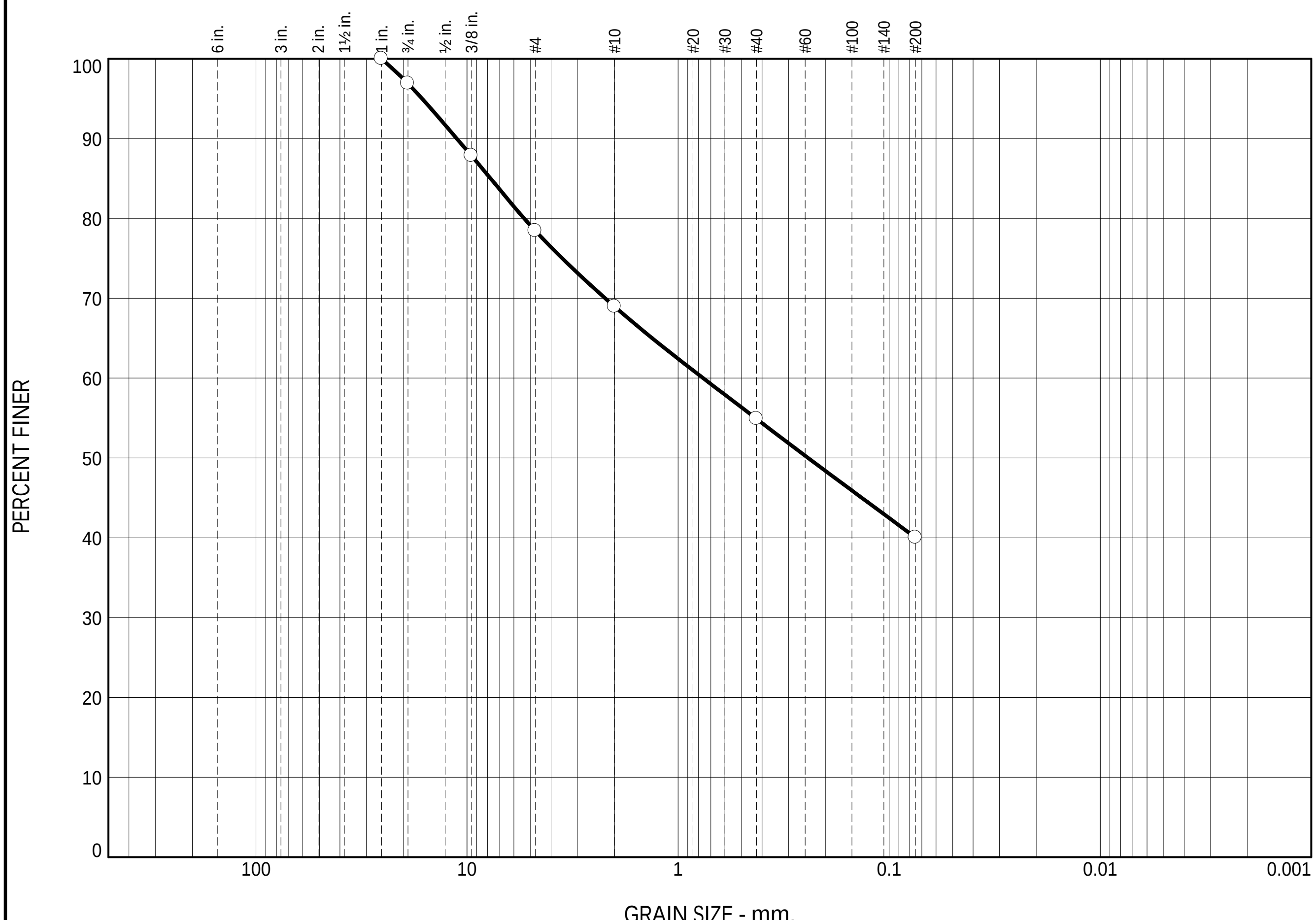
Figure 8

Tested By: JC 12/22/22 Checked By: JPB 01/03/23

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	3.1	18.4	9.5	14.1	14.9	40.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			7.7311	0.7610	0.2421					

MATERIAL DESCRIPTION	TEST DATE	USCS	NM
○ BROWN-GRAY SILTY SAND WITH GRAVEL	12/22/22	SM	9.7

Project No. 488729.2163 Client: LIGHTSTAR RENEWABLES, LLC
Project: OLD MEYERS SOLAR
WAPPINGER FALLS, NY
○ Source of Sample: B-6 Depth: 8.0-10.0 FT Sample Number: S-5

Remarks:
○SAMPLE DESCRIPTION BASED ON USCS & VISUAL CLASSIFICATION
F.M.=2.47

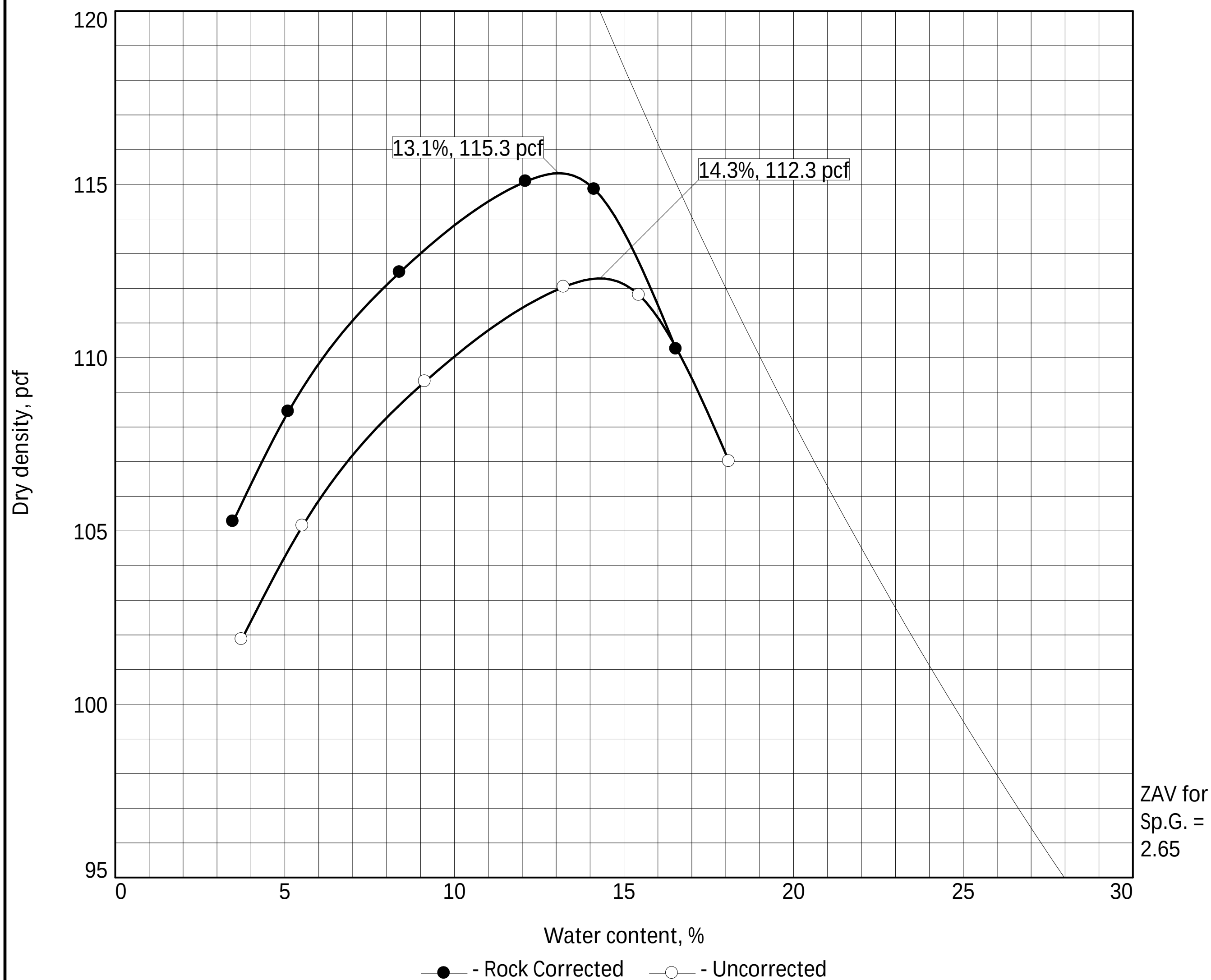
TRC Engineers, Inc.

Mt. Laurel, NJ

Figure 9

Tested By: JC 12/22/22 Checked By: JPB 01/03/23

COMPACTION TEST REPORT



Test specification: ASTM D 698-12 Method B Standard
ASTM D4718-15 Oversize Corr. Applied to Each Test Point

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in.	% < No.200
	USCS	AASHTO						
0.0-5.0 FT	ML	A-4(0)	19.0		26	3	9.1	50.6

ROCK CORRECTED TEST RESULTS	UNCORRECTED	MATERIAL DESCRIPTION
Maximum dry density = 115.3 pcf	112.3 pcf	BROWN SANDY SILT
Optimum moisture = 13.1 %	14.3 %	

Project No. 488729.2163 Client: LIGHTSTAR RENEWABLES, LLC
Project: OLD MEYERS SOLAR
WAPPINGER FALLS, NY Date:
○ Source of Sample: COMPOSITE Sample Number: BULK

TRC Engineers, Inc.

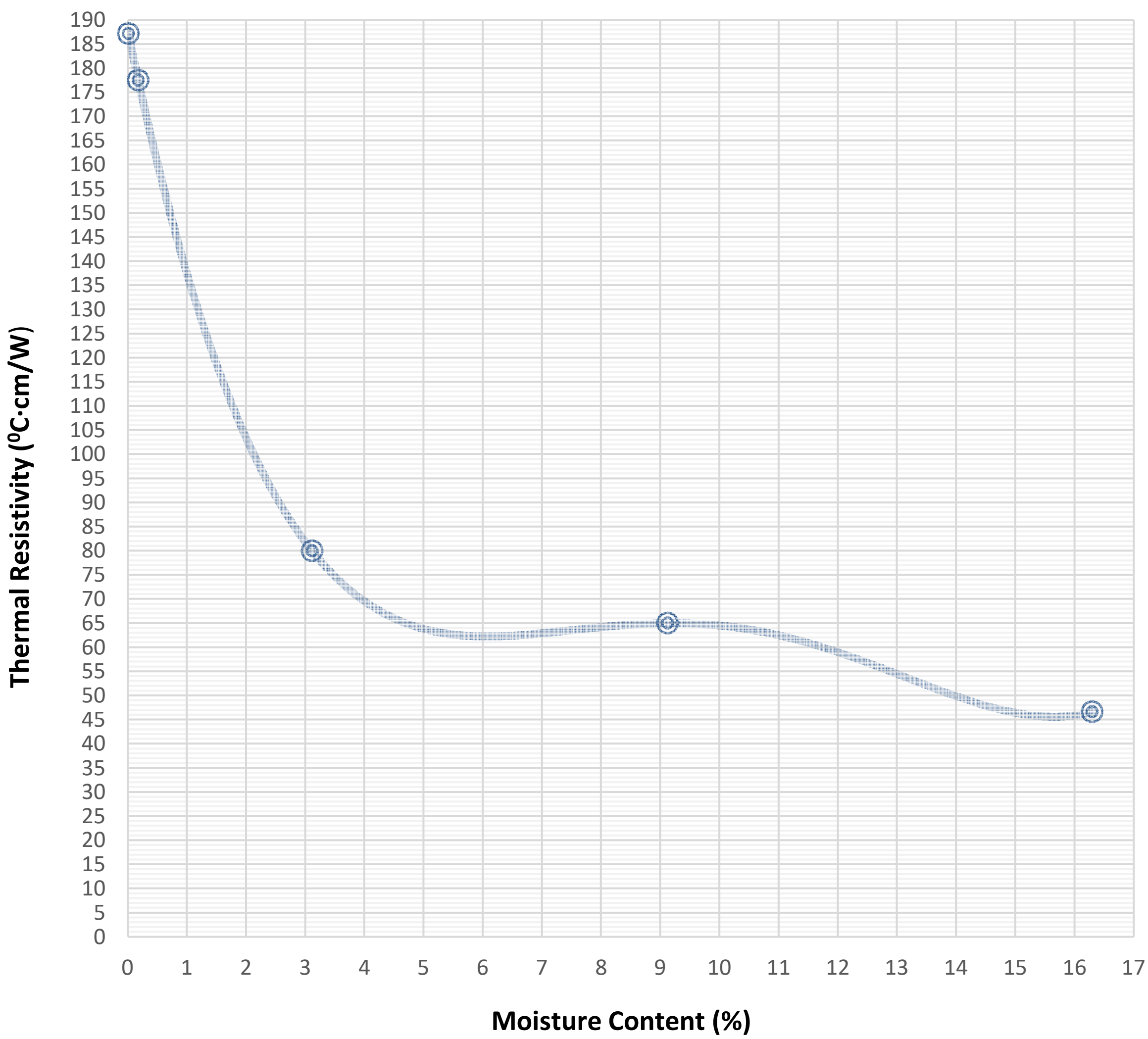
Mt. Laurel, NJ

Remarks:

Figure 10

Composite, BULK, 0.0-5.0 FT

THERMAL RESISTIVITY DRY-OUT CURVES (ASTM D5334)
488729.2163: Old Meyers Solar



Specimen ID:	Composite, BULK, 0.0-5.0 FT
USCS:	ML
Received Moisture:	19.0%
LL:	26
PI:	3
P200:	50.6
Max. Dry Dens.:	115.3 pcf (112.3 pcf - Before Rock Correction Factor)
Optimum Moisture:	13.1% (14.3 % - Before Rock Correction Factor)

Specimen was prepared at approximately 2% above optimum moisture content and at approximately 90% of the maximum dry density as determined by the Standard Proctor test before the rock correction factor was applied (See note on Summary Table).

KE CORROSION

3028 ALDON AVE. LAS VEGAS, NV 89121

702-340-1186 KDE@KECORROSION.COM

CLIENT
TRC Solutions, Inc.
16000 Commerce Parkway, Suite B
Mount Laurel, NJ 08054

PROJECT NO: 488729.2163 Phase 0Task7 Task 000003

PROJECT
Old Meyers Solar

DATE: December 2, 2022

LAB ID: 22-0148

Sample By: Client

Analyzed By: Kurt D. Ergun

RESULTS FOR CORROSIVITY ANALYSIS OF SOILS

Sample Number:	
Sample Location:	Bulk
Sample Depth:	0.0-5.0
Laboratory Testing Methods	
pH Analysis, ASTM D4972(in H2O)	7.90
PH Analysis, ASTM D4972(in CaCl2)	7.03
Water Soluble Sulfates, ASTM D516 (mg/kg)	33
Chlorides, ASTM D512 (mg/kg)	25
Oxidation-Reduction, ASTM D1498 (mV)	+643
Sulfides, AWWA 4500-S (mg/kg)	Nil
Resistivity, ASTM G187 (ohm-cm)	8600

Kurt D. Ergun
Chemist

Note: The tests were performed in accordance with applicable ASTM, AASHTO, or AWWA methods. Test results submitted are only applicable to samples tested at referenced locations and are not indicative of the results of similar materials.