Madison Fields Solar Project, LLC
Case No. 19-1881-EL-BGN

Application Part 4 of 8

Part 4 includes:

- **Exhibit L	Geotechnical Engineering Report**

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Madison Fields Solar Project, LLC
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Exhibit L
Geotechnical Engineering Report

Olsson
June 30, 2020

Respectfully submitted,

/s/ *Christine M.T. Pirik*

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GEOTECHNICAL ENGINEERING REPORT
MADISON FIELDS SOLAR PROJECT
MADISON COUNTY, OHIO

Prepared For:

Madison Fields Solar Project, LLC
Kansas City, Missouri

June 30, 2020
Olsson Project No. 020-0986

olsson®

olsson

June 30, 2020

Madison Fields Solar Project, LLC
Attn: Mr. Jimmy Balough, P.E.
422 Admiral Blvd
Kansas City, Missouri 64106

Re: Geotechnical Engineering Report
Madison Fields Solar Project
Madison County, Ohio
Olsson Project No. 020-0986

Dear Mr. Balough,

Olsson has completed the geotechnical engineering report for the above referenced project. The enclosed report summarizes our understanding of the project, presents the findings of the borings and laboratory tests, discusses the observed subsurface conditions, and based on those conditions, provides geotechnical engineering recommendations for this project.

We appreciate the opportunity to provide our geotechnical engineering services for this project. If you have any questions or need further assistance, please contact us at your convenience.

Respectfully submitted,
Olsson, Inc.

Michael Flanagan
Geotechnical Project Manager

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EXECUTIVE SUMMARY

Olsson, Inc. (Olsson), under authorization and contract with Madison Fields Solar Project, LLC (Madison Fields), completed a geotechnical investigation for the Madison Fields Solar Project in Madison County, Ohio. This report is intended to be used for foundation and roadway design purposes for the investigated locations at the project site.

The geotechnical investigation consisted of geotechnical borings, standard penetration tests (SPT), split-spoon soil sampling, bulk soil sampling, test pits, general soil laboratory testing, electrical resistivity testing, thermal resistivity testing, and axial and lateral pile load testing. This program of geotechnical investigation was selected to accurately and efficiently evaluate the strength, compressibility, stiffness, and density characteristics of the soil at the project site, as well as to evaluate the general suitability of the solar array systems proposed.

In general, the field investigation encountered a layer of cultivated topsoil overlying primarily clayey soil. Some sands were encountered in localized areas, and at depths typically exceeding 6 feet.

The primary findings of the design phase geotechnical explorations and analyses indicate the following:

- In general, the results indicate the soil at the site is suitable for support of a driven pile solar array foundation system.
  - Some isolated glacial erratics (cobbles and boulders) were encountered in four of the total eighteen test pits completed. Pile driving obstruction risk appears relatively low across the site, but isolated obstacles should be anticipated.
- The results of the geotechnical borings indicated that several investigated sites exhibited zones of lower strength and/or higher compressibility soil that may require remediation for support of conventional spread footing foundations.
  - Investigated locations GEO-33, GEO-34, GEO-42, GEO-55, and GEO-61 can likely be remediated with removal of the shallow lower strength soil and replacement with compacted engineered fill. Site specific bearing capacity and settlement calculations should be completed by the foundation engineer of record to determine if correct measures are required.
  - If these areas will have only pile foundations, slightly lower parameters may be needed for pile foundation analysis and remediation should not be required.
- Based on the results of testing, the soils at the site generally exhibit relatively low soluble sulfate levels and cement with a S0 exposure class is suitable for design purposes.

- In some cases where foundation excavations will extend solely into clay soils, a dewatering system consisting of a sump and pump may be sufficient. However, in areas where shallow groundwater was noted along with the presence of permeable sand layers, there is the potential need for an advanced excavation dewatering system consisting of deep wells or well points.
- Results from the geotechnical drilling and analysis indicated that the private access roads and ancillary structure locations investigated for this report can be designed using typical best practices. A summary of recommended geotechnical parameters for foundation design is included with this report.

A. INTRODUCTION

The Madison Fields Solar Project is a proposed solar a commercial scale renewable energy project consisting of a series of solar photovoltaic (PV) modules spread across approximately 2,000 acres. This report describes the preliminary phase investigation and testing performed, presents the results of this work, and provides preliminary geotechnical analyses and recommendations for structure foundations, as well as general construction considerations. This report addresses geologic and geotechnical risks and summarizes the geotechnical investigation completed at selected locations spread throughout the proposed development.

A.1. Project Background

Madison Fields Solar Project, LLC (Madison Fields) is developing the Madison Fields Solar Project in Madison County, Ohio. As part of the design phase geotechnical investigation, we performed geotechnical explorations for the proposed solar panel array locations and other associated project infrastructure, including the potential substations. This report includes the geotechnical data obtained from the field investigation and provides conclusions and recommendations from these investigations for foundation design. We were not aware of previous investigation performed for the project site.

We understand the proposed project consists of constructing solar panel arrays and associated electrical infrastructure. At the time of this report, the foundation design has not been provided to ***Olsson***. As a result, ***Olsson*** has provided the analysis herein based on assumed foundation design values based on experience with similar solar developments.

Specific solar array locations have not been provided, but the investigations were performed based on the areas targeted by Madison Fields for development at the time of the investigations. Appendix A provides a summary of the geotechnical field test locations, including the associated geotechnical investigation identification number (Geotechnical ID).

The geotechnical recommendations presented herein are based on the available project information, proposed project location, and the subsurface conditions described in this report. If the loads or any of the noted information is incorrect, please inform ***Olsson*** so that we may amend the recommendations presented in this report if appropriate.

A.2. Site Location and Topography

The proposed Madison Fields Solar Project is located in rural Madison County, Ohio approximately 8 miles northeast of the village of Mechanicsburg (Figure 1). Smaller communities of Irwin and Rosedale are located just north and east of the site, respectively. Figure 2 shows the general project parcels as indicated by Madison

Fields's preliminary project layout at the time of the geotechnical investigations. The coordinates of the geotechnical test locations are provided in Appendix A.

The project area consists primarily of agricultural land, which had been tilled or recently planted at the time of the investigations. The project site exhibits a nearly flat topography. Elevations at the central and southwest project areas range from site range from approximately 1007 feet along the northeast project boundary to 1023 feet along the southwest project boundary. Topography at the project site is shown in Figure 3.

At the time of our investigation, standing surficial water at the geotechnical boring locations was not present; however, several enhanced drainage paths through the agricultural fields were noted crossing the project area, including between GEOs 12 and 36 traveling southeast to northwest and between GEOs 19 and 22 traveling approximately east to west. A group of trees approximately 4 acres in total area was noted between GEO-21 and GEO-31, and a thin tree line oriented approximately southwest to northeast was also noted between GEO-02 and GEO-14.

A.3. Site Geology

A.3.1 Regional Physiography

The project site is located in the Darby Plain Province of Ohio. The Darby Plain Province has moderately low relief and consists of broadly hummocky ground moraines with several broad, indistinct recessional moraines. The Darby Plain is bordered by the Reesville and Cable Moraines to the south and west, the Powell Moraine to the north, and slopes increasingly eastward toward the lower elevation Columbus Lowland to the east.

The surficial geology consists of Wisconsinan-aged glacial till with a large outwash deposit in the center of the region. Thicknesses of the glacial till are mapped as at least 20 to 80 feet deep, with some deposits on the order of over 250 feet thick where incised bedrock valleys are present (ODNR shaded drift thickness map). The surficial glacial deposits overlie deep Devonian and Silurian-aged sedimentary bedrock.

A.3.2 Geologic History

The project site is located within a geomorphic region known as the Ohio Till Plain. The region experienced several episodes of glaciation, the most recent about 10,000 to 15,000 years ago. Surficial geology deposits originated from glacial lake sediments, ground and end moraine sediments, and glacial outwash. Glacial till and moraine sediments are composed mostly of clayey soil with isolated interlayered areas of silt, sand, and gravel. End moraine deposits form hummocky ridges surrounding flat areas of ground moraine and glacial lake deposits. The outwash deposits contain sand and gravel, representing areas of fast-moving water on the edges of glaciers (Pavey, 1999).

Prior to the glacial advances, bedrock likely was fairly shallow, and some incised valleys into the bedrock are present. Bedrock units at the site consist of:

- Tymochtee and Greenfield Dolomites, Undivided: Silurian aged, olive gray to yellowish brown, thin to massive bedded dolomite and shale (not mapped within the site boundary)
- Lockport Dolomite: Silurian aged, white to gray, finely to coarsely crystalline, medium to massive beds, vuggy and locally cherty
- Salina Group: Silurian aged, gray to yellow gray to olive gray, laminated to thinly bedded dolomite with gray shale, anhydrite, and gypsum laminations
- Clinton and Cataract Groups: Silurian aged dolomite and limestone, gray, olive green, yellow, and reddish gray, laminated to thickly bedded and finely to coarsely crystalline, with interbedded to sparsely interbedded greenish gray silty shale

These are generally deeper than the proposed pile installation/foundation depths and should not be encountered during construction. Bedrock units are indicated on Figure 7.

A.3.3 Local Geology and Soils

Surficial geology at the site consist primarily of Quaternary surficial deposits consisting of Ground moraine deposits comprised primarily of a clay matrix with interlayered sand, silt, and some gravel (Pavey, 1999). The soils are mapped primarily as glacial till or glacial outwash, described as sedimentary carbonate soils (see Figures 4 and 5). The USDA surficial soil mapping (Figure 6) indicates that most of the soils are lean clay (CL), and elastic silt (MH), with lesser areas of low plasticity silt (ML). Based on experience and actual soil conditions encountered, the site is primarily covered with lean clay (CL) type materials.

A.4. Geologic and Geotechnical Hazards

Olsson has reviewed the project area, geologic conditions, and published information with regard to site conditions and potential geologic and geotechnical hazards. The following sections discuss commonly considered hazards and the anticipated potential for these to affect development of the project. Appendix B provides a summary of geologic and geotechnical hazards for the site. Design considerations for selected risks are provided in Section E.

A.4.1 Seismicity and Faulting

The site is located in a relatively inactive seismic area and therefore the design seismicity is low. Seismicity for project design is further discussed in Section E.5. There are no active folds or faulting in the vicinity of the project area (USGS Quaternary Fault Database, 2019).

Overall, the seismicity and faulting risks in the vicinity of the site appear low.

A.4.2 Liquefaction

Liquefaction is the phenomena of a sudden drop in soil shear strength under undrained conditions from the typical yield strength to the substantially lower liquefied strength. This occurs from a rapid build-up of excess pore pressures during a seismic disturbance or other strong vibrations. There are five main items required for liquefaction to occur:

- Type of soil – Typically fine to medium grained sand and silt soils are susceptible to liquefaction
- Soil gradation – Typically well graded materials are less susceptible to liquefaction than poorly graded materials
- Moisture content or saturation – very high natural moisture content at or near saturation is required for liquefaction to occur
- Soil density –Soils are considered to be either dilative or contractive depending on their density. Soils with a higher density are less susceptible to liquefaction.
- Energy Driving Liquefaction – Some form of energy is required to trigger liquefaction. Liquefaction can be triggered by the dynamic application of a single large increment of shear stress or by repeated application of smaller shear stress increments. Typical sources of liquefaction are earthquakes and blasting, and less commonly pile driving.

The seismicity at the site is relatively low, and much of the site was found to consist of lean clay soils which have higher resistance to liquefaction. The seismicity of the site is also low reducing the potential for driving energy to trigger liquefaction. Based on the information reviewed, the risk of liquefaction for the project area appears low.

A.4.3 Collapse and Swell Potential

Loess or eolian soils are typically collapsible. These soil types are mapped in the region but do not appear to be mapped within the footprint of the project. Further, the presence of the loess soils were not detected in the soil borings. Therefore, either the loess is absent or very thin across the surface of the site and soil collapse is not anticipated to be a significant concern for the project.

Soils with moderate to high plasticity are considered to have shrink/swell potential. In general, soils with liquid limit values less than 50 and a plasticity index less than 25 are considered to have low shrink-swell potential. Soils with liquid limit values of 50 to 60 and a plasticity index of 25 to 35 are considered to have moderate shrink-swell potential. Soils with liquid limit values greater than 60 and a plasticity index value greater than 35 are considered to have high shrink-swell potential (Das, 2000).

Sand and silt soils generally have low plasticity and are not considered susceptible to significant swell potential. Lean clay soils (low to moderate plasticity) are anticipated to have a liquid limit value less than 50 and a plasticity index value less than 25 and exhibit low to moderate swell potential. Fat clay soils (moderate to high plasticity) have a liquid limit value greater than 50 and a plasticity index value greater than 25 and exhibit high swell potential. Swell potential of the clay soils is further discussed in Section C.6.

A.4.4 KARST POTENTIAL

Karst is "a terrain, generally underlain by limestone, dolomite, or evaporite bedrock in which the topography is chiefly formed by the dissolving of rock, and which may be characterized by sinkholes, sinking streams, closed depressions, subterranean drainage, and caves" (Gustavson et al., 1980). Caves and related solution features pose a risk to overlying structures.

Review of potential karst features in the USGS publication "Karst in the United States: A Digital Map Compilation and Database" (Weary and Doctor, 2014) indicates that the project is mapped within an area noted to have karst features underlying more than 50 feet of glacial deposits. Specifically, the site is underlain by the Salina bedrock formation, which has known karst features, which includes limestone/dolomite bedrock. On the very eastern tip of the project site, east of GEO-62, the karst potential is mapped shallower than 50 feet underlying glacial sediments.

A more detailed review of the karst potential from the Ohio Department of Natural Resources interactive karst map indicates that the overall karst area of Ohio mostly ring the project area, and no mapped karst features (consisting of either field verified or suspected karst features) are located in or within close proximity to the project area.

Overall, the site appears to be within a mapped karst zone noted as karstic features at depths greater than 50 feet, has some shale as the upper bedrock unit and does not have any identified karst features per the Ohio DNR database, therefore, the risk of development of karst features appears relatively low.

A.4.5 SUBSIDENCE FROM MINING AND OIL AND GAS PRODUCTION

Most of the mineral extraction in Ohio occurs in the eastern half of the state where the glacial soils are absent and thicker coal seams are present in younger bedrock. Due to the relatively thick glacial deposits and lack of significant coal reserves or other mined resources mapped within the project area, risk of subsidence due to mining appears to be low. Some sand and gravel deposits likely are mined for construction materials, but these are typically surface mines which do not cause subsidence of collapsing underground works.

Oil and gas production is prevalent in Ohio, but found almost entirely in the eastern half of the state. The Ohio DNR map indicates no oil and gas fields or wells are present in Madison County. Subsidence risk due to oil and gas development is considered low.

A.4.6 SLOPE STABILITY

The relief across the site is relatively flat with less than 30 feet of elevation change across the entire project area. Large scale slope instability issues are not anticipated for the majority of the site. Locally steeper relief along more pronounced streams or other drainageways may have moderate potential for slope instability and some offset of development features from these drainageways may be warranted.

A.4.7 FLOODING

A review of mapped flooding potential from the FEMA flood mapping website indicated the flowing creeks to the south and northwest of the project bounds are considered to be within a Zone A floodplain. Figures 8 indicate the areas mapped as Zone A floodplain.

Within the site boundaries, the site is at a distance away from the creeks and should be a low potential for flooding.

During the field work (specifically the pile load testing), heavy rains were experienced in the area and flooding was observed at the site. Due to the relatively flat relief of the site, ponding of water to depths on the order of several inches were observed through many of the farm fields. While this was likely due to the very high precipitation events above normal rainfall amounts, during wetter periods some ponding of water should be expected.

B. EXPLORATORY AND TEST PROCEDURES

The following sections describe the field and laboratory testing performed to evaluate the project site. The primary site investigation was performed in April and May of 2020. Field pile testing was performed in May of 2020. Laboratory testing was performed from April and May of 2020. A summary of the investigation and test locations completed at the time of this report is provided in Appendix A.

The geotechnical investigations for the Madison Fields Solar Project consisted of soil borings, test pit excavations, soil sampling, and pile load testing. In addition to the field investigation, laboratory testing was conducted on selected soil samples from the borings. Thermal resistivity and electrical resistivity testing were also performed in support of the project electrical design (by others). This geotechnical investigation program was selected to develop preliminary design parameters of the soils at the project site, and to provide a general discussion of construction considerations.

Prior to the start of field work, coordinates of the geotechnical investigation locations were selected by ***Olsson*** and approved or revised by Savion. In general, the site investigation locations were selected to provide spatial coverage of the site. The test locations were staked in the field by ***Olsson*** prior to beginning the site investigation.

B.1. Geotechnical Borings

A total of 81 borings were performed for this geotechnical investigation, with 79 borings being completed at locations within the proposed solar array and two borings (GEO-73 and GEO-74) completed at the proposed substation locations (see Figure 8 and Appendix A). Borings at the proposed array were completed to a target depth of 20 feet using 4-inch diameter continuous flight solid stem augers. Borings at the proposed substation locations were completed to a target depth of 50 feet using 4 ¼-inch internal diameter hollow stem augers. All borings were drilled with a track-mounted drill rig. The boring locations were located in the field by ***Olsson*** personnel using a hand-held GPS device based on information provided by the client. Completed locations of the borings are included in Appendix A and the boring logs are provided in Appendix C. Figure 8 indicates the location of the borings performed for the project.

Soil samples were obtained at selected intervals in the borings using a standard split-spoon sampler during the Standard Penetration Tests (SPT; “SS” on the boring logs). The standard split-spoon sampler was driven in three 6-inch intervals into the substrata with blows from a 140-pound automatic hammer free-falling 30 inches. Penetration resistance (blow counts) were recorded for each 6-inch drive. Penetration resistance of the final 12 inches is considered SPT “N” values for the SS sampler. The blow counts and SPT “N” values are shown on the boring logs at the respective depths the samples were taken. SPT testing was performed in accordance with ASTM D1586.

At select locations and depths, undisturbed samples were obtained using a hydraulically pushed, thin-walled Shelby tube (denoted “U” on the boring log). Shelby tube samples were collected in general accordance with ASTM D1587. This sampling method includes using a thin-walled, steel tube sampler with a diameter of 3-inches connected to a sampling head that is attached to the drill rods. The tube sampler is then pushed by the hydraulic rams of the drill rig into the soil below the bottom of the drill hole and then retracted to obtain a sample.

Soil samples were sealed in the field in order to preserve their in-situ moisture content. Samples were transported to ***Olsson’s*** laboratory facility in Olathe, Kansas for testing following completion of the borings.

An ***Olsson*** technician observed the drilling, and sampling, and prepared field logs of the material encountered in each boring during the drilling operation. The field logs included the technician’s and driller’s interpretation of the conditions between samples and approximate elevations of each stratum change. The boring logs presented in Appendix

C represent the project engineer's interpretation of the field logs based on visual classification and laboratory tests of the samples.

B.2. TEST PIT EXCAVATIONS

Test pits were performed at 18 of the geotechnical boring locations as part of the geotechnical investigation (Figure 9; Appendix A). Test pits are normally performed for solar farm projects to provide a better indication of obstructions that small-diameter soil boring investigations may not encounter. Test pits were excavated to a nominal depth of 10 feet below grade to evaluate the anticipated embedment depths of the piles.

The test pits were performed by Dynahoe Excavating located in Circleville, Ohio, under subcontract to ***Olsson***. The test pits were completed with a track-mounted excavator.

Soil sampling was performed at changes in strata from either the test pit wall or the excavator bucket. All soil classifications and sample logging was completed by ***Olsson*** personnel. Test pit logs are included in Appendix D of this report.

All test pit samples were sealed in the field in order to preserve their in-situ moisture content. Physical soil characteristic samples were delivered to ***Olsson's*** laboratory facility in Denver, Colorado.

B.3. LABORATORY TESTING

The following laboratory tests were performed by ***Olsson*** to characterize the soil encountered at the site:

- Moisture content tests in accordance with ASTM D2216, "Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass"
- Dry unit weight tests in accordance with ASTM D7263, "Standard Test Methods for Laboratory Determination of Density (Unit Weight) of Soil Specimens"
- Atterberg Limit determinations in accordance with ASTM D4318, "Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils"
- Sieve analysis in accordance with ASTM D6913, "Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis"
- Percent passing the #200 sieve tests in accordance with ASTM D1140, "Amount of Material is Soils Finer than No. 200 (75-µm) Sieve"
- Unconfined compressive strength of soil tests in accordance with ASTM D2166, "Standard Test Method for Unconfined Compressive Strength of Cohesive Soil"
- Unconsolidated-undrained triaxial strength of soil testing in accordance with ASTM D2850, "Standard Test Method for Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils"

- Soil consolidation testing in accordance with ASTM D2435, “Standard Test Methods for One-Dimensional Consolidation Properties of Soils Using Incremental Loading”
- Direct shear testing in accordance with ASTM D3080, “Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions”
- California Bearing Ratio tests in accordance with ASTM D1883, “Standard Test Method for CBR (California Bearing Ratio) of Laboratory-Compacted Soils”
- Standard Proctor Density determinations in accordance with ASTM D698, “Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))”
- Soil pH tests in accordance with ASTM G51
- Soluble chloride and soluble sulfate of soils in accordance with EPA Method 300.0

The laboratory test results are presented on the respective soil boring logs, and in the laboratory summary in Appendix E.

B.4. ELECTRICAL RESISTIVITY TESTING

Field electrical resistivity testing was completed at a total of 21 locations (GEO-02, GEO-06, GEO-09, GEO-15, GEO-17, GEO-22, GEO-30, GEO-32, GEO-34, GEO-35, GEO-40, GEO-45, GEO-47, GEO-55, GEO-58, GEO-64, GEO-68, GEO-77, GEO-80, and Substation locations GEO-73 and GEO-74) during the design phase geotechnical investigations (Figure 10; Appendix F). Soil resistivity testing was completed by ***Olsson*** personnel in accordance with ASTM method G57 “Standard Test Method for Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method” (equivalent to IEEE Std. 81). Electrode “a”-spacings of 0.5, 1, 1.5, 2, 3, 5, 7, 10, 15, 20, 30, 45, 70, 100, 150 and 200 feet were used at the solar array locations and an additional spacing of 300 feet at the proposed substation. At each of the locations, measurements were taken to determine average soil resistivity in two approximately perpendicular arrays.

The equipment used to collect the data consisted of a Supersting resistivity meter, four metal electrodes and connecting wire. Co-linear arrays of four electrodes were placed in the ground for each measurement. Electrical current was input to the ground through the two outer electrodes of the array. The voltage drop produced by the resulting electrical field was measured across the two inner electrodes. The “a”-spacing was increased with each measurement, expanding the array about a common center. Increasing the electrode separation increases the depth of investigation and indicates vertical variation in resistivity. The resistivity meter read in apparent resistivity (Ω-ft) directly and did not require the conversion of electrical potential and inductance or resistance to provide the apparent resistivity.

The soil electrical resistivity results are included as Appendix F.

B.5. Thermal Resistivity Testing

Soil samples for thermal resistivity testing were collected by ***Olsson*** personnel at ten locations across the project site (Figure 11). Bulk samples for testing were obtained from the soil borings to a depth of approximately 5 feet below the surface, excluding the highly organic surficial soil. Bulk samples were recompacted to 85 percent of the soil's maximum dry density for the testing. The samples were transported to Soil Engineering Testing, Inc., (SET) in Bloomington, Minnesota, for laboratory testing in accordance with ASTM D5334, "Standard Test Method for Determination of Thermal Conductivity of Soil and Soft Rock by Thermal Needle Probe Procedure". Laboratory tests included measurement of the soil's moisture content, maximum dry density, and thermal dry-out characteristics, which is a function of moisture content. The results of these tests are presented in Appendix G.

B.6. Percolation Testing

Olsson performed field percolation testing at 9 locations across the project site. Percolation tests were performed in one hole near each boring location which was drilled to a depth of approximately 5 feet below existing grade. The test hole was drilled using standard auger techniques with a 3.25-inch internal diameter (6-inch external diameter) hollow-stem auger using a track-mounted drill rig. After drilling, each test hole was cleaned of sediment prior to performance of percolation tests. The side of the hole was slightly roughened, and the test hole was presoaked for approximately 24 hours prior to the test. Percolation testing was performed by filling the hole with water and reading the drop in the water head at 30-minute intervals across a 4-hour observation period.

In some locations, the free groundwater table was encountered at a depth equal to or shallower than 4 feet. At these locations, percolation testing was attempted but a change in water level within the percolation test hole was not observed and the percolation rate was indeterminate.

Based on the testing across site, the percolation rate of the on-site clay material above the water table is determined to be approximately 1 inch per hour. The infiltration rate of the materials where the water table is shallow would be much less. The results of the tests are presented in Appendix J of this report.

B.7. Driven Pile Testing

B.7.1. Driven Pile Exploratory and Test Procedures

The following sections describe the field exploration and pile load testing performed to evaluate the project site. The field work was performed in May of 2020. A summary of the investigation and test locations is provided in Appendix A.

Prior to the start of field work, coordinates of the geotechnical investigation locations were selected by ***Olsson*** and approved or revised by Madison Fields Solar. In general, the site investigation locations were selected to provide spatial coverage of the site and to test at least one location within each different soil strata identified from the geotechnical borings. The test locations were staked in the field by ***Olsson*** prior to beginning the site investigation, and are summarized in Appendix A.

B.7.2. Pile Test Installation

A total of 30 locations were selected for testing at this project site (Figure 12). At each of the 30 locations, 2 steel piles with a length of 12 feet were driven to a nominal depth of 8 feet below the existing grade (with 4 feet of stick up) by Solar Pile Driver, LLC of Ozark, Missouri. The pile installer used a GAYK HRE 4000 hydraulic vibratory pile driver to complete the installation, which applies a low frequency to the piles and does not significantly disturb the soil upon installation.

The piles were W 6x9 shape and were comprised of steel with a yield stress of 50 kips per square inch (ksi). Table B.7.2.-1 indicates the dimensions and installation data for the W 6x9 piles used for the project. ***Olsson*** oversaw the pile installation. Notes on the pile installation are included in Table 9.

Table B.7.2.-1: Pile Dimensions Used For Pile Installation

Pile Size	W 6x9
Steel Grade	50 ksi
Embedment Depth	8 feet
Section Depth	5.9 inches
Flange Width	3.94 inches
Web Thickness	0.170 inches
Flange Thickness	0.215 inches

B.7.3. Pile Load Testing

The soil/pile system was allowed to remain installed for about one week before field testing, in order to allow time for the system to stabilize and allow excess pore water pressures developed in the clay soils during driving to dissipate. Following this stabilization period, Dynahoe Excavating of Circleville, Ohio, mobilized a CAT 316 track-mounted excavator to the project site to assist with axial uplift and lateral load testing of the piles. ***Olsson*** staff performed the pile load testing.

Further details of the pile load testing is discussed below.

B.7.3.1. Axial Uplift Test (Tension)

Olsson performed the axial tension testing in general accordance with ASTM D3689, “Standard Test Methods for Deep Foundations Under Static Axial Tensile Load.” The testing equipment was positioned directly above the central axis of the pile to minimize eccentric loading and avoid applying moment or lateral load as the force was being applied in the vertical direction. A distance of at least five times the maximum diameter (or section depth) of the pile was provided between the test pile and the reaction points. The materials used for the axial tensile testing were selected to be of sufficient strength and stiffness to allow for deflection of the pile without elastic shortening of the testing apparatus.

The materials used for the axial uplift tensile test consisted of:

- Reaction frame provided by the track-mounted excavator
- Calibrated hydraulic hand pump
- Calibrated digital load cell
- Hardware, chains, and shackles to connect the pump and load cell to the reaction frame
- Calibrated displacement sensors capable of 4-inches of travel and a precision of 0.001 inches
- Surveyor's tripod used for displacement measurements detached from pile system

At each pile testing installation location, the excavator was grounded such that compression of the soil was negligible, which served as the lower reaction point. The top of the pile was clamped to the load cell and hydraulic actuator, which were connected to the excavator centered above the pile with a chain and shackles, which served as the upper reaction point. Olsson manually used the hydraulic actuator pump to pull the pile vertically to specific loads, which were determined by reading the load cell. Table B.7.3.1-1 indicates the loading increments used for the axial uplift testing. The load testing apparatus is shown in Figure B.7.3.1-1 below.

Figure B.7.3.1-1: Pile Uplift Load Testing Apparatus (prior to tightening for testing)

To measure displacement, two calibrated displacement sensors were magnetically attached to the pile. The sensors were placed on different sides of the pile. One of the sensors was placed at a height of approximately 4 feet measuring relative to the surveyors tripod, which was not attached, and therefore not moving, due to the axial uplift force on the pile. The second sensor measured displacement relative to the ground surface. Redundant measurements at varying heights allows for verification that the testing process is performed properly (no tilting or horizontal movement) and provides a failsafe in case a sensor fails. Once the desired load was reached, readings were collected immediately and at a period of 1-minute after being exposed to the load.

Table B.7.3.1-1: Axial Uplift Load Sequence

Axial Load (pounds)	Deflection Recording Time (seconds)
0	--
250	0, 60
500	0, 60
750	0, 60
1,000	0, 60
1,500	0, 60
2,000	0, 60
2,500	0, 60
3,000	0, 60
3,500	0, 60
4,000	0, 60
4,500	0, 60
5,000	0, 60
5,500	0, 60
6,000	0, 60
6,500	0, 60
7,000	0, 60
7,500	0, 60
8,000	0, 60
8,500	0, 60
9,000	0, 60
9,500	0, 60
10,000	0, 60
10,500	0, 60
11,000	0, 60
11,500	0, 60
12,000	0, 60
12,500	0, 60
13,000	0, 60

In all cases, once the pile began to pull out of the ground, the loading could not be advanced to the next desired load and the test was terminated. Upon completion of the testing, the piles were removed from the ground.

Results of the axial uplift testing are provided and discussed in Section E.1.1.1.

B.7.3.2. Lateral Test

Olsson performed lateral pile load testing in general accordance with ASTM D3966, “Standard Test Methods for Deep Foundations Under Lateral Load.” The testing equipment was placed such that the load was horizontal from the reaction point on the pile, which was at a height of approximately 4 feet above the existing grade. A distance of at least five times the maximum diameter (or section depth) of the pile was provided between the test pile and the reaction points. The materials used for the lateral testing were selected to be of sufficient strength and stiffness to allow for deflection of the pile without elastic shortening of the testing apparatus.

The materials used for the lateral load test consisted of:

- Reaction frame provided by the track-mounted excavator
- Calibrated hydraulic hand pump
- Calibrated digital load cell
- Hardware, chains, and shackles to connect the pump and load cell to the reaction frame
- Calibrated displacement sensors capable of 4-inches of travel and a precision of 0.001 inches
- Surveyor’s tripod used for displacement measurements detached from pile system

At each pile testing installation location, the excavator was grounded by advancing the bucket into the ground such that compression of the soil was negligible. The pile was clamped to the load cell and hand pump at a height of 4-feet above the existing grade, which were connected to the excavator horizontally offset from the pile with a chain and shackles. Olsson manually used the hydraulic actuator pump to pull the pile laterally to specific loads, which were determined by reading the load cell. Table B.7.3.2-1 indicates the load sequence used for the lateral tests. The load testing apparatus is shown in Figure B.7.3.2-1 below.

Figure B.7.3.2-1: Pile Lateral Load Testing Apparatus

To measure displacement, two calibrated displacement sensors were used which measured the deflection of the pile away from stationary points. One of the sensors was placed at a height of approximately 4 feet on surveyors tripod, which was not attached, and therefore not moving, due to the lateral force on the pile. The second sensor measured lateral displacement relative at the ground surface. Once the desired load was reached, readings were collected immediately and at a period of 1-minute after being exposed to the load. In 18 of the 30 lateral tests, the travel of the top dial gauge was exceeded during loading. Where this occurred, approximate measurements were made using a tape measure to provide more deflection data, and these measurements are included in Appendix H, but exact accuracy of measurements beyond the 4-inches of travel of the dial gauge should be considered a rough estimation of deflection. When the deflection at the top of the pile exceeded 4 inches (the maximum travel of the gauge), testing was terminated after this load step and obtaining a rebound (zero load) final reading.

Table B.7.3.2-1: Lateral Load Sequence

Lateral Load (pounds)	Deflection Recording Time (seconds)
0	--
500	0, 60
1,000	0, 60
1,500	0, 60
0	0, 60
1,500	0, 60
2,000	0, 60
2,500	0, 60
0	0, 60
2,500	0, 60
3,000	0, 60
3,500	0, 60
0	0, 60
3,500	0, 60
4,000	0, 60
4,500	0, 60
0	0, 60
4,500	0, 60
5,000	0, 60
5,500	0, 60
0	0, 60

Upon completion of the testing, the piles were removed from the ground and transported off site.

Results of the lateral testing are provided and discussed in Section E.1.1.2.

C. SUBSURFACE CONDITIONS

The following sections discuss the results of the field and laboratory testing performed for the project.

C.1. SOIL STRATIGRAPHY

Specific conditions at each boring location are shown on the boring logs in Appendix C. The logs represent subsurface conditions at each specific boring location. Stratification boundaries shown on the boring logs represent the approximate depth of changes in soil types. The changes are likely more gradual in-situ. The boring logs do not reflect variations that may occur between borings or across the project site. The nature and extent of such variations may not become evident until construction.

The typical stratigraphy, as determined from field data, consists primarily of stiff to very stiff lean to sandy lean clay with occasional sand layers. Below the upper 6 to 10 feet, either the clayey soils continued to the depths investigated or the upper clays were underlain by sandy soils primarily below that depth. A detailed review of the soil layers encountered at the project site is included in the following sections.

C.2.1. Topsoil and Surficial Soil

Topsoil was encountered across the site and its thickness is typically about 9 to 12 inches. The topsoil was generally clayey with agricultural or grass root mats and organic content was high. Localized zones of thicker or thinner topsoil should be expected.

C.2.2. Lean Clay Soils

The topsoil is typically underlain primarily by lean clay with some parts sand, silt, and gravel. These clays were generally observed to be light to dark brown, reddish brown, and light gray to dark gray in color. Sand content in the clay was highly variable (up to 50 percent in some samples), and occasionally included gravel and cobbles, but typically clay dominant soils were encountered throughout the depths shallower than 12 feet.

Results of the Atterberg limits tests indicate the soils at the site have liquid limits ranging from approximately 17 to 47 percent and plastic limits ranging from approximately 13 to 18 percent.

Moisture contents in the lean clay soils ranged from about 8 to 34 percent, with an average of about 16 percent. The dry unit weight of the clay samples obtained ranged from approximately 92 pounds per cubic foot (pcf) to 143 pcf, with an average of 119 pcf. The moist unit weights were calculated from the measured moisture content and corresponding dry unit weights of the samples. The resulting moist unit weights ranged from approximately 117 to 158 pcf, with an average of 140 pcf.

Hand penetrometer tests conducted on samples collected during drilling indicated unconfined compressive strengths typically exceeding 1.5 tsf. Laboratory strength testing indicated median and average unconfined compressive strengths of 1.0 tsf and 1.3 tsf, respectively.

C.2.3. Sand Soils

Sand soils with some clay or silt portion were generally encountered deeper in the soil profile, typically below 6 feet. These sands were generally observed to be brown colored with some red or gray tinting. Shallower sand lenses tended to be fine to medium grained with a significant portion clay and silt, while deeper soils included fine to coarse grained sand with some gravel and cobbles.

The percent fines in the sand samples ranged from 5.5 to 46.7 percent in the sand samples tested. Gravel content up to 25.7 percent was observed in the tested samples.

SPT testing indicates the sands varied from loose to very dense but were typically medium dense to dense.

C.3. GROUNDWATER OBSERVATION

Shallow groundwater was observed in a majority of the geotechnical borings, with depths ranging from 3.0 to 14.5 feet during drilling and 0.5 to 18.5 feet immediately following drilling completion. At 2 of the geotechnical borings (GEO-13 and GEO-28), groundwater was not observed either during drilling or immediately following drilling, but this is likely due to a lack of sand seams in these specific boring locations and groundwater not equilibrating through the low-permeability clay soils. A summary of groundwater measurements in the test pits is provided in Table 1.

Upon removal of some of the test piles and in test pits excavated to facilitate pile removal, water was also encountered in the upper 8 feet below ground surface, confirming the shallow water levels on the order those observed while drilling.

Variations and uncertainties exist with relatively short-term water level observations that were recorded during this exploration. Water levels can and should be anticipated to vary between boring locations, as well as with time within a specific boring. Groundwater levels may be expected to fluctuate with precipitation, site grading, drainage and adjacent land use. With low permeability clay soils, equilibrium water levels may not be reached during drilling and some variability in water levels should be expected.

C.4. SOIL CHEMICAL TESTING

Chemical tests, consisting of soil pH, soluble chloride, and soluble sulfate testing, were performed on 21 selected samples. The results of the chemical testing indicate that the soils have a pH ranging from 6.3 to 7.8 (slightly acidic to slightly basic soils). The soils contain 2.03 to 7.20 mg/L chloride, and 3.55 to 18.7 mg/L sulfate. Chemical test results are summarized in Table C.4.1 and included in Appendix E.

Table C.4.1 Summary of Soil Chemical Test Results

Investigation ID	Depth [feet]	pH	Chloride [mg/kg dry]	Sulfate [mg/kg dry]
GEO-02	1-2.5	6.31	3.82	5.32
GEO-06	1-2.5	6.54	3.39	11.9
GEO-09	3.5-5	7.33	4.31	5.84
GEO-15	1-2.5	7.46	3.22	7.70
GEO-17	3.5-5	7.73	3.47	5.29
GEO-22	1-2.5	7.78	4.70	9.20
GEO-30	1-2.5	7.46	2.67	8.08
GEO-32	1-2.5	7.29	4.54	14.3
GEO-34	3.5-5	7.77	3.43	4.16
GEO-35	6-7.5	7.62	4.04	8.79
GEO-40	1-2.5	7.04	7.09	4.16
GEO-45	1-2.5	7.10	3.89	6.56
GEO-47	6-7.5	7.58	7.20	17.5
GEO-55	3.5-5	7.53	3.73	3.55
GEO-58	1-2.5	7.23	4.32	5.12
GEO-64	1-2.5	6.90	6.98	10.9
GEO-68	1-2.5	6.52	2.85	7.59
GEO-73	1-2.5	6.93	4.84	9.64
GEO-74	1-2.5	7.09	2.03	18.7
GEO-77	3.5-5	7.50	2.39	12.4
GEO-80	3.5-5	7.58	2.73	4.97
Average		7.3	4.1	8.7
Standard Deviation		0.4	1.4	4.2
Minimum		6.3	2.0	3.6
Maximum		7.8	7.2	18.7

C.5. GENERAL LABORATORY TESTING

Laboratory testing results are discussed below and are summarized in Table 2 and provided in Appendix E.

C.5.1. MOISTURE CONTENT

A total of 170 moisture content tests were conducted on soil samples collected from the geotechnical borings during the geotechnical investigation. Moisture contents in the sand soils ranged from about 3 to 17 percent, with an average of about 10 percent. Moisture contents in the lean clay soils ranged from about 8 to 34 percent, with an average of about 16 percent.

C.5.2. GRAIN SIZE ANALYSES

Grain size analyses were performed on 13 soil samples collected at various depths from the geotechnical borings. Based on the results of the grain size analyses and visual inspection, eight samples were classified as sandy clays, silty clays, and lean or lean to fat clays with sand (CL, CL/CH, CL/ML), four samples were classified as clayey sands (SC), silty, clayey sands (SC/SM) or silty sands (SM), and one sample was classified as poorly graded sand with silt and gravel (SP/SC). The percent fines (percent by weight passing the number 200 sieve) ranged from approximately 50.9 to 89.8 percent, with an average of 65.5 percent in the clay samples tested indicating relatively high sand contents in the clay soils. The percent fines in the sand samples ranged from 5.5 to 46.7 percent in the sand samples tested. Gravel content up to 25.7 percent was observed in the tested samples.

C.5.3. UNIT WEIGHT

A total of 51 dry unit weight tests were performed on 3-inch diameter thin-wall tube samples collected from the geotechnical borings. The soils tested primarily included clay soils, although two tests were performed on predominantly sand soils (SC/SM). The dry unit weight of the clay samples obtained ranged from approximately 92 pounds per cubic foot (pcf) to 143 pcf, with an average of 119 pcf. The moist unit weights were calculated from the measured moisture content and corresponding dry unit weights of the samples. The resulting moist unit weights ranged from approximately 117 to 158 pcf, with an average of 140 pcf. Dry density test results are included in Appendix C.

C.5.4. ATTERBERG LIMITS

Atterberg limits testing was performed on fine-grained soil samples and used to classify the material encountered in the borings. A total of 15 Atterberg limits tests were conducted on selected samples from the borings.

Results of the Atterberg limits tests indicate the soils at the site have liquid limits ranging from approximately 17 to 47 percent and plastic limits ranging from approximately 13 to 18 percent. The plasticity indices varying between 4 and 30 percent, classifying the soil as lean clay (CL) and silty clay (CL/ML) in accordance with the Unified Soil Classification System (USCS). Discussion on soil swell based on Atterberg limits can be found in Section C.6.

C.5.5. STANDARD PROCTOR

A total of 10 standard Proctor tests were conducted on bulk soil samples collected at shallow depths. Results of the standard Proctor density testing indicated the soil's maximum dry density ranges from approximately 96 to 125 pcf. The corresponding optimum moisture content ranged from approximately 12 to 26 percent. Standard Proctor density test results are summarized in Table C.5.5 and included in Appendix E.

Table C.5.5 – Summary of Standard Proctor Density Test Results

Geotechnical ID	Depth [ft]	USCS Classification	Maximum Dry Density [pcf]	Optimum Moisture Content [%]	95% Maximum Dry Density at Optimum Moisture Content [pcf]
GEO-13	1-5	CL	116.7	14.8	127.3
GEO-35	1-5	CL	122.2	12.7	130.8
GEO-45	1-5	CL	112.1	16.4	124.0
GEO-52	1-5	CL	110.1	17.7	123.1
GEO-58	1-6	CL	111.4	16.4	123.2
GEO-60	1-6	CL	107.6	19.4	122.1
GEO-73	1-3	CH	96.0	25.7	114.6
GEO-74	2-4	CH	96.5	24.3	114.0
GEO-77	1-5	CL	108.1	19.2	122.4
GEO-80	1-6	SC	125.0	11.9	132.9
Average			110.6	17.9	123.4
Standard Deviation			9.5	4.5	6.0
Minimum			96.0	11.9	114.0
Maximum			125.0	25.7	132.9

C.5.6. Shear Strength

As noted in Section C.2, the project site typically consists of upper clay layers for the entire explored profile or clay underlain by sand soils, with a few noted exceptions. The following sections discuss, in detail, the shear strength parameters of the soils to be used in foundation design.

C.5.6.1. Undrained Shear Strength

Uniaxial unconfined compressive strength tests and triaxial unconsolidated undrained shear strength tests were completed on 26 samples collected across the site and indicate an unconfined compressive strength of ranging from approximately 400 psf to 8,200 psf. Laboratory strength results are provided in Appendix E. 21 of the 26 tests exceeded 1000 psf unconfined strength. The shear strength of these tests can be approximated as half of the unconfined compressive strength, indicating a minimum laboratory shear strength value of approximately 200 psf, a median shear strength of 1050 psf, and an average shear strength of 1300 psf.

The SPT results at each of the geotechnical boring locations are shown on the boring logs in Appendix E. The SPT values in clay soils at each boring location within the solar arrays were reviewed from a depth of 1 to 20 feet. The minimum SPT value for soils within the planned solar array was SPT = 3 at GEO-33 at a depth of 3.5 feet. The SPT value can be correlated to the soil undrained shear strength (Das 2010).

A number of hand penetrometer tests were conducted on Shelby tube and split spoon samples collected during drilling. The results indicated an estimated unconfined compressive strength ranging from 0.5 to greater than 4.5 tons per square foot (tsf), which corresponds to an undrained shear strength of 500 to greater than 4,500 psf. Most hand penetrometer measurements exceeded an unconfined compressive strength of 1.5 tsf.

Based on an analysis of the results presented above, the recommended undrained shear strength design value (for use in solar array foundation design) is 1,000 psf at frost depth, and higher with depth at the site. At the ancillary structure locations (GEO-73 and GEO-74), the recommended undrained shear strength design value is 1,500 psf at frost depth based on test data specifically at those two locations. The results of the investigation indicate that, while the majority of the soils exceed the recommended design undrained shear strength value, some soil layers at various depths exhibit strength less than the recommended design value. The foundation designer should perform a complete bearing capacity check for each foundation design to verify these recommendations once final design information is available.

C.5.6.2. Drained Shear Strength

The drained shear strength of the granular soils was estimated from correlations to SPT results collected during sampling in the boreholes and from two direct shear tests performed on a granular samples from GEO-23 at a depth of approximately 9 feet and GEO-67 at a depth of approximately 9 feet. The direct shear test resulted in peak friction angles of 30.6 and 33.1 degrees, respectively. The direct shear test results are included in Appendix D.

The SPT results, which are included on the boring logs in Appendix C, ranged from 9 to greater than 50 blows for fewer than 6-inches of sampler penetration in granular soils and from 3 to greater than 50 blows for fewer than 6-inches of sampler penetration in clay soils. In general, SPT results in the granular soils generally exceeded 10 blows per foot at or below the anticipated foundation depths. Three exceptions to this occurred at the following locations: GEO-24 @ 18.5 feet (N = 9), GEO-30 @ 6 feet (N = 9), and GEO-64 @ 18.5 feet (N = 9). The SPT value can be correlated to the soil friction angle (Das, 2007). An average SPT value of 10 in sandy material correlates to a friction angle of approximately 32 degrees.

For solar array foundation design, a design friction angle of 31 degrees is recommended for shallow (frost zone) granular soil layers and a value of 33 degrees is recommended for deeper granular soil based on the SPT N-values and direct shear testing results.

The drained shear strength of cohesive soil was evaluated based on correlations to the measured Plasticity Index provided by Terzaghi et al (1996). The results of Atterberg Limits testing indicated that the Plasticity Index ranged from 4 to 30 percent. According to the correlation, the estimated drained friction angle of the cohesive soil at the project site ranged from 28 to 34 degrees. For analysis purposes, a drained friction angle of 30 degrees for the cohesive soil is recommended.

C.5.6.3. Lower Strength Soil Layers

Several notably lower undrained shear strengths from SPT, Qp, and unconfined compressive strength testing were observed within the clay soils at various depths from the geotechnical investigations. A summary of the lower strength layers (undrained shear strengths less than 1,000 psf) from field and laboratory test results is provided in Table 5.

C.6. Swell Potential

The result of the laboratory testing indicates the clay soils across the site have liquid limits below 60 percent, and typically below 40 percent. If allowed to become full saturated, swell potential of soils encountered should be on the border between low and medium. This does not include any additional loads from the solar array foundations. The laboratory test results are included in Appendix E. Swell potential is considered to be low and does not appear significant for either pile foundation or spread footing design.

C.7. California Bearing Ratio Testing

Design for roads and general working areas is based in part on the strength of the subgrade that can be reasonably achieved. Five samples of the shallow subgrade soils were tested for this project. The bulk samples were collected from soil immediately below the existing topsoil, which typically extended to a depth of approximately 1 to 5 feet below the surface. The samples tested consisted of sandy and clayey soil. All samples were transported to SET for laboratory testing. The soil samples were prepared to approximately 95 percent of the maximum standard Proctor density at the optimum moisture content. Specimens were soaked for a period of 4 days before CBR tests were performed. Results of the CBR testing are summarized in Table C.7-1 and included in Appendix E.

Table C.7-1 Summary of California Bearing Ratio Test Results

Investigation ID	Depth [ft]	USCS Classification	Maximum Dry Density [pcf][1]	Optimum Moisture Content [%][1]	CBR Value[2,3] [Optimum Moisture Content]
GEO-13	1-5	CL	116.7	14.8	4.7
GEO-35	1-5	CL	122.2	12.7	4.3
GEO-45	1-5	CL	112.1	16.4	2.6
GEO-52	1-5	CL	110.1	17.7	3.7
GEO-58	1-5	CL	111.4	16.4	3.6
GEO-60	1-5	CL	107.6	19.4	3.5
GEO-77	1-5	CL	108.1	19.2	2.0
GEO-80	1-5	SC	11.9	132.9	3.0

[1] From standard Proctor moisture density curve, ASTM D698

[2] Test specimens were soaked for a period of 4 days before CBR tests were performed

[3] Test samples recompacted to 95 percent of standard Proctor maximum dry density at optimum moisture content.

D. SITE PREPARATION

D.1. GENERAL SITE AND SUBGRADE PREPARATION

All topsoil, vegetation, major root systems, organic soils, and any loose, soft or otherwise unsuitable or deleterious material should be stripped and removed from the areas where spread foundations, roadways, and other ancillary structures will be built or fill placement will occur. Rootzone materials at the project site appear to be on the order of 9 to 12 inches thick, but some variation in this layer should be anticipated. The topsoil generally was organic-rich and consisted primarily of cultivated corn stubble, grass, and root stringers at the base of the topsoil layer. These rootzone materials should be carefully separated to avoid incorporation into structural fill.

Site clearing, grubbing, and stripping should be completed during periods of dry weather. Operating heavy equipment on the site during periods of wet weather could result in excessive pumping and rutting of the subgrade soils.

Foundations for the solar array foundations and deep foundations for ancillary structures are typically placed on natural ground, and significant stripping or the use of compacted structural fill is not widely anticipated, except where excavation of unsuitable material below the foundation embedment depth is performed or if mass grading is needed to level the substation pad (which is not anticipated at this site). The results of the geotechnical exploration indicate soil consisting primarily of clay soils in the upper 6 to 10 feet of the soil profile with sand soils encountered to that depth in isolated areas. Therefore, conventional excavation machines are anticipated to be suitable for excavation of the foundations.

D.1.2. SHALLOW FOUNDATION EXCAVATIONS AND BACKFILL

Upon excavation to the proposed bearing surface, the excavation base should be inspected by the geotechnical engineer of record or authorized representative. Verification of the undrained shear strength of clayey soil should be performed for shallow spread foundations using a static cone penetrometer (SCP) or field vane shear tester. Verification of the friction angle of sand soils should be performed with a dynamic cone penetrometer (DCP).

If, in the course of excavating for shallow foundation or roadway construction, the base of the excavation becomes rutted, damaged, or is otherwise determined to be of inadequate character or unsuitable for construction in the opinion of the geotechnical engineer of record or authorized representative, the conditions shall be noted and discussed with the geotechnical engineer or record to determine appropriate corrective measures.

We recommend an ***Olsson*** geotechnical engineer, or their authorized representative, review the base of new construction excavations prior to the placement of any new fill soils or any foundations to evaluate for the intent of the recommendations in this report and minimize the potential of unnecessary soil corrections being performed. Disturbance, desiccation, or wetting of the subgrade soils between grading and placement of foundations can result in deterioration of the previously completed subgrade. If conditions change after a subgrade has been inspected, we recommend re-evaluation of the subgrade to verify the condition of the soil prior to construction of the foundations.

Compaction of in-situ clayey soils intended for support of the foundation base is not required at solar array locations where silty or clayey soils are present unless the results of the subgrade testing indicates improvement is required or soils are disturbed during construction activities. For disturbed clayey soils, the disturbed soils should be removed and replaced with engineered fill. At sites where sands are encountered at the subgrade elevation, surface compaction should be performed with a minimum of one pass with a smooth drum vibratory compactor provided this practice does not draw water to the surface. Should the primarily sandy subgrades become disturbed, we recommend leveling and surface compaction of the surficial soil to 95 percent of the maximum dry density according to Standard Proctor.

If the soils in excavations are sensitive to moisture content change or disturbance, consideration can be given to protecting the soil base against damage by use of a flowable concrete mud mat. Prior to placement of the mud mat, the exposed subgrade should be protected from construction traffic and foot traffic should be kept to a minimum, whenever possible.

At locations where the subgrade soils are less than the design soil strengths or become rutted or disturbed during construction, options for subgrade improvement may consist of:

- Reworking and recompacting the native materials to achieve both a minimum of 95 percent of the material's maximum dry density as determined by a laboratory Standard Proctor method of test and the design undrained shear strength or friction angle of the soil.
- Removal of the unsuitable materials and replacement with engineered fill as discussed in Section D.2.
- Deep foundations are also generally an option for locations with lower soil strengths. It is anticipated that the foundations for the solar arrays and the taller structures for the substation areas will be designed with deep foundations already. If lower strength soils are encountered, increasing the embedment depths of these piles could also be considered rather than removal or improvement of the low strength soils.

Lower strengths and potential soil improvement options should be discussed with ***Olsson*** as the geotechnical engineer of record for the project. Confirmation of the selected improvement method also should be reviewed by the foundation engineer for compliance with the support assumptions used in the foundation design.

D.2. Fill

Any structural fill placed below shallow spread foundations should consist of approved engineered fill. Engineered fill should comply with recommendations in Table D.2-1. Alternative engineered fill materials may be used depending upon availability and approval by the foundation engineer. Samples of all fill soils should be submitted to ***Olsson*** for review prior to use on the site.

Fill materials which may be considered suitable for use as general fill to raise site grades consist of material classified as CL, CL-ML, SM, SC, SP-SM, or coarser. It should be free of organic matter or debris, rocks greater than 3 inches in diameter, and have a liquid limit and plasticity index less than 45 and 20, respectively. High plasticity silt or clay (MH, CH) soils should not be used as fill within 4 feet of footings or within 2 feet of slab or pavement subgrades. Silt soils (classified as ML) may be moisture susceptible and should be used with caution. Considering the site was primarily lean clay soils, using silt for mass grading is not recommended unless specific site conditions indicate a significant benefit to selecting this material.

Engineered fill should be placed in lifts not exceeding 8 to 12 inches in loose thickness or one third the diameter of the roller, whichever is less, and moisture conditioned to within ±3 percent of the optimum moisture content. It is recommended that each lift be compacted to a minimum of 95 percent of the maximum dry density obtained in accordance with ASTM Specification D698, Standard Proctor Method. Fills placed in excess of 10 feet will require further evaluation at the time of the final geotechnical investigation.

Compaction should be verified using a nuclear density gauge to ensure that the specified density requirements of the fill materials are being met. If compaction is not being achieved, adjustment of the material's moisture content, the type/source of the material, or the placement and compaction procedures (specifically lift thickness) may need to be modified to achieve the specified compaction. Typically vibratory rollers are required for compaction of granular materials and a sheepsfoot roller is required for clayey soils.

For foundations where overexcavations are required, the excavations and subsequent placement of engineered fill should be oversized by 1 foot on all sides for each foot of excavation below the foundation embedment depth. For example, a 1-foot excavation below the foundation depth will require a bottom of foundation width (and length) 2 feet wider than a standard foundation width (1-foot on each side of the footing).

New fill placed for ancillary structures should be placed in maximum loose lift thicknesses of 8 to 12 inches and compacted as recommended in Table D.2-1. The lift thicknesses should be limited to 4 inches when compacting in small areas requiring hand-operated equipment such as vibrating plate compactors, walk behind trench rollers, or jumping jacks.

An ***Olsson*** representative should regularly observe and monitor the excavation and grading operations and perform field density tests to document that moisture and compaction requirements are being achieved.

Table D.2-1 Recommended Fill Placement Guidelines

Areas of Fill Placement	Material Type	Minimum Compaction Recommendation	Moisture Content (% of Optimum)
Structural Fill Below Foundations	ODOT Granular Material* Spec. Section 703.11 (or similar)	95% Standard Proctor (ASTM D 698)	-3 to +3 percent
General Fill to Raise Site Grades	Approved excavated native materials (CL, CL-ML, SC, SM, or SP)	95% Standard Proctor (ASTM D 698)	-3 to +3 percent
Private Access Road Subgrade	Approved excavated native materials	95% Standard Proctor (ASTM D 698)	-3 to +3 percent
Private Access Road Aggregate	ODOT Granular Material* Spec. Section 703.11 (or similar)	95% Standard Proctor (ASTM D698)	-3 to +3 percent

*Ohio Department of Transportation Granular Material should consist of well-graded sand and gravel materials with less than 10 percent fines

The moisture content for the structural fill at the time of compaction should generally be maintained between the ranges specified in Table D.2-1. More stringent moisture limits may be necessary with certain soils and some adjustments to moisture contents may be necessary to achieve compaction in accordance with project specifications. It should be noted that clayey materials will be more difficult to compact in the presence of excess moisture content, whereas granular materials tend to be less sensitive to moisture content during compaction.

D.3. Drainage Considerations and Dewatering

Water should not be allowed to collect at the ground surfaces near foundations either during or after construction as this may lead to softening of the subgrade. Provisions should be made to quickly remove accumulating seepage water or storm water runoff from excavations and roadway subgrades. Subgrades should be allowed to dry before continuing with construction. Undercut or excavated areas should be sloped toward one corner to allow rainwater or surface runoff to be quickly collected and gravity drained or pumped from construction areas. Subgrade soils that are exposed to precipitation or runoff should be evaluated by ***Olsson*** prior to the placement of new fill, reinforcing steel, or concrete, to determine if corrective action is required.

To minimize concerns related to improper or inadequate drainage away from foundation bearing subgrades or from cohesive backfill materials used in utility trenches or roadways, we recommend that site grading should provide for efficient drainage of rainfall or surface runoff away from new structures and roads.

Depending on the depth of excavations and unique geologic conditions at each solar array location, groundwater removal could consist of sloped excavations and sump pumps or may require more aggressive well-point dewatering systems. In general, excavations that extend solely into clay may only require excavations sloped to a sump collection point and pump to remove collected water, whereas, excavations that extend into one or more sand or silty layers below the groundwater table may require aggressive dewatering, depending on the level of dewatering needed. Shallow groundwater and the presence of permeable sand layers were encountered at the many of the tested locations. The contractor should be prepared to remove infiltrating water in all excavations based on the observed groundwater levels denoted in Section C.3 and Table 1.

Due to the limited depth of foundation excavations, more aggressive dewatering methods such as dewatering points or wells likely are not required. The potential for requiring dewatering points or wells would increase as excavations extend to greater depths in the ground or as they get in close proximity to saturated soil layers.

Care must be taken to avoid inducing additional settlement as a result of dewatering. The dewatering equipment should be installed and maintained by a dewatering contractor with significant experience with similar soil conditions. Much of the success of a dewatering program is dependent on the skills and expertise of the dewatering contractor.

D.4. Temporary Slopes and Excavations

Construction site safety is the responsibility of the general contractor. The contractor shall also be solely responsible for the means, methods, techniques, sequencing, and operations during construction. ***Olsson*** is providing the following information solely as a service to our client. Under no circumstances should ***Olsson's*** provision of the following information be construed to mean that we are assuming responsibility for construction site safety or the contractor's activities. Such responsibility is not implied and should not be inferred.

The contractor should be aware that slope height, slope inclination, and excavation depths (including utility trench excavations) should in no case exceed those specified in local, state, or federal safety regulation; e.g., *OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926,* or successor regulations. Such regulations are strictly enforced, and if not followed, the owner, the contractor, or earthwork or utility subcontractors could be liable for substantial penalties.

The soil in the upper 10 feet at the project site were typically observed to be primarily Type B (stiff clay soils requiring 1H:1V slopes) with lesser areas of Type C (granular soils requiring 1.5H:1V slope) from OSHA soil classifications. This should be verified during construction by the OSHA-defined competent individual to ensure that the benching or slopes are adequate.

Temporary slopes exceeding 5H:1V should be properly benched prior to placement of new fill. As an alternative to flatter and benched temporary slopes, vertical excavations can be temporarily shored. The contractor should be responsible for the design of temporary shoring in accordance with applicable regulatory requirements. Permanent fill and cut slopes at the site should not exceed 3H:1V. Where steeper slopes are planned, additional analysis should be performed once grading plans have been developed.

If excavations, including utility trenches, are extended to depths of more than 20 feet, OSHA requires that the side slopes of such excavations be designed by a professional engineer registered in the state where construction is occurring.

D.5. CONSTRUCTION EQUIPMENT MOBILITY

The on-site soils may be susceptible to degradation and softening under construction equipment traffic, especially when exposed to high moisture levels. Excessive pumping and rutting may occur during construction operations, especially under repeated traffic loads or during periods of wet weather. Depending on weather events and the severity of the degradation, temporary stabilization techniques may be required.

Some general guidelines for reducing equipment mobility problems and addressing potential soft and wet surface soils are as follows:

- Optimize surface water drainage at the site during construction.
- Whenever possible, wait for dry weather conditions to prevail, and do not operate construction equipment on the site during wet conditions. Ruts caused by construction vehicle traffic will accelerate subgrade disturbance.
- Disc or scarify wet surface soils during periods of favorable weather to accelerate drying.
- Temporarily recompact loose subgrade soils if rain is forecast to promote site drainage and reduce moisture infiltration.
- Use construction equipment that is well suited for the intended job under the existing site conditions. Heavy rubber-tired equipment typically requires better site conditions than lightly loaded track-mounted equipment.

It may be necessary to take steps to aggressively improve equipment mobility if construction must proceed during unfavorable conditions.

E. STRUCTURES

Solar panel arrays are typically supported on some form of a deep foundation system. Typical deep foundation systems include driven and vibrated steel piles, helical piers (ground screws), screw piles, and drilled piers. In some cases, the solar trackers have also been supported by a shallow spread footing (ballasted) foundation system that can be cast-in-place or precast.

Based on the results of the geotechnical investigation all of the above foundation systems appear to be feasible for the project site. However, ***Olsson*** understands that a driven steel pile foundation system is commonly the most economical and, thus, the most desirable foundation system to support the solar arrays.

If spread foundations or drilled shaft foundations are to be considered for the solar panel array foundations the results and recommendations contained in Section E.2 for design of the ancillary structures also could be used for design of the solar panel array foundations.

E.1. CONVENTIONAL PILE FOUNDATION DESIGN FOR SOLAR PANEL ARRAY FOUNDATIONS

Based on discussions with Madison Fields, a driven pile foundation system is currently planned for use and an additional phase of pile load testing is being performed by ***Olsson*** at the time of this report.

Of primary concern for the pile option (beyond defining the design parameters for use in foundation design) is the presence of driving obstructions such as cobbles, boulders, dense or cemented sands, or shallow bedrock at the project site. The results of the soil borings performed during our investigation did not encounter large obstructions such as cobbles or boulders shallower than 8 feet; however, in four of the 18 test pits (TP-23, TP-34, TP-39, and TP-64), a minor amount of cobbles or boulders were encountered shallower than a depth of 8 feet. Cobbles were typically 3 to 4 inches in diameter and boulders were typically up to 12 inches in diameter where noted, and appeared to be erratic glacial inclusions of varying mineralogy. Bedrock at the site is anticipated to be relatively deep and well below the typical pile embedment depths. Sands were encountered at several locations; however, the sands did not appear very dense or cemented within the upper 12 feet.

During installation of the field piles for the load testing phase, full penetration to the target depth of 8 feet was achieved for all 60 piles in less than 90 seconds, with no observable obstructions noted. Overall, the risk for pile driving obstructions, while cannot be totally disregarded due to the vast area of the proposed development, the lack of significant obstructions observed in the borings and test pile installations, and only scattered cobbles and boulders encountered in the test pits, appears relatively low; however, up to boulder size erratics can be common in glacial terrains and isolated obstacles for pile driving should be anticipated.

This geotechnical investigation was performed at selected locations spread across the project site. The results of load testing on piles should serve to develop appropriate pile driving criteria to be used during construction of the project. Should undesirable soil conditions be encountered during pile installation (such as the presence of loose soils), the piles could be extended deeper into the ground. Piles in undesirable soil conditions could also be predrilled and grouted in place for additional capacity; however, feasibility of this method could be limited due to the need for casing to potentially maintain borehole stability in saturated sand soils.

Foundation excavations and pile driving activities should be observed by ***Olsson*** to confirm conditions are consistent with this geotechnical report.

E.1.2. PILE LOAD TESTING RESULTS

The following sections discuss the results of the field testing performed for the project. Based on the results of soil borings and test pits performed by Olsson, 4 distinct typical soil profiles were selected for the project site as provided below. Pile load testing was performed at the underlined locations below.

- Strata 1A – Sites with predominantly clay soils for the entire explored profile: GEO-01, <u>GEO-02</u>, GEO-03, <u>GEO-04</u>, GEO-07, GEO-08, GEO-09, GEO-11, GEO-13, GEO-14, GEO-15, GEO-16, GEO-18, GEO-22, <u>GEO-25</u>, GEO-26, GEO-28, <u>GEO-31</u>, <u>GEO-32</u>, <u>GEO-33</u>, <u>GEO-35</u>, <u>GEO-36</u>, GEO-37, GEO-38, <u>GEO-39</u>, GEO-40, GEO-41, GEO-43, <u>GEO-44</u>, GEO-45, GEO-46, GEO-47, <u>GEO-48</u>, GEO-50, GEO-52, GEO-53, GEO-54, GEO-56, GEO-58, GEO-63, <u>GEO-64</u>, <u>GEO-66</u>, <u>GEO-68</u>, GEO-69, <u>GEO-71</u>, GEO-76, GEO-78, GEO-79, and GEO-80
- Strata 1B – Sites with primarily clay underlain by predominantly sand soils at a transition depth below 8-feet: GEO-05, GEO-06, GEO-10, <u>GEO-12</u>, <u>GEO-17</u>, <u>GEO-19</u>, GEO-20, GEO-21, GEO-24, GEO-27, <u>GEO-34</u>, <u>GEO-42</u>, <u>GEO-49</u>, GEO-51, <u>GEO-55</u>, GEO-57, GEO-62, GEO-65, <u>GEO-70</u>, GEO-72, GEO-75, and GEO-77. For the analysis of pile testing and for pile embedment depths on the order of 8 feet below grade, Strata 1B is anticipated to behave similarly to Strata 1A. However, sand soils were encountered in this subset of the borings at depths greater than 8 feet below grade and should piles be installed below that depth, design parameters for sand layers at Strata 1B locations may be required. Depths to sand layers at these locations are indicated on the soil boring logs in Appendix C.
- Strata 2: Sites with a predominantly clay profile underlain by sand at a minimum depth of 5 feet:
  <u>GEO-23</u>, <u>GEO-29</u>, <u>GEO-30</u>, <u>GEO-59</u>, <u>GEO-61</u>, GEO-67, and GEO-81
- Strata 3: Sites with clay soils with an isolated sand layer below 5 feet:
  <u>GEO-60</u>

Individual axial uplift and lateral test results for all tested locations are provided in Appendix H.

E.1.2.1. AXIAL UPLIFT TESTING RESULTS

Appendix I provides the vertical displacement versus vertical load plots for each of the 4 soil profiles indicated in Section E.1.2. The maximum observed vertical loading corresponding to a vertical displacement of 0.25-inches is summarized in Table E.1.2.1-1.

Table E.1.2.1-1: Maximum Vertical Load Corresponding to 0.25-inch Vertical Displacement

Geotechnical ID	Pile Type	Pile Embedment Depth (feet)	Load Corresponding to 0.25-Inch Axial Displacement (pounds)
GEO-02	W 6x9	8	5,500
GEO-04	W 6x9	8	7,000
GEO-12	W 6x9	8	4,500
GEO-17	W 6x9	8	5,500
GEO-19	W 6x9	8	5,500
GEO-23	W 6x9	8	5,500
GEO-25	W 6x9	8	7,000
GEO-29	W 6x9	8	8,200
GEO-30	W 6x9	8	5,200
GEO-31	W 6x9	8	4,800
GEO-32	W 6x9	8	6,400
GEO-33	W 6x9	8	8,500
GEO-34	W 6x9	8	9,500
GEO-35	W 6x9	8	7,500
GEO-36	W 6x9	8	6,200
GEO-39	W 6x9	8	7,000
GEO-42	W 6x9	8	4,200
GEO-44	W 6x9	8	7,000
GEO-48	W 6x9	8	5,800
GEO-49	W 6x9	8	9,000
GEO-51	W 6x9	8	4,500
GEO-55	W 6x9	8	5,500
GEO-59	W 6x9	8	5,300
GEO-60	W 6x9	8	3,700
GEO-61	W 6x9	8	5,900
GEO-64	W 6x9	8	6,900
GEO-66	W 6x9	8	5,700
GEO-68	W 6x9	8	4,200
GEO-70	W 6x9	8	4,400
GEO-71	W 6x9	8	5,700

Results of the testing generally indicated that significant axial displacement (uplift) of the pile was typically observed prior to reaching the practical limit of the testing apparatus.

Based on theoretical axial bearing capacity equations, the estimated uplift capacity is typically taken as 90 percent of the capacity due to skin friction used in compression (FHWA, 2002). The pullout testing performed by Olsson indicated that the limiting capacity observed in the field was approximately 3,700 pounds determined at GEO-60, which was determined through soil borings to have a predominantly clay subsurface profile with a sand layer from 5 to 7 feet. The remaining pullout values observed from field testing exceeded 4,200 pounds, with most exceeding 5,000 pounds. A calculation of theoretical uplift capacity (with a reduction for the upper topsoil zone) indicates an ultimate pull-out resistance on the order of 8,500 psf for clay and 2,250 psf for sand. The results generally agree with this range for pullout capacity. The calculated average alpha factor for clays is slightly higher than the typical theoretical value of 0.41 (Das 2007). Based on our field testing, recommended ultimate uplift values of skin friction to a minimum depth of are shown in Table E.1.2.1-2.

Table E.1.2.1-2: Recommended Uplift Pile Parameters for Pile Foundation Design

Soil Strata	Soil Conditions	Depth Below Grade (feet)	LPIle Soil Type	Effective Unit Weight (pcf)	Clay Undrained Shear Strength (psf)	Sand Friction Angle (degrees)	Unit Skin Friction (ksf)*
1A	All Clay	0-3	Soft Clay (Matlock)	135	1000	--	--
		3-20	Mod. Stiff Clay Without Free Water	72.6	2000	--	0.82
1B	Clay to 8 ft (with sand layers below)	0-3	Soft Clay (Matlock)	135	1000	--	--
		3-8 (min)	Mod. Stiff Clay Without Free Water	72.6	2000	--	0.50
		Sand at depths specific to location	Sand (Reese)	57.6	--	30	0.50
2	Clay Overlying Sand Deeper than 5 feet	0-3	Soft Clay (Matlock)	135	1000	--	--
		3-5	Mod. Stiff Clay Without Free Water	72.6	2000	--	0.82
		5-20	Sand (Reese)	57.6	--	30	0.50
3	Clay with Mid Sand from 5 to 7 feet	0-3	Soft Clay (Matlock)	135	1000	--	--
		3-5	Mod. Stiff Clay Without Free Water	72.6	2000	--	0.50
		5-7	Sand (Reese)	57.6	--	40	0.33
		7-20	Stiff Clay with Free Water (Reese)	72.6	3000	--	0.60

*Skin friction calculated based on average values from field test. Skin friction of clay layers based on lower bound values is approximately 0.50 ksf. Strata 3 values are governed by the lower bound strengths.

Ultimately, the foundation designer should determine an appropriate allowable uplift load to limit axial movement. It is anticipated that typical uplift loading due to wind loading is approximately 3,500 psf for interior columns and 4,000 psf for exterior columns, coupled with a maximum deflection of 1 inch. Results of the field testing indicate that the piles installed as noted in this report are anticipated to perform without excessive displacement at typical loads in most cases. In addition, if piles are connected, additional capacity from the connections are anticipated.

E.1.2.2. Lateral Load Testing Results

Appendix I provides the lateral deflection versus the lateral displacement at the top of pile and at the ground surface for each of the four soil profiles considered for the project. Table E.1.2.2-1 summarizes the displacement at the pile head and at ground surface for the maximum achieved loading.

Table E.1.2.2-1: Summary of Lateral Displacement at Maximum Test Load

Geotechnical ID	Pile Type	Pile Embedment Depth (feet)	Maximum Test Load (pounds)	Displacement at Maximum Test Load (inches)	
				Top of Pile (4 feet)	Grade (0 feet)
GEO-02	W 6x9	8	4,900	+4.00	2.84
GEO-04	W 6x9	8	5,200	+4.00	1.74
GEO-12	W 6x9	8	5,340	+4.00	2.12
GEO-17	W 6x9	8	4,850	+4.00	2.10
GEO-19	W 6x9	8	5,100	+4.00	1.98
GEO-23	W 6x9	8	4,500	+4.00	2.10
GEO-25	W 6x9	8	4,500	4.00	1.63
GEO-29	W 6x9	8	5,120	+4.00	1.75
GEO-30	W 6x9	8	4,000	4.81	2.82
GEO-31	W 6x9	8	5,000	4.55	2.36
GEO-32	W 6x9	8	4,260	4.75	2.30
GEO-33	W 6x9	8	4,500	4.81	2.63
GEO-34	W 6x9	8	4,500	3.73	1.68
GEO-35	W 6x9	8	5,180	4.00	1.86
GEO-36	W 6x9	8	5,320	+4.00	1.82
GEO-39	W 6x9	8	4,040	+4.00	2.18
GEO-42	W 6x9	8	4,000	4.65	2.65
GEO-44	W 6x9	8	4,520	+4.00	2.13
GEO-48	W 6x9	8	4,460	+4.00	2.07
GEO-49	W 6x9	8	5,500	3.81	1.77
GEO-51	W 6x9	8	4,280	+4.00	2.12
GEO-55	W 6x9	8	4,460	+4.00	2.11
GEO-59	W 6x9	8	4,320	+4.00	2.22
GEO-60	W 6x9	8	5,160	+4.00	1.85
GEO-61	W 6x9	8	5,280	+4.00	1.97
GEO-64	W 6x9	8	5,100	+4.00	1.89
GEO-66	W 6x9	8	4,920	+4.00	1.86
GEO-68	W 6x9	8	5,380	4.25	2.09
GEO-70	W 6x9	8	5,440	4.00	1.80
GEO-71	W 6x9	8	5,000	4.35	2.19

It is anticipated that the maximum lateral load is typically on the order of 2,000 pounds for interior columns and 2,500 pounds for exterior columns, coupled with a maximum deflection of 3 inches (in the strong pile direction) at the pile head and approximately 1 inch at ground surface. Based on the results of the field testing, the estimated deflection under the typical maximum loads are anticipated to be less than the maximum allowable deflection based on the field testing for the W 6x9 piles specifically.

Olsson used the software LPile by Ensoft, Inc., to use numerical modeling to evaluate piles as were installed at the project site. The deflections estimated through the computer modeling were compared to the lateral deflections observed at the project site. This is a more refined method of evaluating lateral soil behavior than using prescribed values recommended by the software developer. A calibration of the in-situ lateral deflections versus the theoretical deflections estimated by LPile are provided in Appendix I for W 6x9 piles. Using this information, if the foundation designer decides to adjust the pile size, the soil parameters should stay the same and are anticipated to represent the actual in-situ conditions.

Table E.1.2.2-2: Recommended Lateral Pile Parameters for Pile Foundation Design

Soil Strata	Soil Conditions	Depth Below Grade (feet)	LPIle Soil Type	Effective Unit Weight (pcf)	Clay Undrained Shear Strength (psf)	Sand Friction Angle (degrees)	Static Lateral Modulus of Subgrade Reaction, Kh (pci)	Strain Factor, E_{50}
1A	All Clay	0-3	Soft Clay (Matlock)	135	1000	--	--	0.02
		3-20	Mod. Stiff Clay Without Free Water	72.6	2000	--	1000	0.007
1B	Clay to 8 ft (with sand layers below)	0-3	Soft Clay (Matlock)	135	1000	--	--	0.02
		3-8 (min)	Mod. Stiff Clay Without Free Water	72.6	2000	--	1000	0.007
		Sand at depths specific to location	Sand (Reese)	57.6	--	30	60	--
2	Clay Overlying Sand Deeper than 5 feet	0-3	Soft Clay (Matlock)	135	1000	--	--	0.02
		3-5	Mod. Stiff Clay Without Free Water	72.6	2000	--	1000	0.007
		5-20	Sand (Reese)	57.6	--	30	60	--
3	Clay with Mid Sand from 5 to 7 feet	0-3	Soft Clay (Matlock)	135	1000	--	--	0.02
		3-5	Mod. Stiff Clay Without Free Water	72.6	2000	--	1000	0.007
		5-7	Sand (Reese)	57.6	--	40	200	--
		7-20	Stiff Clay with Free Water (Reese)	72.6	3000	--	1000	0.006

In order to calibrate the models, varying shear strength parameters were used to more closely model the observed deflection during the pile load testing with the LPile software. The parameters indicated in Table E.1.2.2-2 are recommended for lateral analysis, which include a weaker zone at the surface to account for loss of strength during freeze/thaw conditions. These parameters do not include factors of safety or group effect multipliers. Factors of safety, where included, may be reduced for wind or other transient loading. The foundation designer should determine the factors of safety and group effect modifications as appropriate during their design.

Preliminary analyses for lateral loading design are presented for assumed interior and exterior columns installed to a depth of 8 feet below the existing grade (W 6x9, W 8x10, and W 10x12 steel piles) in Appendix I. Piles were assumed to extend 4 feet above the ground surface for both interior and exterior columns. The following loads were assumed for this analysis, but the analysis should be evaluated based on final loads anticipated for the project.

- External Pile: Lateral Load 1,600 lbs, Moment of 19,000 in-lbs, Axial load 1,840 lbs (identified as Load Case 1 in Appendix I)
- Internal Pile: Lateral Load 1,400 lbs, Moment of 18,500 in-lbs, Axial load 1,640 lbs (identified as Load Case 2 in Appendix I)

A maximum allowable pile head deflection of 3 inches was assumed for loading in the strong-axis direction). Results of the preliminary analysis indicate that the lateral deflection is not anticipated to exceed 3 inches. Based on this preliminary analysis, a shorter pile depth could be considered provided suitable uplift resistance is achieved, which could be confirmed using pullout tests during construction.

It should be noted that during lateral pile testing, the flange of the W 6x9 pile sections were distorted slightly where the pile clamp attached to the pile. This did not affect the measurement of displacement or appear to significantly affect the pile structural capacity, as this was only observed on the side of the pile with the pile clamp.

E.1.2.3. Comment On Axial Compression Loading

While not performed for this phase of investigation, piles installed for support of solar PV racking structures will also be exposed to axial compressive loading. The vertical loading is anticipated to be low, and rarely governs the foundation design. For evaluation of the axial compression bearing capacity, theoretical analysis should be suitable for foundation design and a minimum of the full uplift capacity determined during the pile uplift testing can be relied upon for axial compression support of the piles for each strata.

By using the observed pullout testing and calculating the theoretical end bearing of the W 6x9 piles, an ultimate capacity on the order of 6,000 psf for the lowest observed pull out value and 7,200 psf as a more average value are anticipated

The sustained loading from the solar structures on the piles also may result in long-term settlement, although the total settlement of an individual pile is anticipated to be less than ½ inch.

E.2. SHALLOW FOUNDATION DESIGN FOR ANCILLARY STRUCTURES

The foundation design and loading for the project ancillary structures were not provided to ***Olsson*** for this analysis, but it is assumed that shallow spread or mat foundation systems placed directly on native soil may be used for the less critical structures and at the substation and transmission line locations. If ***Olsson's*** assumptions are not fully reflected in the final foundation design, the recommendations in this section will need to be verified.

E.2.1 ALLOWABLE BEARING CAPACITY FOR SPREAD FOOTING FOUNDATIONS

The spread footings for any ancillary structures likely will bear fully on native clay soils or isolated pockets of granular soils.

The following sections discuss, in detail, the determination of the allowable bearing capacity for the solar panel or ancillary structure spread footing foundations.

Allowable soil bearing pressure for a spread footing is based on the shear strength obtained from testing and investigation. A discussion of the soil shear strength was provided in Section C.5.6. The following is a more detailed description of the procedure used to determine the allowable bearing capacity.

The ultimate bearing capacity of the soil supporting a spread footing can be determined using the Terzaghi-Meyerhoff equation as follows:

$$q_{ult} = {}^{1}/_{2}\,\gamma' B_{eff} N_{\gamma} F_{\gamma s} F_{\gamma d} F_{\gamma i} + q N_q F_{qs} F_{qd} F_{qi} + s_u N_c F_{cs} F_{cd} F_{ci} \qquad \text{(Das 2010)}$$

where:

q_{ult} = ultimate bearing pressure

γ = unit weight of the soil

B = average footing width over the length in bearing

N_{γ} = bearing capacity factor

q = surcharge at foundation level

N_q = bearing capacity factor

s_u = design undrained shear strength of the soil

N_c = bearing capacity factor

F = shape (subscript “s”) depth (subscript “d”) and inclination (subscript i) factors

The first and second terms of the above equation are associated with granular soils which typically exhibit drained modes of failure (except under earthquake loading) and where excess pore pressures are allowed to dissipate when the soil when sheared. These terms represent the ultimate drained bearing capacity.

The third term of the equation is associated with fine-grained/clayey soils which typically exhibit an undrained mode of failure and where excess pore pressures can build up in the soil when sheared. This term represents the ultimate undrained bearing capacity.

Since the soils encountered at the project site have layers of both granular and cohesive materials the critical mode of failure may be associated with either drained or undrained conditions and the ultimate bearing capacity should be calculated for each.

E.2.1.1. Bearing Capacity – Undrained Analysis

During undrained loading conditions where excess pore pressures can build up in the soil when sheared, the first term is dropped from the Terzaghi equation, and the second term reduces to the overburden pressure, representing the ultimate undrained bearing capacity shown as follows:

$$q_{ult} = qN_q + s_u N_c F_{cs} F_{cd} F_{ci} \qquad \text{(Das 2010)}$$

Final foundation loads and dimensions for the proposed substation have not been provided at the date of this report. Therefore, to calculate the ultimate bearing capacity, the shape, depth, and inclination subscripts have been assumed to be 1.0. The allowable soil bearing pressure is then obtained by dividing the ultimate bearing capacity by a factor of safety. A factor of safety is usually used for foundations under normal load cases. A one-third reduction in the factor of safety can be used for cases with transient loading, such as wind.

If the recommendations of this report are followed, shallow foundations nearby the completed borings for the substation supported by native soils may be designed using a net allowable soil bearing pressure of up to 2,500 psf (for foundation widths less than 10 feet). Shallow spread foundations should be designed to apply a uniform soil bearing pressure to the supporting soil.

The allowable soil bearing pressure should be confirmed once the final foundation design is available. ***Olsson*** can assist with this verification if desired.

E.2.1.2. Bearing Capacity – Drained Analysis

During drained loading conditions soils where excess pore pressures are allowed to dissipate when sheared, the third term is dropped from the Terzaghi equation and the ultimate drained bearing capacity is estimated as follows:

$$q_{ult} = {}^{1}\!/_{2}\,\gamma' B_{eff} N_{\gamma} F_{\gamma s} F_{\gamma d} F_{\gamma i} + q N_q F_{qs} F_{qd} F_{qi} \qquad \text{(Das, 2010)}$$

where:

q_{ult} = ultimate bearing pressure

γ = unit weight of the soil

B_{eff} = average effective footing width in bearing

L_{eff} = average effective footing length in bearing

N_q, N_d, N_γ = bearing capacity factors

q = surcharge at foundation level

F = shape (subscript “s”) depth (subscript “d”) and inclination (subscript i) factors

Using a friction angle of 30 degrees, and a factor of safety of 3.0, an allowable bearing capacity of 3,000 psf can be considered for foundation design.

Calculation of the allowable soil bearing pressure should be performed once the final foundation design is available. ***Olsson*** can assist with this verification if desired.

E.2.1.3. Bearing Capacity Determination

Based on an assumed ancillary structure spread foundation either 2 feet wide (strip) or up to 10 feet square (isolated), and design shear strength at the substation locations GEO-73 and GEO-74 of 1,500 psf and a design friction angle of 30 degrees, a net foundation bearing pressure from the undrained case of 2,500 psf can be used for shallow foundation design.

E.2.2. Foundation Settlement

Based on typical settlement limits for substations, it is assumed that settlement on the order of 1 inch total and 0.5 inches differential can be tolerated by the proposed substation equipment. The following sections discuss the settlement evaluation performed for the project site. Based on the results of the soil types encountered, settlement will likely consist of both immediate, elastic settlement, and long-term consolidation settlement.

E.1.2.1. Soil Modulus

In following, the small strain Young's modulus is computed from:

$$E_o = 2G_o(1 + \nu)$$

Based on a Poisson's ratio of 0.40 and a shear wave velocity of 700 ft/s from experience with similar soil types, the resulting design small strain Young's modulus, E_o, is 5,500 ksf.

Additionally, correlations for G_{max} are available based on average SPT values, as follows:

$$G_{max} = 325(N_{60})^{0.68}$$ (Holtz, 2011)

Based on an average N_{60} value of 15 within the zone of influence, the resulting G_{max} value is 2,050 ksf and resulting E_o value is 5,740 ksf.

The small strain Young's modulus should be similarly adjusted by the reduction factor to estimate the soil behavior at strain levels similar to those anticipated for foundation settlement. The resulting Young's modulus is approximately E = 2,010 ksf.

E.2.2.1. Elastic Settlement

The immediate or elastic settlement of a soil can be computed based on the application of the extreme load case, using the following equation based on elastic theory:

$$S = \frac{B_{eff} q_o}{E_s}\left(1 - \nu^2\right) I$$ (Das, 2007)

where:

S = elastic settlement

q_o = contact pressure

B_{eff} = effective foundation width

E_s = elastic soil modulus

ν = Poisson's Ratio (assumed to be 0.40 for partially saturated clay soils)

I = shape factor = 1.12 (Day, 2006)

Using this formula, the foundation design engineer can compute the immediate settlements induced by the footing under the allowable load. Based on an applied bearing pressure increase and the effective foundation width for the assumed foundation design, the maximum total immediate settlement is estimated to be less than ½-inch.

E.2.2.2. Long-Term Settlement from Consolidation Test Results

The long-term settlement of clay soils supporting the foundation can be computed using the results of the consolidation test results and the following equation:

$$S = \frac{C_r}{1+e_o} \cdot L \cdot \log\left(\frac{\sigma'_p}{\sigma'_{vo}}\right) + \frac{C_c}{1+e_o} \cdot L \cdot \log\left(\frac{\sigma'_f}{\sigma'_p}\right)$$ (Das, 2010)

where:

C_r = recompression index = 0.006

C_c = compression index = 0.07

e_o = initial void ratio = 0.516

L = height of soil layer

σ'_p = minimum past effective stress where soil transitions from overconsolidated to normally consolidated (varies with depth, results from lab tests provide a *general* indication of the overconsolidation ratio)

σ'_{vo} = original effective stress at the midpoint of the clay layer below foundation

σ'_f = final effective stress equal to $\sigma'_{vo} + \Delta\sigma'$, where $\Delta\sigma'$ = average pressure increase to the clay layer caused by the added load (normal operating load conditions)

Using this formula, the foundation design engineer can compute the long-term consolidation settlements induced by the footing, based on the application of the normal operating load. To calculate the consolidation settlement, the soil should be split into several layers, with the effective stress recalculated at the midpoint of each layer. The depth of calculation should be taken as twice the approximate width of the foundation plus embedment.

Consolidation testing was completed at substation boring GEO-73 at a depth of approximately 4 feet. Based on the results of the consolidation test and normal loading for the current foundation design (increase from the existing stress level at the foundation embedment depth), the long-term total settlement is estimated to be on the order of approximately 1 inch for up to a 10-foot by 10-foot foundation using the allowable bearing pressure provided herein, with differential settlements of approximately ½ total settlement

E.2.3. Drilled Shaft Foundations For Ancillary Structure Locations

For critical structures at the substation locations, drilled shafts may be considered for support of the structures. In the absence of specific foundation design information, recommendations for bearing capacity and lateral load capacity cannot be explicitly calculated at this time. The foundation designer should calculate the design axial and lateral capacity once final design information is available. The design values for geotechnical evaluation of drilled shafts are provided in Table 7 and are based on results from the geotechnical boring and laboratory testing at the Substation borings. For drilled shafts, we recommend a factor of safety of 2 for end bearing and a factor of safety of 2.5 for skin friction. It should be noted that the values provided in Table 7 are ultimate values and do not incorporate a factor of safety. Individual shafts designed per the parameters provided in the above table are anticipated to experience settlements less than 1 inch, but this should be verified by the foundation designer. This assumes that proper drainage is provided around the foundations to avoid moisture changes in the subgrade soils.

An uplift resistance can be calculated as a combination of allowable uplift skin friction and the overall pile weight for the design of a steel reinforced pile. Uplift resistance should be taken as 90% of the calculated skin friction value (FHWA, 1999). The structural capacity of the drilled shafts should be determined using applicable local building codes. The surficial soil should be included with reduced values to account for strength reduction during times of thaw and high moisture content, which is less conservative than neglecting the upper (topsoil/frost zone) altogether.

Recommended lateral resistance parameters for use in design are included in Table 7 based on soil consistency and soil type. We anticipate that the software LPile will be used for analysis of the piles.

As discussed previously, to minimize the disturbance of the bearing soils supporting the existing foundations, the contractor should be prepared to drill with temporary casing. While removing the casing, the casing should be extracted at a slow, uniform rate, with the pull in line with the center of the shaft. We recommend the installation contractor review this report, the soils and conditions encountered, and adjust the means and methods for the drilled shaft installation accordingly. It is the contractor’s responsibility to install the piles without significant soil disturbance. If temporary casing cannot be removed or if soil disturbance is created by the means and methods during construction these items should be discussed with the geotechnical and structural engineer to determine if additional measures are required for foundation support.

An ***Olsson*** field technician should be on-site to observe the shaft as it is drilled and also during concrete and reinforcing steel placement. The base of the drilled shafts should be clean and free of debris or loose soil prior to placing concrete or reinforcing steel. Concrete for the drilled shaft foundation should be placed promptly after drilling operation to reduce exposing the subsoil to rain, surface runoff, or drying conditions. If foundation bearing soils are subjected to such conditions, the soils should be reevaluated by an ***Olsson*** representative prior to reinforcing steel or concrete placement.

Free-fall concrete placement is not recommended unless approved by the structural engineer. The use of a bottom dump hopper or tremie pipe could be considered to prevent potential aggregate segregation or sidewall disturbance. Concrete should be placed with a tremie pipe if standing water or drilling fluid is present in the hole. The tremie pile should always remain within the placed concrete at a depth sufficient to ensure that water is not allowed to mix into the fluid concrete during placement.

The values provided in Table 7 are for single piles with a minimum center-to-center distance of 3 to 5 pile diameters (which is common for substation structures). If the spacings between the shafts are less than indicated above, the axial capacity of the individual shaft should be reduced using group efficiency factors to account for the group action. The group efficiency factor depends on the shaft spacing, shaft diameter, and geometry of the group (number of rows and columns). Similarly, if the shaft spacings are less than 3 to 5 times the diameter of the drilled shaft then the lateral capacity of the individual shaft should be reduced using P-multiplier for group action. The P-multiplier factor depends on the shaft spacing, shaft diameter, and its position (row and column) with respect to the group. Furthermore, the estimated settlement indicated above is for individual shafts supporting the load; however, if the spacing is less than 3 to 5 times the diameter of the shaft, the settlement may increase due to group effects. Group efficiency, P-multiplier factors, and group settlement can be provided upon request.

E.3. FROST DEPTH AND DESIGN CONSIDERATIONS

Based on local codes, frost depth for the area is considered to be approximately 32 inches per the Ohio Building Code (Section 4125.03) The extreme frost penetration for the project based on national publications is 36 inches (NAVFAC, 1986), but extreme frost penetration is rarely what local building codes require for frost protection. The piles and foundations on the site should be designed to the minimum required frost depth per the local building code which is anticipated to be at least 32 inches below the lowest adjacent finished grade to provide frost protection.

Pile foundation design will need to consider frost heave for pile movement. The initial freezing of the soil to the pile (ultimate adfreeze bond) occurs when the frost initial progresses into the ground and around the embedded pile. This adfreeze force on the pile results in little actual displacement of the piles (heave) and is not the primary force that needs to be designed for when considering frost heave of the piles. After the initial frost front penetrates the ground surface, capillary effects (also referred to as ice lensing) draw water to the freezing front from below. This capillary action is dependent upon several factors including but not limited to material type, particle size distribution (or void size), and groundwater level. (Rajaei, 2015).

As the capillary effects feed the freezing zone, the initial adfreeze bond breaks and what is commonly referred to as tangential frost heave strength starts to develop. This is the force that actually causes frost heave movement and can be up to 10 times less than the initial adfreeze forces. Based on the soil's liquidity index of less than 0.25 and an active frost layer depth of about 3 feet below grade, the recommended tangential heave force is 1,672 psf for concrete piles (Nidowicz, 1998). A reduction factor of 0.7 is recommended for steel piles (Kim, 2015 and Nidowicz, 1998), reducing the design tangential heave force to 1,170 psf. This value should be multiplied by the contact surface area of the pile (using the perimeter box projection of the pile shape, not the flange and web surfaces) and then subtract the dead load of the pile and solar panel array to calculate the theoretical tangential heave force for design considerations.

It is recommended that this force be considered a separate load case from wind uplift load, as the piles will be frozen in the ground during winter which will increase the pullout resistance during the winter months. The pile should be embedded to a depth where skin friction below the frost zone provides adequate pullout resistance due to frost heave.

It should be noted that frost heave has been demonstrated to be closer to the full initial adfreeze value if porous, non-frost-susceptible gravel or coarse sand materials are present above underlying silt or clay soils. If this is the design case based on grading and fill placement, consideration should be given to using the full adfreeze value of 2,090 psf for steel piles (Canadian Foundation Engineering Manual).

E.4. SLIDING FRICTION

Lateral resistance of the foundations will be achieved through a combination of base shear resistance mobilized at the footing-subgrade interface and passive earth pressure acting on the vertical faces of the footings at right angles to the direction of applied load. A friction coefficient value of 0.40 can be used between the native soil and the foundation concrete for base shear and sliding resistance (Potyandy, 1961).

E.5. SEISMIC CLASSIFICATION

For this project site, we recommend using a Site Class "D" (stiff soil profile) as per the 2015 International Building Code (IBC) for structures at the site. The recommended site coefficients and spectral acceleration parameters for structural design are provided in Table E.5-1 below for Site Class B and should be converted to Site Class "D" by the foundation designer accordingly.

Table E.5-1 Recommended Seismic Design Parameters

Site	Latitude (North)	Longitude (West)	Parameters for Site Class B		Recommended Site Class
			S_S	S_1	
GEO-51	40.086998	83.478004	0.143	0.065	D

Notes: S_s = 0.2 sec (short-period) Mapped Spectral Acceleration (for site class B)
S_1 = 1.0 sec Mapped Spectral Acceleration (for site class B)

E.6. Soil Corrosivity and Reactivity

Based on the results of soil chemical testing presented in Section C.4, the sulfate levels in the soil are considered negligible (ACI, 2014) and a sulfate exposure class of S0 is recommended for the site. Therefore, in accordance with recommendations by ACI (2014), the use of Type I cement appears suitable for use at the site. The foundation engineer of record has final responsibility for selection or approval of an appropriate concrete mix design.

Electrical resistivity testing was performed at 21 locations. The results of these tests indicated the project site includes soils with electrical resistivity values less than 2,000 ohm-cm, indicating a moderate to high risk of corrosivity to buried metal. For shallow pile consideration, the mean apparent resistivity value for electrode (“a”) spacings less than 20 feet was 4,275 ohm-cm. This value assumes that the depth of measurement is approximately 0.5 to 1.0 of the a-spacing. The foundation engineer of record has final responsibility for selection or approval of appropriate protection for the foundations.

F. PRIVATE ACCESS ROAD DESIGN

F.1. Subgrade Preparation

After stripping and grubbing, the road subgrade should be compacted with a minimum of one pass of a compactor. Unless otherwise directed by the geotechnical engineer, the final prepared subgrade should be proofrolled with a loaded dump truck or similar rubber-tired equipment with a total weight of at least 20 tons, immediately prior to placement of new roadways. Proofrolling operations should be observed by a representative of the geotechnical engineer. Unstable or unsuitable soils revealed by proofrolling should be reworked to provide a stable subgrade or removed and replaced with structural fill under the direction of the geotechnical engineer. Alternative methods of subgrade stabilization may include use of crushed stone, scarification and recompaction, and chemical stabilization.

It is recommended that the subgrade soil be prepared to a minimum 95 percent of the materials maximum Standard Proctor (ASTM D698) dry density. The subgrade moisture content at the time of compaction should be maintained within the ranges specified in Section D.2. for the applicable materials. It is important that the roadway subgrade support be relatively uniform, with no abrupt changes in the degree of support. Non-uniform support can occur at the transition from cut to fill areas, in areas of varying soil moisture or soil types, in areas where rock appears near final grade, or where improperly placed utility backfill has been placed across or through areas to be paved. Improper subgrade preparation such as inadequate vegetation or demolition debris removal, failure to identify soft or unstable areas by proofrolling, and inadequate or improper compaction can also produce non-uniform subgrade support.

For subgrade soils prepared in this manner, a limiting CBR of 2.0 percent can be used for private access road design. This value is based upon completed laboratory testing of material collected across the site and ***Olsson***'s judgement.

A representative of ***Olsson*** should be present during subgrade preparation to observe, document, and test compaction of the materials at the time of placement. As recommended for all prepared soil subgrades, we recommend that heavy, repetitive construction traffic be controlled, especially during periods of wet weather, to minimize disturbance.

F.2. PRIVATE ACCESS ROAD SECTION DESIGN

Traffic loading parameters were not provided to ***Olsson*** for the private access road section design, but is it assumed that most of the traffic loading will be flat-bed trucks and pickup traffic for construction of the proposed solar farm. Using assumed values for gravel, concrete, dust control, and foundation components, the estimated traffic loading was 10,000 ESAL's. This may not be the loading for all roads at the site and should be evaluated by the Civil Designer to ensure it is accurate. If the loading estimated in this report is incorrect, ***Olsson*** should be contacted to re-evaluate the aggregate thickness.

Private access roads for solar projects are typically designed with aggregate base. In some cases, geogrid or geotextile reinforcement is used to provide a thinner aggregate section. Using the Giroud Han iterative equation, and assuming a construction traffic loading of 10,000 passes, tire pressure of 100 pounds per square inch (psi), and an axle load of 18 kips, the recommended aggregate thickness for a 3-inch rut depth is provided in Table F.2-1 below, and in Table 8. Likewise, the recommended aggregate thickness for the maintenance condition was calculated based on a traffic loading of 2,000 passes, a tire pressure of 65 psi, an axle load of 5 kips and a 1.5-inch rut depth.

AASHTO low volume road design methods were also used as a comparison for the unreinforced aggregate thicknesses, assuming a resilient roadbed modulus (M_R) of 1,500 psi, an aggregate base modulus (E_{BS}) of 30,000 psi, and a serviceability criteria of 3.0. Using a construction traffic loading with an ESAL18 value of 10,000 and allowable rut depth of 3.0 inches resulted in an unreinforced aggregate thickness of 10.5 inches. For maintenance loading with an ESAL18 value of 2,000 and an allowable rut depth of 1.5 inches, an unreinforced aggregate thickness of 7.5 inches was computed.

Table F.2-1 Summary of Aggregate Thickness for Road Design

Traffic Condition	Max Rut Depth [in]	Percent Compaction [%]	Recommended Aggregate Thickness (inches)			
			Giroud-Han Method			AASHTO Method
			Unreinforced	With Geotextile (Mirafi RS280)	With Geogrid (BX1200)	Unreinforced
Construction	3	95	14	9	8	10.5
Maintenance	1.5	95	10	8	7	7.5

Based on ***Olsson's*** experience, large construction traffic can withstand a rut depth of 3-inches. However, long-term maintenance construction typically includes smaller vehicles and a rut depth of 1.5-inches is often used. Analysis for these rut depths is provided herein. If evaluation for various rut depths is desired by the Owner, ***Olsson*** can provide the corresponding aggregate thickness.

The road section design should promote positive drainage away from the road. Any traffic loading in excess of the assumed values or may result in excessive rutting or surface deterioration, which may reduce the overall life of the road.

The Civil Designer of record has the final responsibility to determine the most economical combination of aggregate and reinforcement, and to evaluate what the final loading conditions for the roadway will be. As a result, the parameters in this section may need to be revised depending on the final loading.

If geosynthetic materials are used, inspections should be performed during construction to evaluate the materials are placed and anchored properly to develop the required strain in the geotextile materials. If materials are not placed properly and strain is not developed, the reinforcing benefit of the geosynthetics may not be fully realized.

F.3. AGGREGATE RECOMMENDATION

We recommend the private access roadways be constructed of aggregate base material, combined with reinforcement (optional). The granular roadway surface should consist of crushed rock material complying with the requirements of the ODOT Granular Material, with no more than 10 percent passing the number 200 sieve, as discussed in Section D.2. Samples of the proposed aggregate materials for the roadways should be submitted to a laboratory to confirm these properties are met. We recommend a smooth drum vibratory compactor should be used to compact the gravel roadway.

If geogrid reinforcement is used, modifications to the gradation requirements may be necessary in order to comply with the manufacturer's recommendations. Alternative road surface materials may be used depending upon availability and approval.

G. LIMITATIONS

The conclusions and recommendations presented in this report are based on the information available regarding the proposed construction, the results obtained from our soil test borings and sampling procedures, the results of the laboratory testing program, and our experience with similar projects. The soil test borings represent a very small statistical sampling of subsurface soils and it is possible that conditions may be encountered during construction that are substantially different from those indicated by the soil test borings. In these instances, adjustments to design and construction may be necessary. This geotechnical report is based on the site plan and information provided to ***Olsson*** and our understanding of the project as noted in this report. Changes in the location or design of new structures could significantly affect the conclusions and recommendations presented in this geotechnical report. ***Olsson*** should be contacted in the event of such changes to determine if the recommendations of this report remain appropriate for the revised site design.

This report was prepared under the direction and supervision of a Professional Engineer registered in the State of Ohio with the firm of ***Olsson***. The conclusions and recommendations contained herein are based on generally accepted professional geotechnical engineering practices at the time of this report within this geographic area. No other warranty is expressed, intended or made. This report has been prepared for the exclusive use of Madison Fields Solar Project, LLC and their authorized representatives for specific application to the proposed project.

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Madison Fields Solar Project

Madison County, Ohio

June 30, 2020

Olsson Project No. 020-0986

FIGURES

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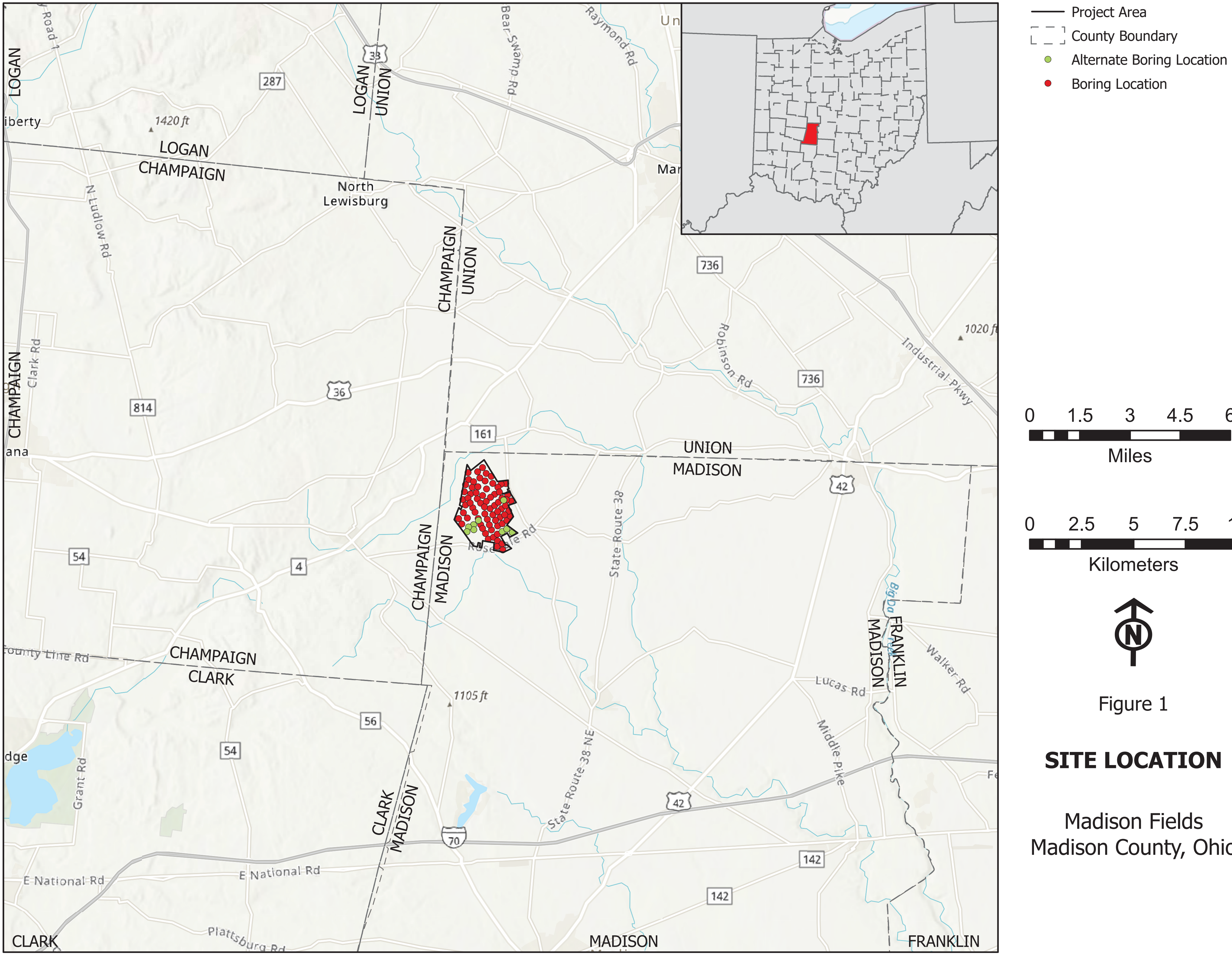


Figure 1

SITE LOCATION

Madison Fields
Madison County, Ohio

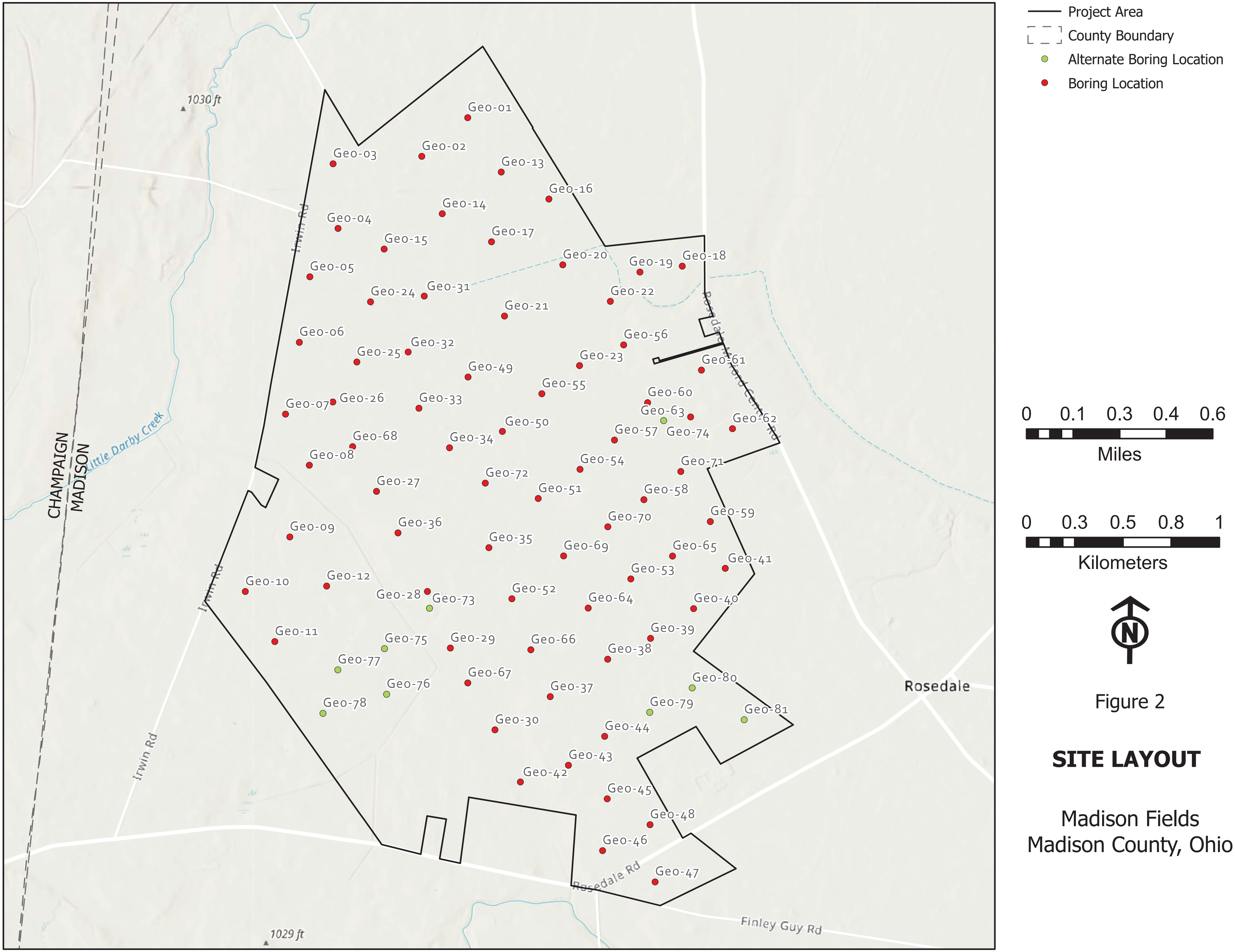


Figure 2

SITE LAYOUT

Madison Fields
Madison County, Ohio

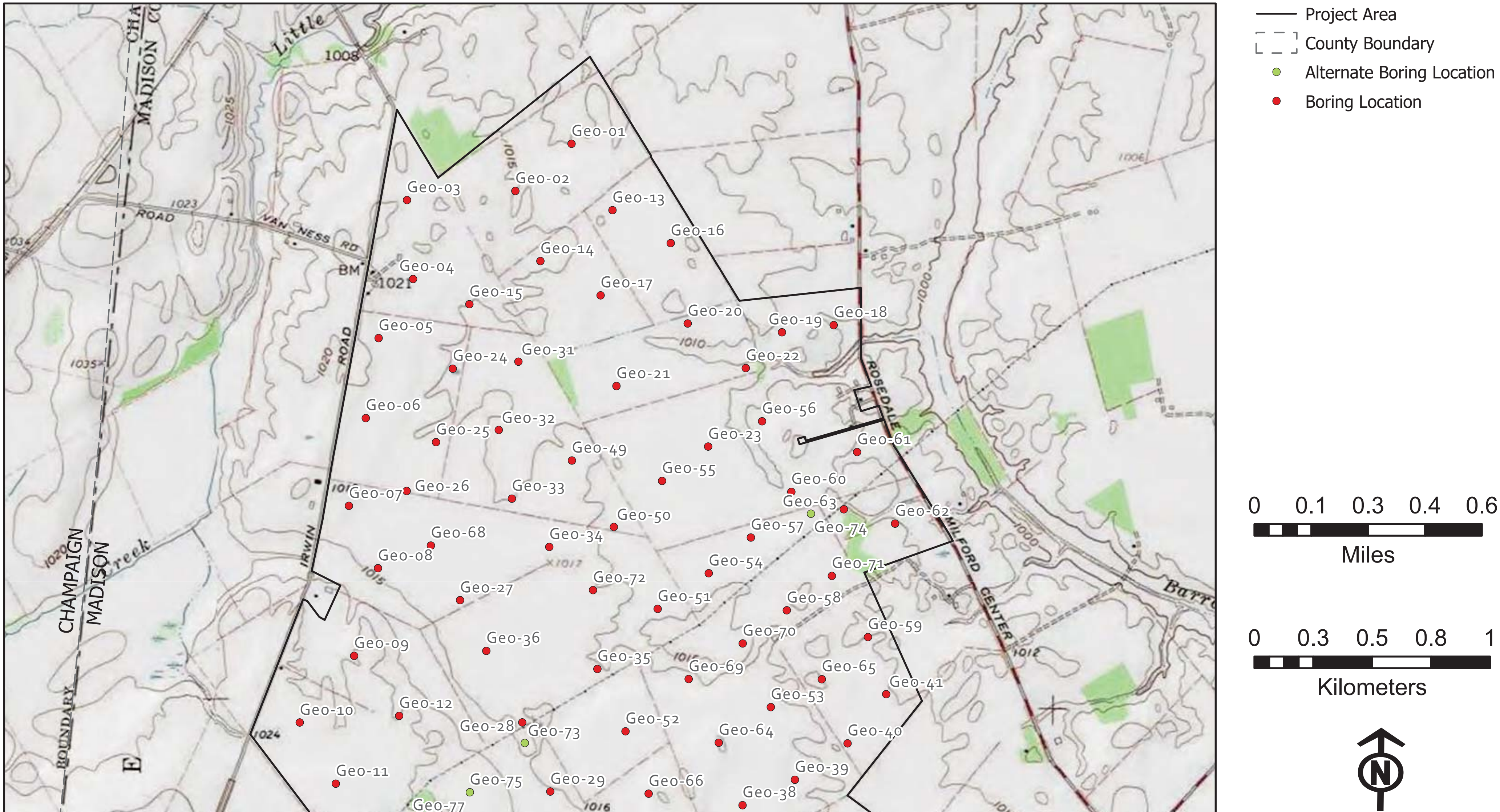
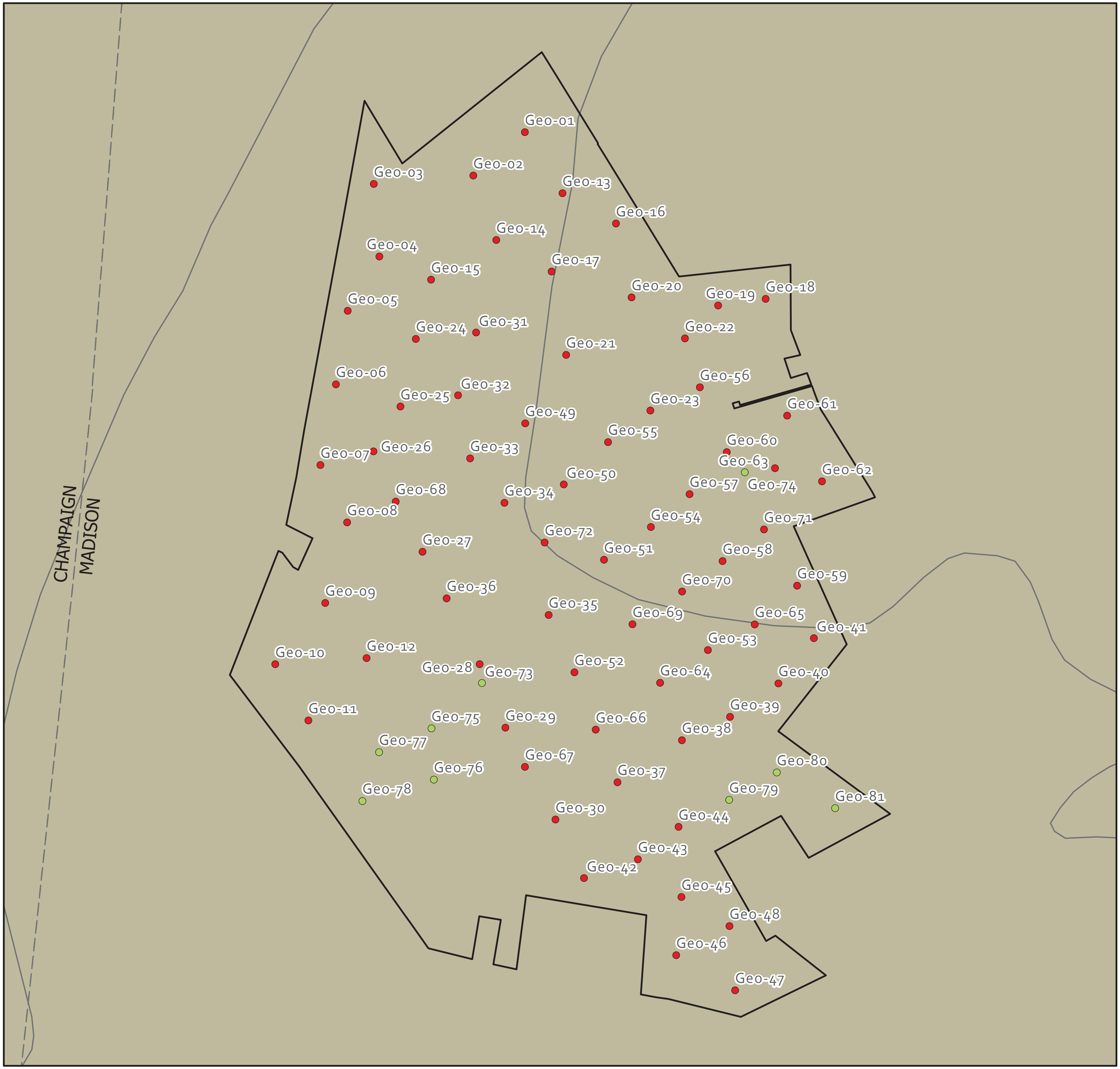


Figure 3

SITE TOPOGRAPHY

Madison Fields
Madison County, Ohio



Project Area
County Boundary
Alternate Boring Location
Boring Location

Surfical Geology

Sedimentary, carbonate

0 0.1 0.3 0.4 0.6

Miles

0 0.3 0.5 0.8 1

Kilometers

N

Figure 4

SURFICIAL GEOLOGY

Madison Fields
Madison County, Ohio

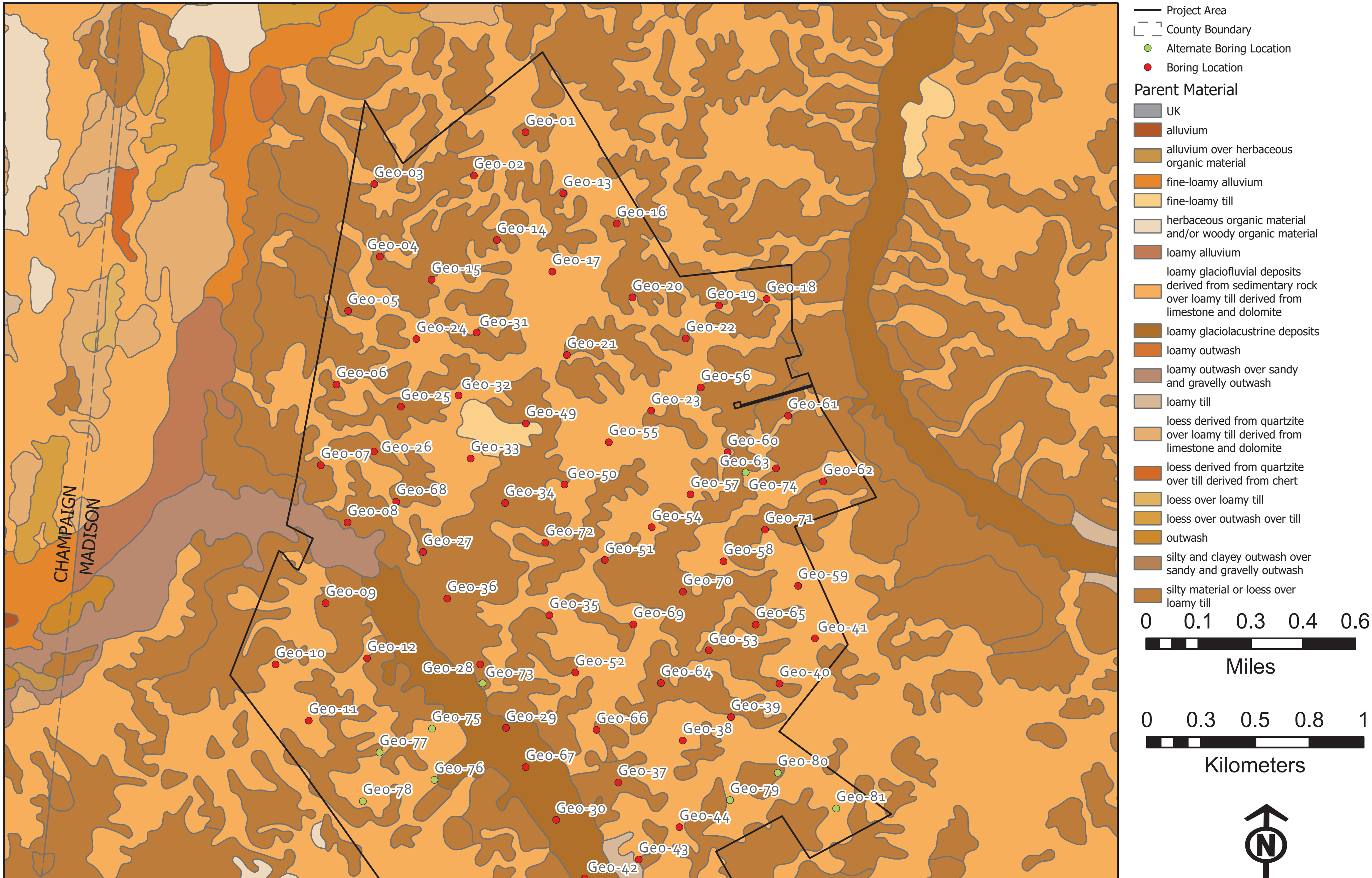


Figure 5

SOIL PARENT MATERIAL

Madison Fields

Madison County, Ohio

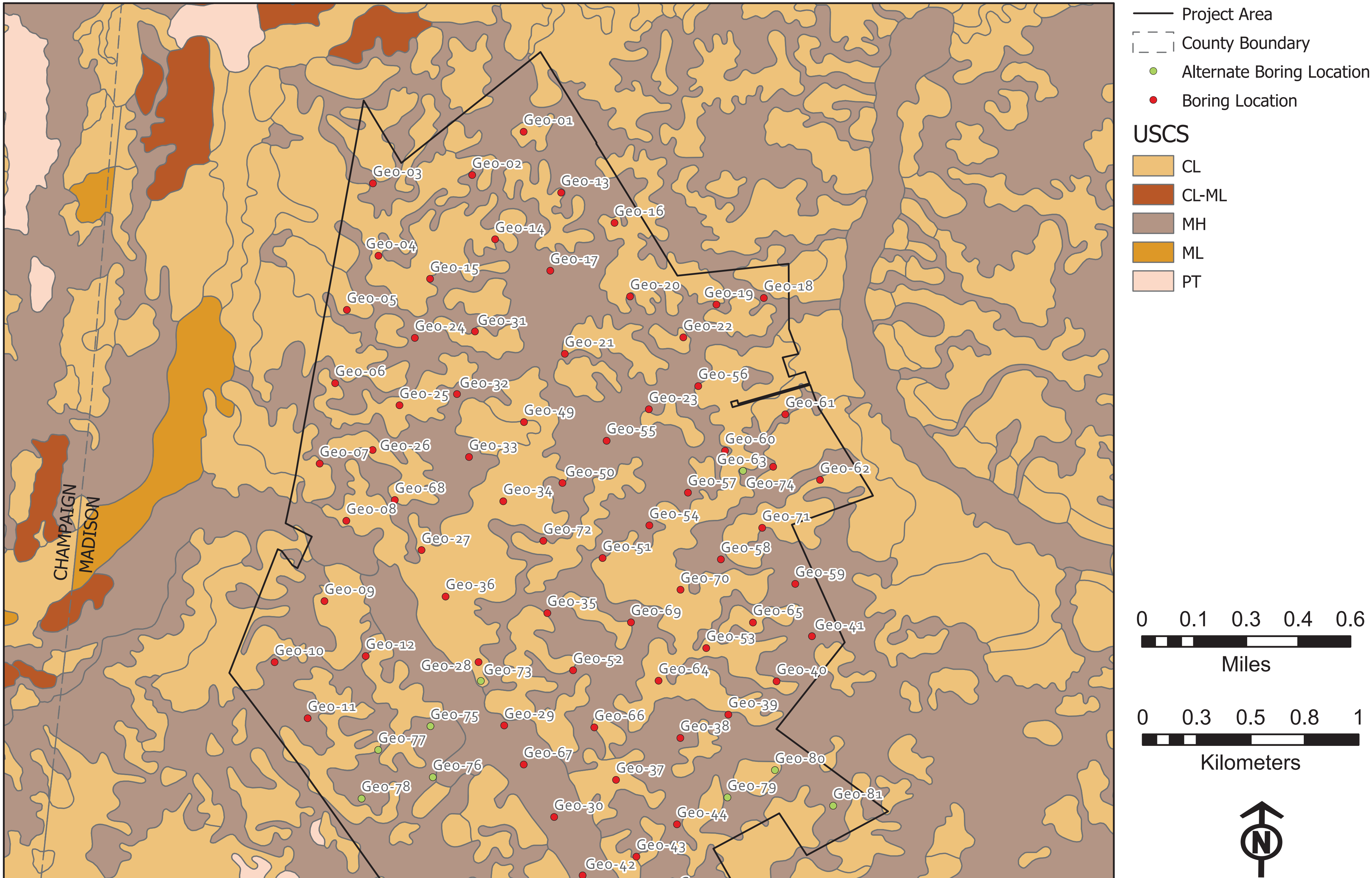
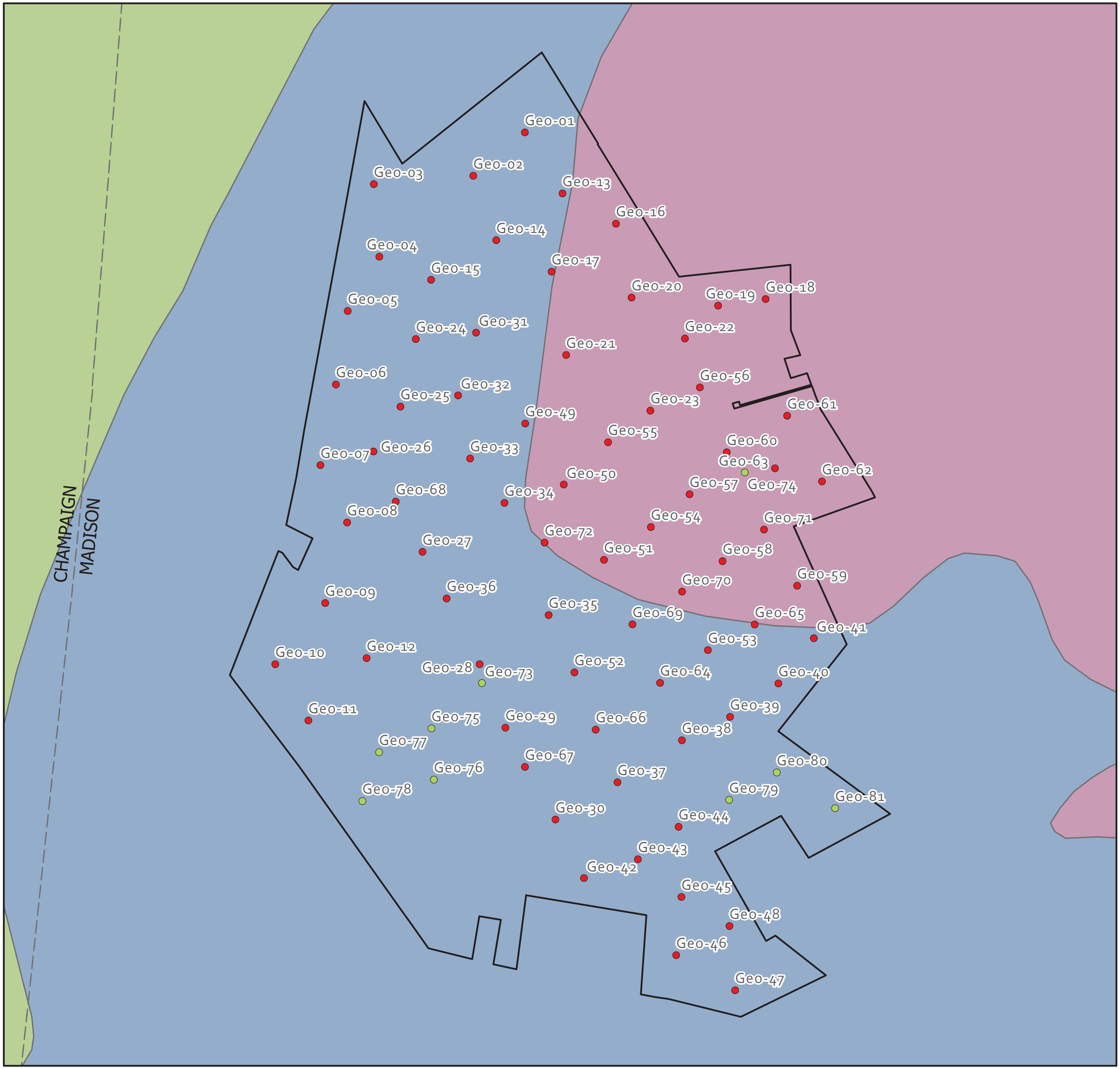


Figure 6

USCS SOIL CLASSIFICATIONS

Madison Fields

Madison County, Ohio



Project Area
County Boundary
Alternate Boring Location
Boring Location

Geologic Formation

SI - Lockport Dolomite - Dolostone
Ss - Salina Group - Dolostone
Stg - Tymochtee and Greenfield Formations, Undivided - Dolostone and Shale

0 0.1 0.3 0.4 0.6
Miles

0 0.3 0.5 0.8 1
Kilometers

N

Figure 7

BEDROCK GEOLOGY

Madison Fields
Madison County, Ohio

Figure 8

FLOODING RISK MAP

Madison Fields
Madison County, Ohio

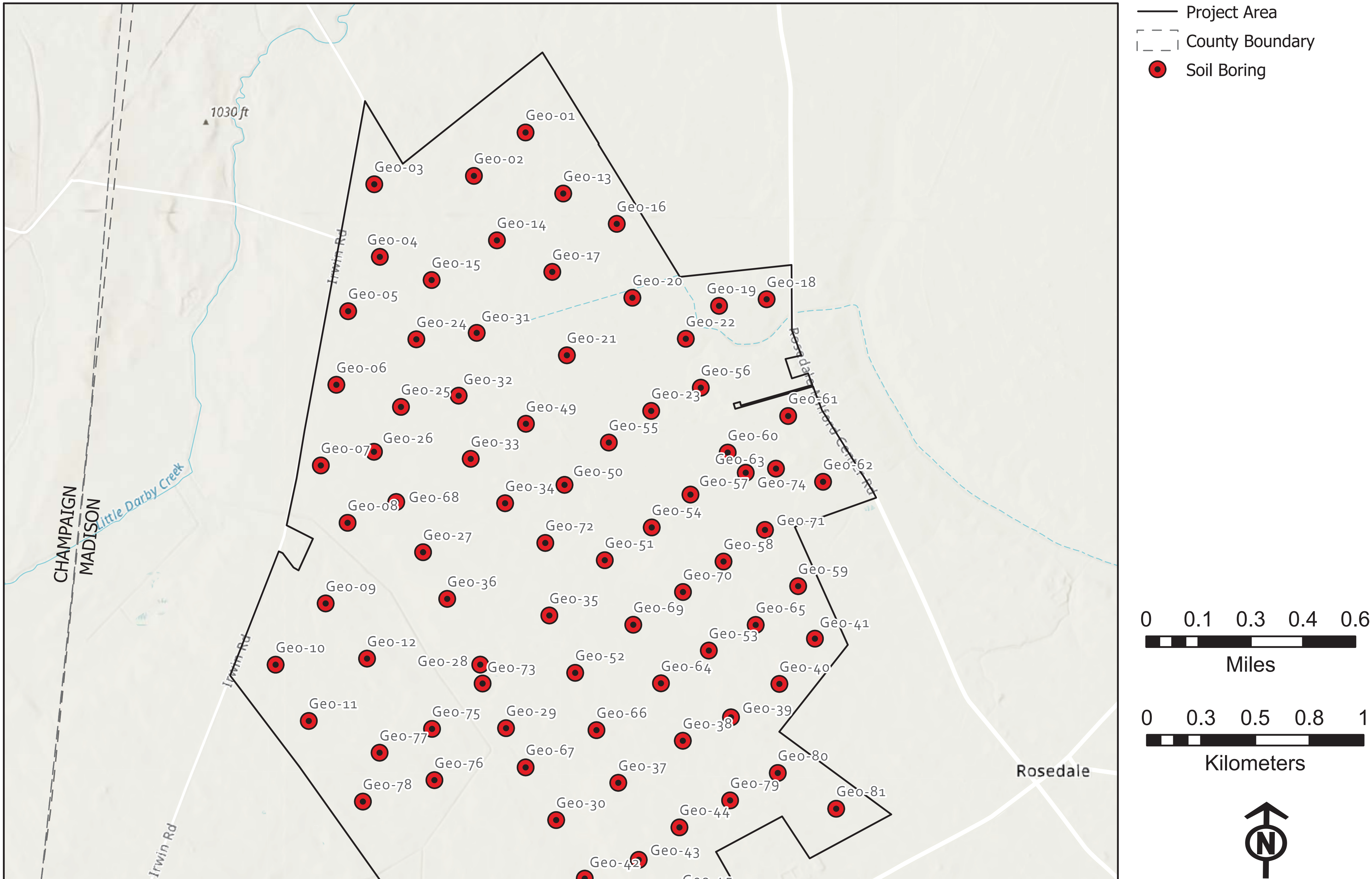
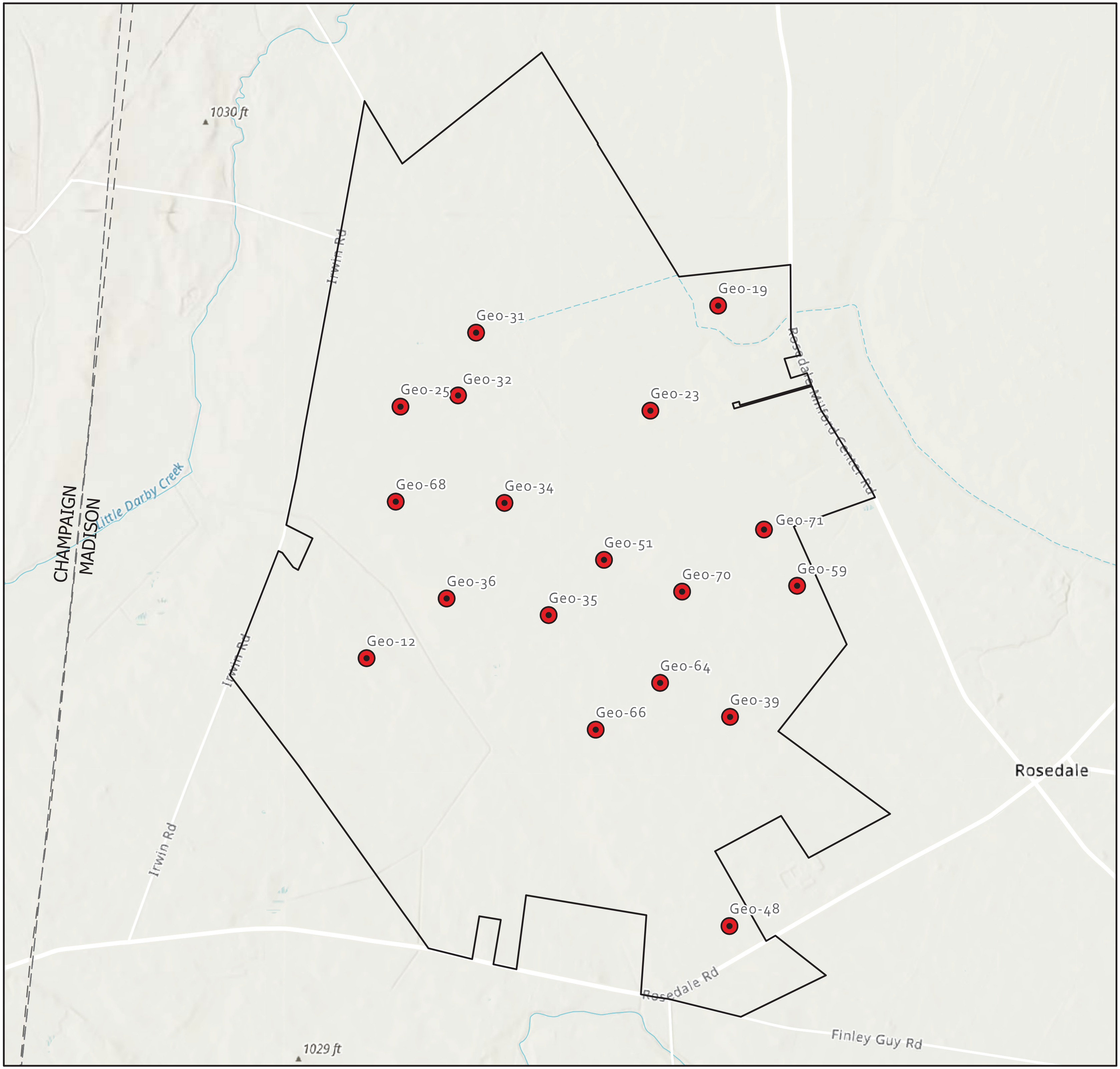


Figure 9

SOIL BORING LOCATIONS

Madison Fields
Madison County, Ohio



Project Area

County Boundary

Test Pit

0 0.1 0.3 0.4 0.6

Miles

0 0.3 0.5 0.8 1

Kilometers

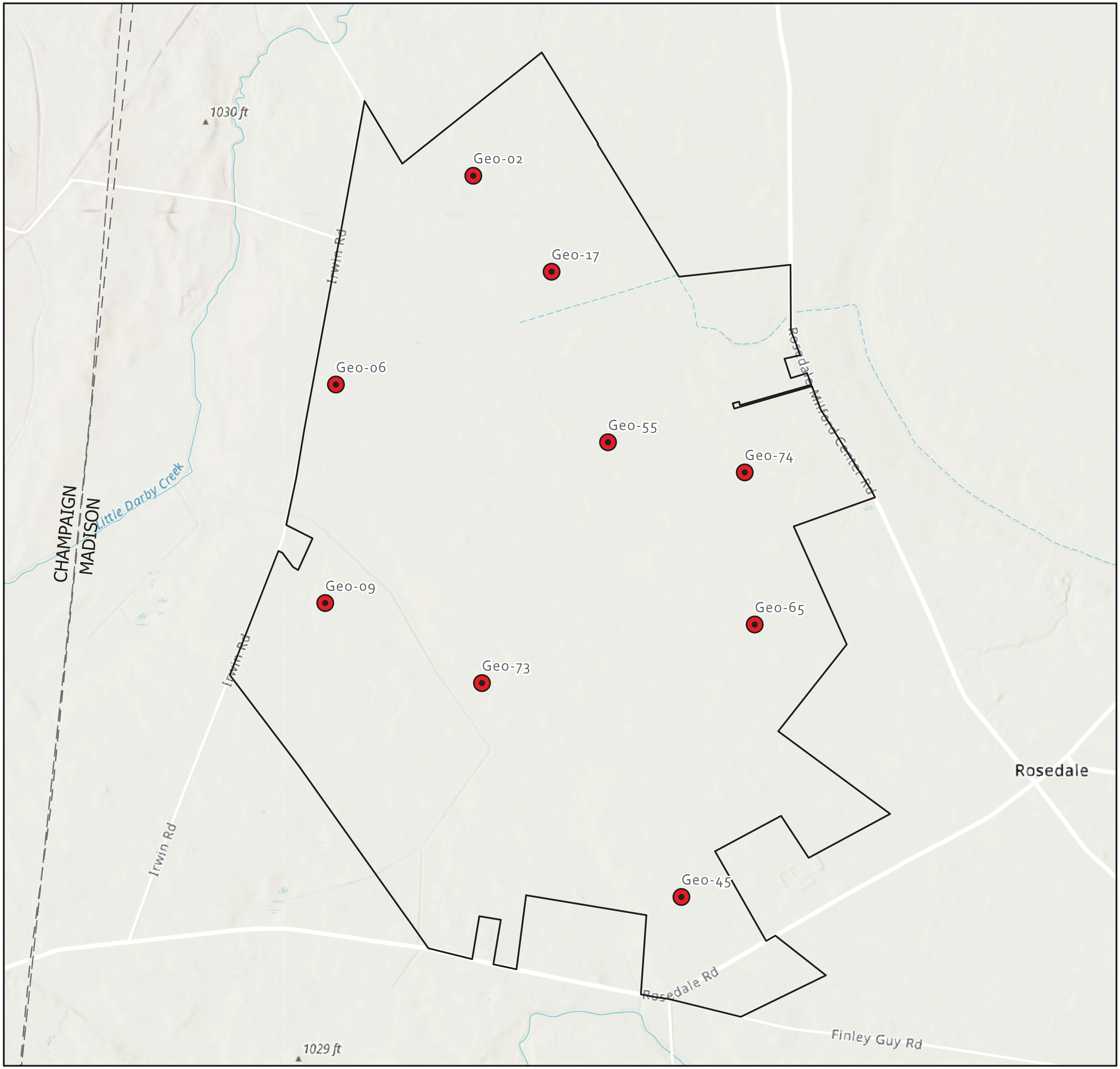
N

Figure 10

TEST PIT LOCATIONS

Madison Fields

Madison County, Ohio



Project Area
County Boundary
Percolation Testing

0 0.1 0.3 0.4 0.6
Miles

0 0.3 0.5 0.8 1
Kilometers

N

Figure 11
PERCOLATION TEST LOCATIONS

Madison Fields
Madison County, Ohio

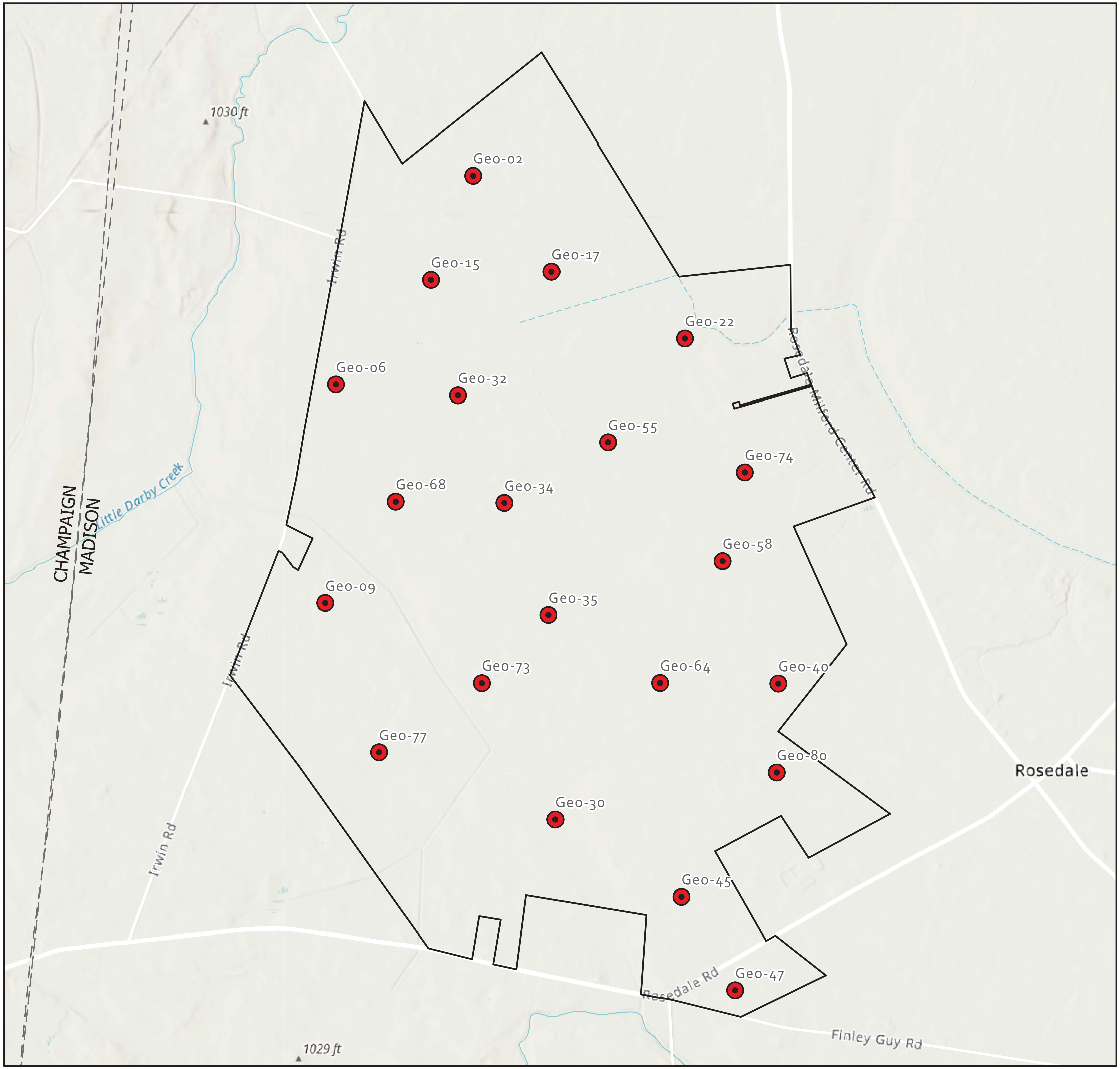


Figure 12

ELECTRICAL RESISTIVITY TESTING LOCATIONS

Madison Fields
Madison County, Ohio

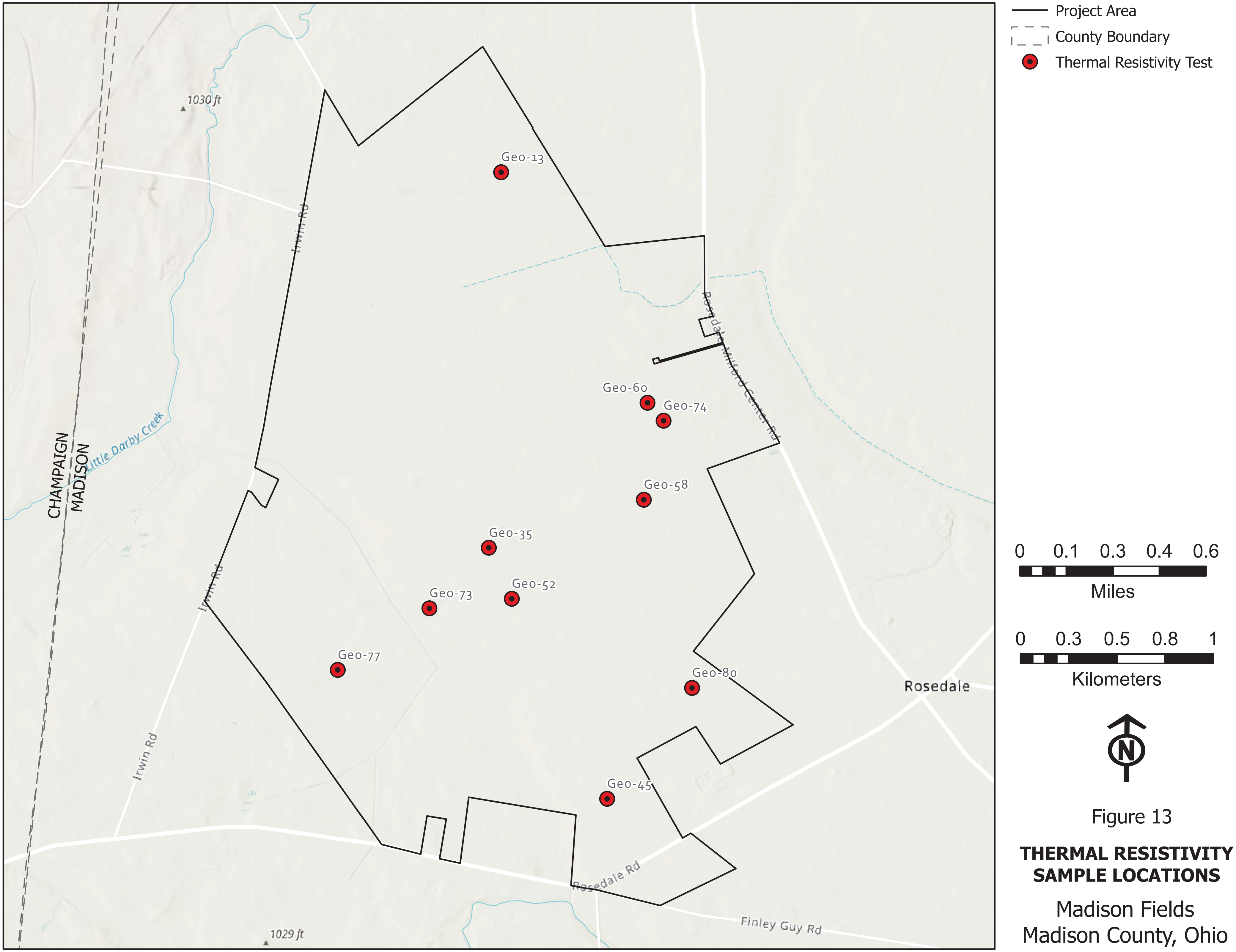


Figure 13

THERMAL RESISTIVITY SAMPLE LOCATIONS

Madison Fields
Madison County, Ohio

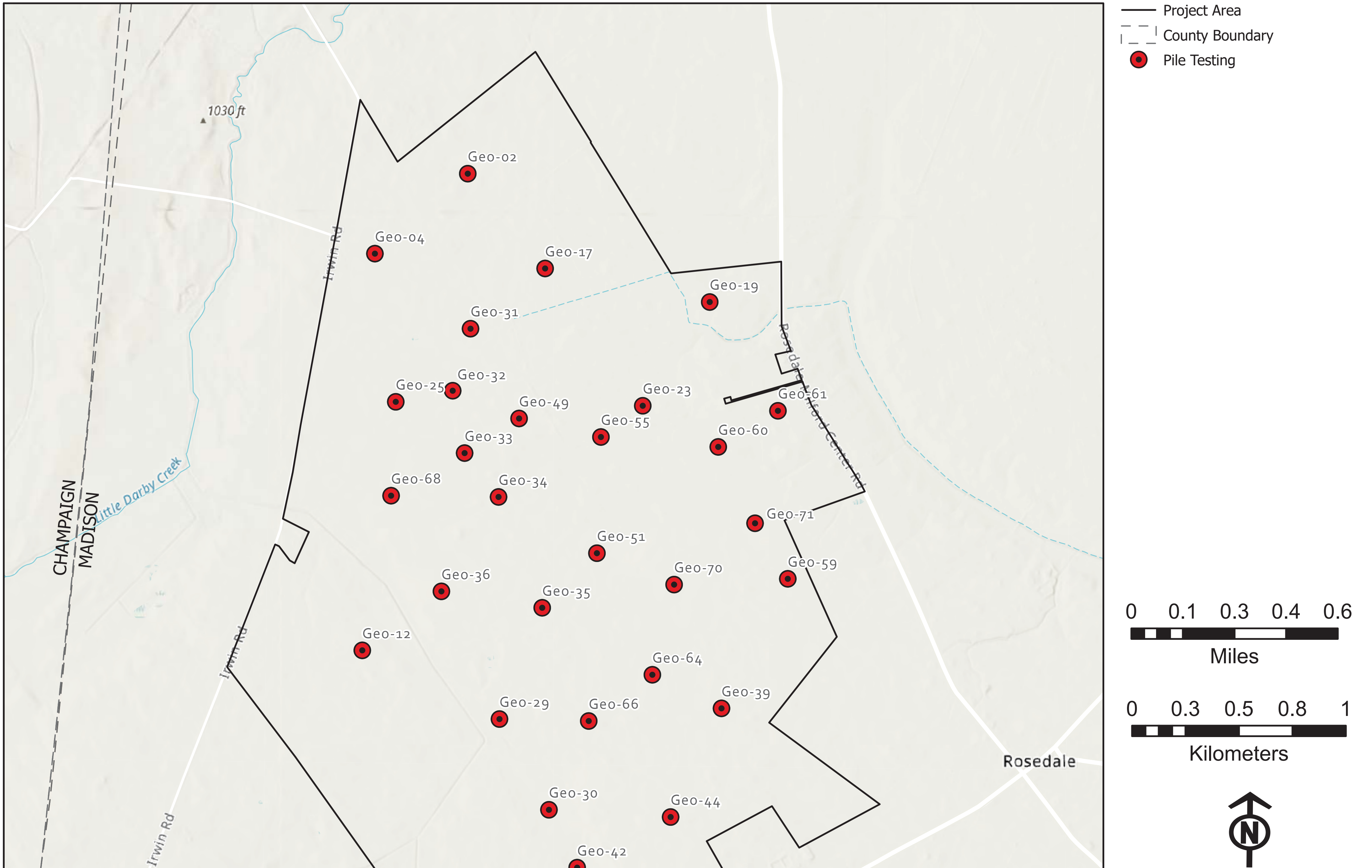


Figure 14

PILE TESTING LOCATIONS

Madison Fields
Madison County, Ohio

Project Area
County Boundary
Boring Locations

0 0.1 0.3 0.4 0.6
Miles

0 0.3 0.5 0.8 1
Kilometers

N

Figure 15

PROJECT AERIAL MAP

Madison Fields
Madison County, Ohio

TABLES

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Table 1
Summary of Groundwater Levels from Soil Borings

Geotech ID	Groundwater Depth [feet]	
	While Drilling	Upon Completion
GEO-01	6.0	6.0
GEO-02	14.0	18.0
GEO-03	5.0	5.5
GEO-04	6.5	9.0
GEO-05	6.0	6.5
GEO-06	10.0	13.5
GEO-07	6.5	11.4
GEO-08	4.5	5.0
GEO-09	4.5	5.6
GEO-10	6.0	4.0
GEO-11	5.0	6.0
GEO-12	6.0	6.0
GEO-13	NE	NE
GEO-14	5.5	7.0
GEO-15	5.5	10.0
GEO-16	11.0	17.2
GEO-17	6.5	4.0
GEO-18	5.5	6.5
GEO-19	6.5	9.3
GEO-20	6.5	3.5
GEO-21	9.0	7.0
GEO-22	6.0	11.3
GEO-23	6.5	0.6
GEO-24	7.0	8.0
GEO-25	6.5	15.0
GEO-26	9.0	12.0
GEO-27	14.5	16.0
GEO-28	NE	NE
GEO-29	6.0	5.5
GEO-30	4.5	4.0
GEO-31	6.0	17.2
GEO-32	3.5	1.3
GEO-33	3.0	0.5
GEO-34	6.5	6.5
GEO-35	12.0	6.5
GEO-36	8.0	17.5
GEO-37	12.0	13.2
GEO-38	5.0	4.4
GEO-39	14.0	17.5
GEO-40	3.5	1.0
GEO-41	4.0	2.5

Geotech ID	Groundwater Depth [feet]	
	While Drilling	Upon Completion
GEO-42	6.0	4.5
GEO-43	6.5	4.8
GEO-44	4.5	11.0
GEO-45	5.5	3.0
GEO-46	5.5	3.5
GEO-47	4.0	12.0
GEO-48	12.0	9.5
GEO-49	14.5	7.8
GEO-50	6.0	5.5
GEO-51	3.5	3.5
GEO-52	12.0	8.5
GEO-53	12.0	13.0
GEO-54	3.5	4.0
GEO-55	6.0	3.5
GEO-56	4.0	6.6
GEO-57	4.0	3.6
GEO-58	3.5	3.5
GEO-59	3.0	1.0
GEO-60	3.0	3.5
GEO-61	5.5	5.0
GEO-62	9.0	6.5
GEO-63	4.5	9.1
GEO-64	4.0	8.0
GEO-65	6.5	6.5
GEO-66	3.0	8.0
GEO-67	5.0	3.5
GEO-68	9.0	15.0
GEO-69	6.0	5.5
GEO-70	3.5	5.0
GEO-71	4.5	6.0
GEO-72	6.5	1.0
GEO-73	4.5	7.5
GEO-74	4.0	5.0
GEO-75	4.0	10.0
GEO-76	5.0	5.5
GEO-77	6.5	5.0
GEO-78	4.5	5.5
GEO-79	4.5	9.5
GEO-80	7.0	18.5
GEO-81	4.0	5.5

NE = Not encountered

Table 1

Project: 020-0986
Prepared by: MRF
Date: 5/15/2020

Madison Fields Solar Project
Madison County, Ohio

Sample Location		Approx Soil Type (1)	Moisture Content [%]	Dry Unit Weight [pcf]	In Situ Unit Weight [pcf]	Atterberg Limits [% moisture content]			Percent Gravel [%]	Percent Sand [%]	Percent Fines [%]	Unconfined Compressive Strength [tsf]	Peak Friction Angle [degrees]
Geotech ID	Depth [ft]					Liq. Limit	Plast. Limit	Plast. Index					
GEO-01	1-2.5'	CL	24.0								82.2		
	3.5-5.0'	CL	26.4										
	6-8.0'	CL	17.2	113.6	133	30	18	12					
GEO-02	3.5-5.0'	CL	21.5										
GEO-03	18.5-20.0'	CL/ML	13.6										
GEO-04	1-2.5'	CL	14.9										
GEO-05	3.5-5.0'	CL	33.7			30	17	13	5.0	27.7	67.4		
	6-8.0'	CL	13.9										
	18.5-20.0'	CL/ML	8.2										
GEO-06	3.5-5.5'	CL	18.4	114.2	135							0.4	
	8.5-10.0'	CL	15.2										
GEO-07	3.5-5.5'	CL	19.8	105.9	127								
	13.5-15.0'	CL	17.1										
GEO-08	3.5-5.0'	CL/ML	14.9	125.3	144								
	6-7.5'	CL/ML	11.3			20	14	6					
	8.5-10.0'	CL/ML	11.6						21.9	31.3	46.7		
	18.5-20.0'	CL/ML	11.2										
GEO-09	6-7.5'	CL/ML	13.8	131.2	149							1.4	
	13.5-15.0'	CL/ML	11.7										
GEO-10	3.5-5.0'	CL/ML	13.7	112.8	128								
	13.5-15.0'	SC/SM	14.2										
GEO-11	3.5-5.0'	CL/ML	14.8	126.3	145								
	13.5-15.0'	CL/ML	11.9										
GEO-12	6-7.5'	CL/ML	12.6			19	14	5					
	8.5-10.0'	CL/ML	12.5	138.9	156								
	18.5-20.0'	CL/ML	14.2										
GEO-13	6-7.5'	CL	11.8										
	15-17.0'	CL/ML	9.9	142.8	157							2.1	
GEO-14	1-2.5'	CL	27.2										
	10-12.0'	CL/ML										3.0	
GEO-15	3.5-5.0'	CL	27.3										
	6-8.0'	CL	25.3	110	138								
GEO-16	3.5-5.0'	CL	13.4										
	10.5-12.5'	CL/ML	12.4	129	145								
GEO-17	1-2.5'	CL	27.4										
	10-12.0'	SC	13.1	127.5	144.2								
GEO-18	3.5-5.0'	CL	19.1										
	15-17.0'	CL/ML	12.7	136.8	154.2								
GEO-19	3.5-5.0'	CL	31.2										
	8.5-10.0'	CL/ML	12.5										
	18.5-20.0'	CL/ML	14.2										
GEO-20	3.5-5.0'	CL	25.6										
	16-18.0'	CL/ML	13.6										
GEO-21	3.5-5.0'	CL/ML	17.6								89.8		
	6-7.5'	CL/ML	15.9			22	15	7					
	18.5-20.0'	CL/ML	14.4										
GEO-22	3.5-5.0'	CL	12.0										
GEO-23	1-2.5'	CL	29.4										
	6-7.5'	CL/ML	14.5	122.2	139.9							1.6	
	8.5-10'	SM											30.6
GEO-24	6-7.5'	CL/ML	14.3	102.7	117.4								
	13.5-15.0'	CL/ML	10.1										
GEO-25	3.5-5.5'	CL/ML	13.4	122.9	139.4							0.8	
	13.5-15.0'	CL/ML	10.1										
GEO-26	1-2.5'	CL	14.6										
	10.5-12.5'	CL/ML	8.2										
GEO-27	6-7.5'	CL/ML	12.2										
	15.5-17.5'	SC/SM	12.3	127.4	143.1							4.1	
GEO-28	3.5-5.5'	CL/ML	11.9										
	13.5-15.0'	CL/ML	8.2										
	18.5-20.0'	CL/ML	10.9										
GEO-29	1-2.5'	CL	28.4										
	10.5-12.5'	CL/ML	11.0	138.1	153.3								
GEO-30	1-2.5'	CL	19.1										
	3.5-5.0'	CL/ML	20.5	114.1	137.5							0.3	
	8.5-10.0'	CL/ML	19.1						0.1	37.5	62.3		
GEO-31	3.5-5.5'	CL	14.3	119.8	136.9							1.5	
	13.5-15.0'	CL/ML	11.5										
GEO-32	3.5-5.5'	CL	20.3	131.3	158.0							0.5	
	13.5-14.5'	SC/SM	7.5										
GEO-33	3.5-5.0'	CL	16.8			28	17	11					
	13.5-15.0'	CL	11.0										
GEO-34	6-7.5'	CL/ML	16.4										
	13.5-15.0'	CL/ML	26.2										
GEO-35	1-2.5'	CL	29.8			36	17	19					
	13.5-15.0'	CL/ML	11.6										
GEO-36	3.5-5.0'	CL/ML	13.2										
	10.5-12.5'	CL/ML	11.7	123.6	138.1								
GEO-37	1-2.5'	CL/CH	27.2			47	17	30					
	6-7.5'	CL	17.4										
	10.5-12.5'	CL	14.7										
GEO-38	3.5-5.0'	CL/ML	14.7	118	135								
	13.5-15.0'	CL/ML	12.3										
GEO-39	13.5-15.0'	CL/ML	11.3										
GEO-40	3.5-5.0'	CL/ML	18.7	111.6	132							0.2	
	18.5-20.0'	CL/ML	10.2										
GEO-41	1-2.5'	CL	17.1										
	8.5-10.0'	CL/ML	10.4										
GEO-42	3.5-5.0'	CL/CH	32.3	100.4	132.8							0.4 (UU)	
	8.5-10.0'	CL	19.2										
GEO-43	6-7.5'	CL/ML	13.2										
	15.5-17.5'	CL/ML	11.6										
GEO-44	6-7.5'	CL	16.8	113	132.0								
	18.5-20.0'	CL/ML	12.8										

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Project: 020-0986
Prepared by: MRF
Date: 5/29/2020

Table 2

Laboratory Testing Results
Madison Fields Solar Project
Madison County, Ohio

Sample Location		Approx Soil Type (1)	Moisture Content [%]	Dry Unit Weight [pcf]	In Situ Unit Weight [pcf]	Atterberg Limits			Percent Gravel [%]	Percent Sand [%]	Percent Fines [%]	Unconfined Compressive Strength [tsf]	Peak Friction Angle [degrees]
Geotech ID	Depth [ft]					Liq. Limit [% moisture content]	Plast. Limit [% moisture content]	Plast. Index [% moisture content]					
GEO-45	3.5-5.0'	CL	27.2			39	18	21	0.9	16.0	83.1		
	6-7.5'	CL	16.4	126.9	147.7							1.3	
	13.5-15.0'	CL/ML	10.9										
GEO-46	6-7.5'	CL/ML	13.6										
	18.5-20.0'	CL/ML	12.7										
GEO-47	3.5-5.0'	CL/CH	30.6										
	18.5-20.0'	CL	13.5										
GEO-48	6-7.5'	CL/ML	12.9	126.5	142.8								
	13.5-15.0'	CL/ML	11.8										
GEO-49	3.5-5.0'	CL	17.4										
	10.5-12.5'	CL	13.8										
GEO-50	3.5-5.0'	CL	20.9	108.3	130.9								
	13.5-15.0'	CL/ML	11.3										
GEO-51	6-7.5'	CL	12.3	136	152.7							2.1	
	8.5-10.0'	SC/SM	11.1										
GEO-52	3.5-5.0'	CL	18.3										
	10.5-12.5'	CL/ML	11.5	131.3	146.4								
GEO-53	3.5-5.0'	CL	23.7	107.6	133.1							0.8	
	18.5-20.0'	CL	15.0										
GEO-54	1-2.5'	CL	25.8										
	3.5-5.0'	CL/ML	14.8	121.5	139.5							1.2	
GEO-55	6-7.5'	CL/ML	13.4	123.8	140.4								
	18.5-20.0'	SC/SM	11.5										
GEO-56	3.5-5.5'	CL/ML	13.2	126.3	143.0								
	13.5-15.0'	CL/ML	13.0										
GEO-57	3.5-5.0'	CL/ML	15.9										
	8.5-10.0'	CL/ML										1.7	
GEO-58	3.5-5.0'	CL/ML	14.8	118	135.5							0.6	
	8.5-10.0'	CL/ML	11.1			17	13	4					
	18.5-20.0'	CL/ML	13.1										
GEO-59	6-7.5'	CL/ML	19.2						6.8	32.6	50.9		
	18.5-20.0'	CL/ML	13.5										
GEO-60	3.5-5.0'	CL	14.6										
	13.5-15.0'	CL	14.6										
GEO-61	3.5-5.0'	CL	22.9			45	17	28					
	6-7.5'	CL	15.4	111.5					8.1	28.0	63.8		
GEO-62	1-2.5'	CL/ML	20.4										
	18.5-20.0'	SM	3.0										
GEO-63	3.5-5.0'	CL	20.0									0.9	
	13.5-15.0'	CL	13.4										
GEO-64	3.5-5.0'	CL	14.4	122.5								2	
	6-7.5'	CL	14.5			25	16	9					
GEO-65	6-7.5'	CL/ML	14.0										
	18.5-19.8'	SM	6.0										
GEO-66	3.5-5.0'	CL/ML	19.9	115.1								1.3	
	13.5-15.0'	CL/ML	9.8										
GEO-67	3.5-5.0'	CL/ML	13.8	119.2								0.5	
	8.5-10'	SM											33.1
	13.5-15.0'	SP/SM	9.1						19.0	50.3	5.5		
GEO-68	3.5-5.0'	CL/CH	22.9										
	10.5-12.5'	CL/ML	10.4										
GEO-69	1-2.5'	CL/CH	27.3	91.8								0.4	
GEO-70	1-2.5'	CL/CH	25.4	94									
	13.5-15.0'	CL/ML	8.6										
GEO-71	3.5-5.0'	CL	17.5	107.6								0.3	
	8.5-10.0'	CL	13.4										
	18.5-20.0'	CL	13.7										
GEO-72	1-2.5'	CL	14.6										
	8.5-10.0'	SM	9.6						20.2	43.3	16.3		
GEO-73	3.5-5.5'	CL	21.3	111.4									
	8.5-10.0'	CL	15.0										
	18.5-20.0'	CL/ML	14.3										
	33.5-35.0'	SC/SM	17.4										
	43.5-43.8'	SC/SM	10.2						20.2	55.9	23.9		
GEO-74	3.5-5.0'	CL	14.8	118.3		34	18	16				0.8	
	8.5-10.0'	CL	12.8										
	18.5-20.0'	CL	22.8						5.2	35.3	59.5		
	23.5-25.0'	CL	22.0										
	33.5-35.0'	SC/SM	10.1										
GEO-75	3.5-5.0'	CL	12.8	124.2	140.1							2.1	
GEO-76	3.5-5.0'	CL/CH	26.1	102.8	129.6							0.7	
	8.5-10.0'	CL/ML	11.8										
GEO-77	6-7.5'	CL/ML	11.6	121.3	135.4	21	15	6					
GEO-78	1-2.5'	CL	22.2										
	8.5-10.0'	CL/ML	11.1	129.1	143.4								
GEO-79	3.5-5.0'	CL	17.1	112.3	131.5								
	13.5-15.0'	CL/ML	10.4										
GEO-80	8.5-10.0'	CL	13.3	123.1	139.5	23	15	8					
GEO-81	6-7.5'	SM	7.5						25.7	43.3	25.6		
	18.5-20.0'	SM	16.0										
Number of Tests			170	51	42	15	15	15	11	11	13	26	2
Minimum Values			3.0	91.8	117.4	17.0	13.0	4.0	0.1	16.0	5.5	0.2	30.6
Maximum Values			33.7	142.8	158.0	47.0	18.0	30.0	25.7	55.9	89.8	4.1	33.1
Average Values			15.8	119.4	140.1	29.1	16.1	13.0	12.1	36.5	52.1	1.3	31.9
Standard Deviations			5.7	11.3	8.8	9.4	1.6	8.2	9.3	11.3	27.1	0.9	1.8

Notes

(1) Approximate Soil Types - see boring logs for full description

Project: 020-0986
Prepared by: MRF
Date: 5/29/2020

Table 2

Laboratory Testing Results
Madison Fields Solar Project
Madison County, Ohio

Table 3
Chemical Test Results on Soil Samples

Geotech ID	Depth (ft)	Soil Type	pH	Chloride (mg/kg dry)	Sulfate (mg/kg dry)
GEO-02	1-2.5	CL	6.31	3.82	5.32
GEO-06	1-2.5	CL	6.54	3.39	11.9
GEO-09	3.5-5	CL/ML	7.33	4.31	5.84
GEO-15	1-2.5	CL	7.46	3.22	7.70
GEO-17	3.5-5	CL	7.73	3.47	5.29
GEO-22	1-2.5	CL	7.78	4.70	9.20
GEO-30	1-2.5	CL	7.46	2.67	8.08
GEO-32	1-2.5	CL	7.29	4.54	14.3
GEO-34	3.5-5	CL/ML	7.77	3.43	4.16
GEO-35	6-7.5	CL/ML	7.62	4.04	8.79
GEO-40	1-2.5	CL	7.04	7.09	4.16
GEO-45	1-2.5	CL	7.10	3.89	6.56
GEO-47	6-7.5	CL/ML	7.58	7.20	17.5
GEO-55	3.5-5	CL/ML	7.53	3.73	3.55
GEO-58	1-2.5	CL	7.23	4.32	5.12
GEO-64	1-2.5	CL	6.90	6.98	10.9
GEO-68	1-2.5	CL	6.52	2.85	7.59
GEO-73	1-2.5	CL	6.93	4.84	9.64
GEO-74	1-2.5	CL/ML	7.09	2.03	18.7
GEO-77	3.5-5	CL/ML	7.50	2.39	12.4
GEO-80	3.5-5	CL/ML	7.58	2.73	4.97

	pH	Chloride	Sulfate
Mean	7.3	4.1	8.7
St. Dev.	0.4	1.4	4.2
Min.	6.3	2.0	3.6
Max	7.8	7.2	18.7

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Project: 020-0986
Prepared by: MRF
Date: 5/15/2020

Table 3

Madison Fields Solar Project
Madison County, Ohio

Table 4
Summary of Standard Proctor Test Results

Geotech ID	Depth [ft]	Soil Type	Standard Proctor Data: Maximum Dry Density	Standard Proctor Data: Optimum Moisture	95% Compaction Moist Unit Wt. at Opt. Moisture	As-Received Moisture	95% Compaction Moist Unit Wt. at in-situ Moisture	CBR Value (corrected at 0.1 inch penetration)
GEO-13	1-5	CL	116.7	14.8	127.3	19.1	132.0	4.7
GEO-35	1-5	CL	122.2	12.7	130.8	13.7	132.0	4.3
GEO-45	1-5	CL	112.1	16.4	124.0	27.4	135.7	2.6
GEO-52	1-5	CL	110.1	17.7	123.1	22.3	127.9	3.7
GEO-58	1-6	CL	111.4	16.4	123.2	20.1	127.1	3.6
GEO-60	1-6	CL	107.6	19.4	122.1	17.9	120.5	3.5
GEO-73	1-3	CH	96.0	25.7	114.6	30.1	118.7	--
GEO-74	2-4	CH	96.5	24.3	114.0	26.8	116.2	--
GEO-77	1-5	CL	108.1	19.2	122.4	26.8	130.2	2.0
GEO-80	1-6	SC	125.0	11.9	132.9	12.9	134.1	3.0

	Maximum Dry Density	Optimum Moisture	95% Compaction Moist Unit Wt. at Opt. Moisture
Mean	110.6	17.9	123.4
St. Dev.	9.5	4.5	6.0
Min.	96.0	11.9	114.0
Max	125.0	25.7	132.9

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Project: 020-0986
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Date: 5/15/2020

Table 4

Madison Fields Solar Project
Madison County, Ohio

Table 5
Summary of Lower Strength Soil Layers

Geotech ID	Structure Type	Thickness of Collapsible Soil Layers [feet]	Anticipated Soil Correction Depths	Anticipated Soil Correction Type
GEO-33	Solar Array	3.0	3-6	None (Pile Foundations)
GEO-34	Solar Array	3.0	3-6	None (Pile Foundations)
GEO-42	Solar Array	6.0	2.5-8.5	None (Pile Foundations)
GEO-55	Solar Array	3.0	3-6	None (Pile Foundations)
GEO-61	Solar Array	7.0	5-12	None (Pile Foundations)

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Project: 020-0986
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Date: 5/15/2020

Table 5

Madison Fields Solar Project
Madison County, Ohio

Table 7
Summary of Geotechnical Parameters for Ancillary Structure Drilled Shaft Foundation Design

									Horizontal Design Parameters										Axial Design Parameters	
Geotech ID	Depth to Top of Layer [ft]	Depth to Bottom of Layer [ft]	Material Type	Total Unit Weight [pcf]	Effective Unit Weight [pcf]	Approx. Depth to Ground-water [ft]	Friction Angle [°]	Undrained Shear Strength [psf]	p-y Modulus, *k* (Static Loading) [lb/in^3]	p-y Modulus, *k* (Cyclic Loading) [lb/in^3]	50% Soil Strain	Pressure-meter Modulus [ksi]	Elastic Modulus [ksf]	Active Earth Pressure Coefficient, K_a	Passive Earth Pressure Coefficient, K_p	N_q (sand) OR N_c (clay)*	Effective Stress at Layer Mid-point [psf]	Effective Stress at Bottom Of Layer [psf]	Ultimate Skin Friction [kips/ft^2]	Ultimate End Bearing [kips/ft^2]
GEO-73	0	2.5	Frost (CL)	110	110	2.5	--	--	--	--	--	--	--	--	--	--	138	275	--	--
	2.5	15	Lean Clay (CL)	120	58	2.5	0	1500	300	--	0.008	2.3	750	0.36	2.77	9.00	635	995	1.05	--
	15	31.5	Silty Clay (CL/ML)	125	63	2.5	0	1000	100	--	0.010	2.3	500	0.36	2.77	9.00	1511	2028	0.70	9.0
	31.5	37.5	Silty Clayey Sand (SC/SM)	130	68	2.5	33	0	125	--	--	1.4	288	0.29	3.39	26.09	2231	2434	0.47	61.1
	37.5	41	Silty Clay (CL/ML)	130	68	2.5	0	2500	500	200	0.006	2.4	1250	0.33	3.00	9.00	2552	2670	1.75	22.5
	41	50	Silty Clayey Sand (SC/SM)	135	73	2.5	33	0	125	--	--	1.5	480	0.29	3.39	26.09	2355	2681	0.49	67.3
GEO-74	0	2.5	Frost (CL)	110	110	2.5	--	--	--	--	--	--	--	--	--	--	138	275	--	--
	2.5	15	Lean Clay (CL)	120	58	2.5	0	1500	300	--	0.008	2.3	750	0.36	2.77	9.00	635	995	1.05	--
	15	27.5	Lean Clay (CL)	125	63	2.5	0	2000	500	200	0.006	2.4	1000	0.33	3.00	9.00	1386	1778	1.40	18.0
	27.5	43.5	Silty Clayey Sand (SC/SM)	130	68	2.5	33	0	125	--	--	1.3	184	0.29	3.39	26.09	2318	2859	0.49	71.7

*Assumes depth/diameter ratio > 3

It is recommended to neglect resistance from frost zone (upper 2.5 feet).

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Project: 020-0986
Prepared by: MRF
Date: 5/15/2020

Table 7

Madison Fields Solar Project
Madison County, Ohio

Table 8
Recommended Aggregate Thickness

Maintenance Traffic		95 % Compaction [Standard Proctor Max Dry Density] 1.5-Inch Rut	3-Inch Rut
Unreinforced		10	N/A
Reinforced	Geotextile*	8	N/A
	Type I Geogrid**	7	N/A
	Type II Geogrid***	6	N/A

Construction Traffic		95 % Compaction [Standard Proctor Max Dry Density] 1.5-Inch Rut	3-Inch Rut
Unreinforced		Does not govern	14
Reinforced	Geotextile*	Does not govern	9
	Type I Geogrid**	Does not govern	8
	Type II Geogrid***	Does not govern	6

+Note that a minimum of 6 inches of aggregate base is recommended for road design to compensate for topsoil stripping.
*Assumed Mirafi RS280i geotextile
*Type I Geogrid: Bidirectional geogrid with Aperature Stability Modulus of at least 0.32 m-N/deg. Minimum Average Roll Value
*Type II Geogrid: Bidirectional geogrid with Aperature Stability Modulus of at least 0.65 m-N/deg. Minimum Average Roll Value

Assumed Traffic Loading Conditions

Construction		Maintenance	
Axle Load [kips]	18	Axle Load [kips]	5
Tire Pressure [psi]	100	Tire Pressure [psi]	65
Axle Passes [each]	10000	Axle Passes [each]	2000
Max Rut Depth [in]	3	Max Rut Depth [in]	1.5

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Project: 020-0986
Prepared by: MRF
Date: 5/15/2020

Table 8

Madison Fields Solar Project
Madison County, Ohio

Table 9
Summary of Driven Pile Installations

Geotech ID	Pile Installation Times (seconds)		Installation Notes
	Pile 1	Pile 2	
GEO-02	56	48	
GEO-04	61	55	
GEO-12	45	62	
GEO-17	44	41	
GEO-19	54	51	
GEO-23	53	55	
GEO-25	58	57	
GEO-29	72	81	Slower progression last 3 feet
GEO-30	22	23	
GEO-31	36	35	
GEO-32	43	42	
GEO-33	53	56	
GEO-34	48	46	
GEO-35	59	53	
GEO-36	55	64	
GEO-39	54	53	
GEO-42	25	28	
GEO-44	42	46	
GEO-48	45	44	
GEO-49	73	74	Slower progression last 3 feet
GEO-51	51	45	
GEO-55	48	50	
GEO-59	35	33	
GEO-60	45	52	
GEO-61	50	46	
GEO-64	71	55	
GEO-66	54	46	
GEO-68	47	49	Slower progression last 1 feet
GEO-70	63	33	
GEO-71	37	36	

*All piles installed to nominal depths of 8 feet below existing ground surface

**Pile 2 installed approximately 20 ft and at a 90° rotation (z-axis) from Pile 1

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Project: 020-0986
Prepared by: MRF
Date: 5/15/2020

Table 9

Madison Fields Solar Project
Madison County, Ohio

APPENDIX A

SITE COORDINATES AND INVESTIGATION SUMMARY

Appendix A
Site Coordinates and Investigation Summary

Geotech ID	Site ID (Array)	Type	UTM NAD83 Z17N Meters Northing	UTM NAD83 Z17N Meters Easting	Soil Boring	Electrical Resistivity	Thermal Resistivity	Percolation Testing	Pile Testing	Test Pit
Geo-01	B-01	Solar Array	4442337.2	288402.8	X					
Geo-02	B-02	Solar Array	4442140.8	288161.2	X	X		X	X	
Geo-03	B-03	Solar Array	4442109.7	287700.6	X					
Geo-04	B-04	Solar Array	4441774.1	287720.7	X				X	
Geo-05	B-05	Solar Array	4441525.7	287570.3	X					
Geo-06	B-06	Solar Array	4441186.8	287510.2	X	X		X		
Geo-07	B-07	Solar Array	4440815.5	287432.3	X					
Geo-08	B-08	Solar Array	4440548.5	287551.4	X					
Geo-09	B-09	Solar Array	4440178.1	287443.9	X	X		X		
Geo-10	B-10	Solar Array	4439899.1	287208.3	X					
Geo-11	B-11	Solar Array	4439636.8	287357.0	X					
Geo-12	B-12	Solar Array	4439920.2	287630.8	X				X	X
Geo-13	B-13	Solar Array	4442052.4	288572.0	X		X			
Geo-14	B-14	Solar Array	4441841.3	288262.4	X					
Geo-15	B-15	Solar Array	4441663.1	287958.0	X	X				
Geo-16	B-16	Solar Array	4441908.3	288816.8	X					
Geo-17	B-17	Solar Array	4441691.5	288515.6	X	X		X	X	
Geo-18	B-18	Solar Array	4441548.6	289502.8	X					
Geo-19	B-19	Solar Array	4441521.8	289282.7	X				X	X
Geo-20	B-20	Solar Array	4441565.9	288883.2	X					
Geo-21	B-21	Solar Array	4441305.3	288576.5	X					
Geo-22	B-22	Solar Array	4441372.4	289126.7	X	X				
Geo-23	B-23	Solar Array	4441041.9	288961.4	X				X	X
Geo-24	B-24	Solar Array	4441390.6	287882.9	X					
Geo-25	B-25	Solar Array	4441079.7	287806.7	X				X	X
Geo-26	B-26	Solar Array	4440874.5	287678.6	X					
Geo-27	B-27	Solar Array	4440407.0	287897.5	X					
Geo-28	B-28	Solar Array	4439883.6	288152.9	X					
Geo-29	B-29	Solar Array	4439588.2	288267.0	X				X	
Geo-30	B-30	Solar Array	4439160.1	288491.3	X	X			X	
Geo-31	B-31	Solar Array	4441415.7	288162.0	X				X	X
Geo-32	B-32	Solar Array	4441127.1	288073.8	X	X			X	X
Geo-33	B-33	Solar Array	4440834.6	288124.6	X				X	
Geo-34	B-34	Solar Array	4440626.9	288279.9	X	X			X	X
Geo-35	B-35	Solar Array	4440105.3	288475.5	X	X	X		X	X
Geo-36	B-36	Solar Array	4440189.8	288005.4	X				X	X
Geo-37	B-37	Solar Array	4439327.4	288780.9	X					
Geo-38	B-38	Solar Array	4439516.5	289082.0	X					
Geo-39	B-39	Solar Array	4439621.0	289306.1	X				X	X
Geo-40	B-40	Solar Array	4439771.6	289532.1	X	X				
Geo-41	B-41	Solar Array	4439977.9	289699.6	X					
Geo-42	B-42	Solar Array	4438887.5	288618.8	X				X	
Geo-43	B-43	Solar Array	4438970.1	288869.3	X					
Geo-44	B-44	Solar Array	4439116.9	289059.7	X				X	
Geo-45	B-45	Solar Array	4438792.6	289067.6	X	X	X	X		
Geo-46	B-46	Solar Array	4438524.3	289039.0	X					
Geo-47	B-47	Solar Array	4438357.5	289308.7	X	X				
Geo-48	B-48	Solar Array	4438654.7	289287.4	X				X	X
Geo-49	B-49	Solar Array	4440992.2	288382.1	X				X	
Geo-50	B-50	Solar Array	4440707.2	288555.6	X					
Geo-51	B-51	Solar Array	4440356.2	288735.6	X				X	X
Geo-52	B-52	Solar Array	4439838.4	288590.4	X		X			
Geo-53	B-53	Solar Array	4439931.1	289208.9	X					
Geo-54	B-54	Solar Array	4440503.9	288954.9	X					
Geo-55	B-55	Solar Array	4440899.1	288763.4	X	X		X	X	
Geo-56	B-56	Solar Array	4441145.4	289192.1	X					
Geo-57	B-57	Solar Array	4440652.6	289136.2	X					
Geo-58	B-58	Solar Array	4440340.9	289283.6	X	X	X			
Geo-59	B-59	Solar Array	4440221.6	289626.2	X				X	X
Geo-60	B-60	Solar Array	4440843.7	289311.3	X		X		X	
Geo-61	B-61	Solar Array	4441007.9	289593.2	X				X	
Geo-62	B-62	Solar Array	4440701.5	289749.2	X					
Geo-63	B-63	Solar Array	4440765.9	289533.0	X					
Geo-64	B-64	Solar Array	4439783.5	288985.5	X	X			X	X
Geo-65	B-65	Solar Array	4440045.8	289427.3	X			X		
Geo-66	B-66	Solar Array	4439572.2	288684.2	X				X	X
Geo-67	B-67	Solar Array	4439405.6	288354.4	X					
Geo-68	B-68	Solar Array	4440641.1	287777.5	X	X			X	X
Geo-69	B-69	Solar Array	4440056.1	288862.3	X					
Geo-70	B-70	Solar Array	4440203.4	289094.2	X				X	X
Geo-71	B-71	Solar Array	4440483.8	289477.4	X				X	X
Geo-72	B-72	Solar Array	4439796.2	288162.2	X					
Geo-73	SB-1	Substation	4440749.3	289393.0	X	X	X	X		
Geo-74	SB-2	Substation	4439590.6	287925.4	X	X	X	X		
Geo-75	Alt-1	Solar Array	4439353.8	287932.4	X					
Geo-76	Alt-2	Solar Array	4439484.6	287681.4	X					
Geo-77	Alt-3	Solar Array	4439260.3	287600.6	X	X	X			
Geo-78	Alt-4	Solar Array	4439237.6	289295.6	X					
Geo-79	Alt-5	Solar Array	4439360.5	289517.8	X					
Geo-80	Alt-6	Solar Array	4439190.9	289784.7	X	X	X			
Geo-81	Alt-7	Solar Array	4442592.9	288779.0	X					

Appendix A

Project: 020-0986
Prepared by: MRF
Date: 5/29/2020

Madison Fields Solar Project
Madison County, Ohio

APPENDIX B

GEOLOGICAL AND GEOTECHNICAL HAZARDS SUMMARY

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Appendix B - Summary of Geologic and Geotechnical Site Hazards

Hazard	Present at Site?	Comment
High groundwater	Likely	Field observations indicate water levels are generally 3 to 6 feet below ground surface across the site with a few exceptions. Shallower groundwater is expected within the glacial terrain.
Flooding	Low	FEMA flood zone mapping indicates the project site is not mapped as having significant flooding potential. Localized zones mapped as Zone A are present to the northwest and south of the project site along rivers.
Scour	Unlikely	The site soils is primarily clayey and much of the site contains dense vegetation that should prevent soil scour for the majority of the site. Areas mapped within the Zone A floodplain may need to consider scour potential depending on stream flow velocities.
Slope failure	Unlikely away from drainages	The project site has low-relief topography away from the drainage features. There is some very localized potential for slope issues along the edges of the creeks and field drainageways, particularly following flooding events.
Subsidence	Unlikely	Project site is not within an area of significant oil and gas extraction or underground mining. The glacial till is generally overconsolidated and should not exhibit excessive settlement
Subsidence – Mining	No	Isolated sand and gravel pits are anticipated in the glacial terrain, but most of the significant mining is east of the site in the unglaciated eastern half of the state.
Subsidence - Caves/Karst	Low	The site is mapped within an area considered to have karst potential in Ohio at depths at or greater than 50 feet. The underlying bedrock units (particularly the Salina Group) are considered to have karst potential, but the Ohio DNR karst mapping site does not indicate any confirmed or suspected karst in the vicinity of the project area. Bedrock was not encountered in the borings, but glacial deposits were observed in all borings which are not susceptible to dissolution.
Earthquake/Seismicity	Low	Based on mapped spectral response acceleration parameters, there is a relatively low probability of experiencing damaging earthquake effects.
Earthquakes – Ground Rupture	No	There are no Quaternary faulting or folding mapped near the site. Seismic activity is mapped as relatively low.
Earthquakes - Liquefaction	Unlikely	Most of the soils are clays and seismicity of the area is relatively low. All of these factors indicate a low risk for liquefaction.

Hazard	Present at Site?	Comment
Swelling/shrinking soil	Unlikely	Based on laboratory testing the soils are considered to have low shrink-swell potential.
Corrosive/Reactive soil	Yes - Corrosivity	Clayey soils with moderate to high moisture contents are present at the site with low electrical resistivity values. Results indicate moderately to highly corrosivity for steel in direct contact with the clayey soils. Sulfate contents are considered “negligible” for concrete mix design.
Made ground	Unlikely	The site is rural in nature with little or no known development and so has low probability of any made ground.
Collapsible soil	Minimal	Collapsible soils are generally associated with loess soils. Loess soils were not encountered during the geotechnical investigations and are not mapped within the project boundaries.

APPENDIX C

SYMBOLS AND NOMENCLATURE
SOIL BORING LOGS

BOREHOLE REPORT NO. GEO-01

Sheet 1 of 1

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Split Spoon / Shelby Tube

APPROX. SURFACE ELEV. (ft): 1011

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
		0								
1010	***ROOT ZONE*** *organic heavy silty clay topsoil, dark brown* — 0.5'									
	LEAN CLAY *with silt and trace organics, firm to stiff, dark brown, moist (CL) [Glacial Till]*		SS 1		3-3-4 N=7		24.0			P-200 = 82.2% PP = 1.5 tsf
	grades to reddish yellow brown	5	SS 2		2-2-3 N=5		26.4			PP = 1.0 tsf
1005	▼									
	grades to with gravel, brown		U 3				17.2	113.6	30/12	PP = 2.0 tsf
	Driller's Note: Cave-in to 9 feet immediately following drilling	10	SS 4		5-6-7 N=13					PP = 2.5 tsf
1000	11.0'									
	SILTY CLAY *with gravel, very stiff to hard, dark gray brown, moist (CL/ML) [Glacial Till]*									
		15	SS 5		5-8-10 N=18					PP = 4.0 tsf
995										
	20.0'	20	SS 6		7-8-9 N=17					PP = 2.5 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 6.0 ft
IAD	▼ 6.0 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/16/20	FINISHED:	4/16/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

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BOREHOLE REPORT NO. GEO-02

Sheet 1 of 1

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Split Spoon | Shelby Tube

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
1015	**APPROX. SURFACE ELEV. (ft):**1015		0								
	ROOT ZONE organic heavy silty clay topsoil, reddish brown **0.5'**										
	LEAN CLAY with silt and trace organics, firm to stiff, dark brown to reddish yellow brown, moist (CL) [Glacial Till]			SS 1		3-3-4 N=7					PP = 1.5 tsf
1010			5	SS 2		3-5-7 N=12		21.5			PP = 1.0 tsf
	grades to with gravel, brown **8.0'**			SS 3		4-4-5 N=9					PP = 2.0 tsf
1005	***SILTY CLAY*** with sand and gravel, very stiff to hard, dark brown and reddish yellow brown, moist (CL/ML) [Glacial Till]		10	SS 4		3-6-6 N=12					PP = 2.0 tsf
	grades to dark brown			U 5							PP = 1.0 tsf
1000	▽ *grades to dark gray brown*		15	SS 6		3-5-7 N=12					PP = 2.0 tsf
	▼										
995	*Driller's Note: Cave-in to 18.5 feet immediately following drilling* **20.0'**		20	SS 7		5-7-8 N=15					PP = >4.5 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 14.0 ft
IAD	▼ 18.0 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/16/20	FINISHED:	4/16/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

olsson	BOREHOLE REPORT NO. GEO-03	Sheet 1 of 1

PROJECT NAME: Madison Fields Solar	CLIENT: Savion, LLC
PROJECT NUMBER: 020-0986	LOCATION: Madison County, Ohio

Legend: Split Spoon; Shelby Tube

APPROX. SURFACE ELEV. (ft): 1017

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE organic (corn) heavy silty clay topsoil, dark reddish brown	0 – 1.0'								
1015	**_LEAN CLAY_** with trace organics, firm, dark brown to reddish yellow brown, moist (CL) [Glacial Till]		SS 1		3-3-4 N=7					PP = 1.5 tsf
	grades to with gravel, dark brown with reddish yellow brown and light gray brown	5.0'	SS 2		1-2-2 N=4					PP = 1.0 tsf
1010	**_SILTY CLAY_** with gravel, very hard, brown, moist (CL/ML) [Glacial Till]	8.0'	U 3							PP = 2.5 tsf
	LEAN CLAY with sand and gravel, very stiff, dark brown, moist	11.0'	SS 4		5-8-13 N=21					PP = 4.5 tsf
1005	**_SILTY CLAY_** with trace sand and gravel, very stiff to hard, dark gray brown, moist (CL/ML) [Glacial Till] *Driller's Note: Cave-in to 12.9 feet immediately following drilling*	15	SS 5		5-7-9 N=16					PP = 2.0 tsf
1000		20.0'	SS 6		6-10-13 N=23		13.6			PP = >4.5 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	5.0 ft
IAD	5.5 ft after 0 Hrs
AD	Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/16/20	FINISHED:	4/16/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD:	CONTINUOUS FLIGHT AUGER		

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BOREHOLE REPORT NO. GEO-04

PROJECT NAME: **Madison Fields Solar**	CLIENT: **Savion, LLC**
PROJECT NUMBER: **020-0986**	LOCATION: **Madison County, Ohio**

Split Spoon | Shelby Tube

APPROX. SURFACE ELEV. (ft): 1018

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE		0								
	organic (corn) heavy silty clay topsoil, dark reddish brown — ***1.0'***										
	LEAN CLAY			SS 1		3-5-6 N=11		14.9			PP = 2.0 tsf
1015	*with gravel and trace organics, stiff to very stiff, brown to reddish brown, moist (CL) [Glacial Till]* — ***4.0'***										
	SILTY CLAY		5	SS 2		6-7-9 N=16					PP = 3.5 tsf
	with sand and gravel, very stiff to hard, brown, moist (CL/ML) [Glacial Till]										
	▽ *grades to with gravel and with trace sand, brown to yellowish brown*			SS 3		4-4-7 N=11					PP = 2.5 tsf
1010											
	▼		10	SS 4		4-10-17 N=27					PP = 4.0 tsf
	grades to dark brown			U 5							PP = 2.0 tsf
1005											
	grades to dark gray brown		15	SS 6		7-7-7 N=14					PP = >4.5 tsf
	Driller's Note: Cave-in to 15.8 feet immediately following drilling										
1000											
	20.0'		20	SS 7		5-7-9 N=16					

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 6.5 ft
IAD	▼ 9.0 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/16/20	FINISHED:	4/16/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

olsson	BOREHOLE REPORT NO. GEO-05	Sheet 1 of 1

PROJECT NAME: Madison Fields Solar	CLIENT: Savion, LLC
PROJECT NUMBER: 020-0986	LOCATION: Madison County, Ohio

Split Spoon ☒ Shelby Tube ■

APPROX. SURFACE ELEV. (ft):1019

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE *organic (corn) heavy clay topsoil, dark reddish brown* **1.0'**	0								
	LEAN CLAY *with trace organics, firm, reddish yellow brown, moist (CL) [Glacial Till]*		SS 1		3-3-5 N=8					PP = 1.5 tsf
1015	*grades to sandy, with trace gravel*	5	SS 2	CL	3-1-3 N=4		33.7		30/13	P-200 = 67.4% PP = 1.0 tsf
	grades to stiff to very stiff, with sand and gravel, brown, moist		U 3				13.9			PP = 3.0 tsf
1010		10	SS 4		3-4-6 N=10					PP = 3.0 tsf
1005	*Driller's Note: Cave-in to 13.5 feet immediately following drilling* **13.5'**		SS 5		50/4"					
	SILTY SAND *with gravel, gray brown, moist (SM) [Alluvium]* **17.0'**	15								
1000	***SILTY CLAY*** *with gravel, hard, dark gray brown, moist (CL/ML) [Glacial Till]* **20.0'**	20	SS 6		12-19-28 N=47		8.2			PP = >4.5 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 6.0 ft
IAD	▼ 6.5 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/16/20	FINISHED:	4/16/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. GEO-06

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	**LOCATION**
020-0986	Madison County, Ohio

Legend: Split Spoon (X box); Shelby Tube (solid box)

APPROX. SURFACE ELEV. (ft): 1017

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE organic (corn) heavy silty clay topsoil, dark brown	0–1.0'								
1015	***LEAN CLAY*** with silt and trace sand and organics, firm, dark gray brown to reddish yellow brown, moist (CL) [Glacial Till]		SS 1		2-3-3 N=6					PP = 1.0 tsf
	grades to with sand and gravel, stiff, reddish brown	5	U 2			0.4	18.4	114.2		PP = 1.5 tsf
1010			SS 3		3-4-6 N=10					PP = 2.0 tsf
	▽ (water level at 10 ft)	10	SS 4		3-5-6 N=11		15.2			PP = 1.5 tsf
1005	*grades to very stiff, dark gray brown* ▼ (water level at 13.5 ft)									
		15	SS 5		9-9-9 N=18					PP = 3.5 tsf
1000	*Driller's Note: Cave-in to 16.5 feet immediately following drilling*	17.5'								
	SILTY CLAYEY SAND fine grained sand, medium dense to dense, dark gray brown, moist (SC/SM) [Alluvium] varies to sandy silty clay (CL/ML)	20 (20.0')	SS 6		9-14-15 N=29					PP = 1.0 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 10.0 ft
IAD	▼ 13.5 ft after 0 Hrs
AD	▽ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/18/20	FINISHED:	4/18/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. GEO-07

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Split Spoon / Shelby Tube

APPROX. SURFACE ELEV. (ft):1016

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
		0								
1015	***ROOT ZONE*** *organic (corn) heavy silty clay topsoil, dark reddish brown* **1.0'**									
	LEAN CLAY *with sand and trace organics, firm to stiff, mottled dark brown and reddish brown, moist (CL) [Glacial Till]*		SS 1		2-2-4 N=6					PP = 2.0 tsf
	grades to with sand and gravel, reddish brown	5	U 2				19.8	105.9		PP = 2.5 tsf
1010			SS 3		3-3-4 N=7					PP = 2.5 tsf
	grades to stiff to hard, dark reddish brown	10	SS 4		3-6-8 N=14					PP = 4.5 tsf
1005	**12.5'**									
	SANDY CLAY *with silt, dense, dark brown, moist (CL) [Glacial Till] varies to silty clayey sand (SC/SM)*	15	SS 5		9-11-17 N=28		17.1			PP = 3.0 tsf
1000	*Driller's Note: Cave-in to 13.8 feet immediately following drilling* **17.5'**									
	SILTY CLAY *with sand and gravel, very stiff to hard, dark gray brown, moist (CL/ML) [Glacial Till]* **20.0'**	20	SS 6		6-6-10 N=16					PP = 4.5 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 6.5 ft
IAD	▼ 11.4 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/18/20	FINISHED:	4/18/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. GEO-08

olsson

PROJECT NAME: Madison Fields Solar	CLIENT: Savion, LLC
PROJECT NUMBER: 020-0986	LOCATION: Madison County, Ohio

Split Spoon (SS) / Shelby Tube (U)

APPROX. SURFACE ELEV. (ft): 1016

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE organic (corn) rich silty clay, dark brown, moist	1.0'								
1015	*LEAN CLAY* with sand and silt and trace organics, firm, dark gray brown, moist (CL) [Glacial Till]	3.0'	SS 1		2-3-3 N=6					PP = 0.75 tsf
	grades to reddish brown		U 2				14.9	125.3		PP = 3.5 tsf
1010	*SANDY SILTY CLAY* stiff to very stiff, reddish brown, moist (CL/ML) [Glacial Till]	5								
	varies to silty clayey sand with gravel (SC/SM)		SS 3		6-8-11 N=19		11.3		20/6	PP = 1.5 tsf
	grades to with gravel, dark reddish brown	10	SS 4		6-7-10 N=17		11.6			P-200 = 46.7% PP = 3.0 tsf
1005										
	grades to dark gray brown	15	SS 5		8-10-17 N=27					PP = 3.0 tsf
1000	Driller's Note: Cave-in depth to 15.0 feet immediately following drilling									
		20.0' / 20	SS 6		6-8-11 N=19		11.2			PP = 3.0 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	∇ 4.5 ft
IAD	▼ 5.0 ft after 0 Hrs
AD	Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/20/20	FINISHED:	4/20/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD:	CONTINUOUS FLIGHT AUGER		

olsson

BOREHOLE REPORT NO. GEO-09

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Legend: Split Spoon (X box), Shelby Tube (solid box)

APPROX. SURFACE ELEV. (ft): 1018

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE *organic (corn) rich silty clay, dark brown, moist* ***1.0'***	0								
	LEAN CLAY *with silt and trace sand and organics, firm to stiff, dark gray brown, moist (CL) [Glacial Till]* ***2.0'***		SS 1		2-3-4 N=7					PP = 2.0 tsf
1015	***SILTY CLAY*** *with sand and gravel, firm, mottled reddish brown and gray brown, moist (CL/ML) [Glacial Till]*	5	SS 2		4-3-4 N=7					PP = 0.75 tsf
	grades to stiff to very stiff, dark reddish brown		U 3			1.4	13.8	131.2		PP = 3.0 tsf
1010		10	SS 4		9-12-17 N=29					PP = 3.0* tsf
1005	*grades to very stiff to hard, dark gray brown, with interbedded silty sand (SM) lenses*									
	Driller's Note: Cave-in to 14 feet immediately following drilling	15	SS 5		4-12-19 N=31		11.7			PP = 3.0 tsf
1000	***20.0'***	20	SS 6		6-15-17 N=32					PP = 4.5* tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	∇ 4.5 ft
IAD	▼ 5.6 ft after 0 Hrs
AD	∇ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/22/20	FINISHED:	4/22/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. GEO-10

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Legend: Split Spoon; Shelby Tube

APPROX. SURFACE ELEV. (ft): 1021

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE organic (corn) rich silty clay, dark brown, moist	0								
1020	***1.0'***									
	SILTY CLAY with sand and trace organics, firm to stiff, mottled reddish brown and gray brown, moist (CL/ML) [Glacial Till]		SS 1		3-3-4 N=7					PP = 2.5 tsf
	grades to with gravel	5	U 2				13.7	112.8		PP = 2.5 tsf
1015	*grades to dark reddish brown*		SS 3		3-3-5 N=8					PP = 3.0* tsf
		10	SS 4		5-4-6 N=10					PP = 1.5 tsf
1010	*grades to dark gray brown* *Driller's Note: Cave-in to 9.9 feet immediately following drilling*									
	12.5'									
	SILTY CLAYEY SAND with gravel, very dense, dark gray brown, moist (SC/SM)	15	SS 5		10-22-32 N=54		14.2			
1005										
	19.0'									
	SILTY CLAY with sand and gravel, hard, dark gray brown, moist (CL/ML) [Glacial Till] ***20.0'***	20	SS 6		11-17-25 N=42					PP = >4.5 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 6.0 ft
IAD	▼ 4.0 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/22/20	FINISHED:	4/22/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. GEO-11

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	**LOCATION**
020-0986	Madison County, Ohio

Legend: Split Spoon; Shelby Tube

APPROX. SURFACE ELEV. (ft): 1022

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
		0								
	ROOT ZONE *organic-poor clay, brown, moist* (0.3')									
1020	***SILTY CLAY*** *with sand and trace organics, firm to stiff, dark gray brown, moist (CL/ML) [Glacial Till]*		SS 1		3-2-3 N=5					PP = 1.75 tsf
	grades to mottled reddish brown and dark gray brown	5	U 2				14.8	126.3		PP = 1.5 tsf
1015	*grades to with sand and gravel, stiff to very stiff, dark reddish brown*		SS 3		4-8-11 N=19					PP = 1.0 tsf
	grades to very stiff to hard, dark gray brown	10	SS 4		7-10-10 N=20					PP = >4.5 tsf
1010										
	grades to with silty sand (SM) lenses	15	SS 5		22-32-30 N=62		11.9			PP = 2.0* tsf
1005	*Driller's Note: Cave-in to 14.8 feet immediately following drilling*									
	(20.0')	20	SS 6		22-39-31 N=70					PP = 3.0* tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	∇ 5.0 ft
IAD	▼ 6.0 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/23/20	FINISHED:	4/23/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD:	CONTINUOUS FLIGHT AUGER		

olsson

BOREHOLE REPORT NO. GEO-12

PROJECT NAME **Madison Fields Solar**	CLIENT **Savion, LLC**
PROJECT NUMBER **020-0986**	LOCATION **Madison County, Ohio**

Legend: Split Spoon; Shelby Tube

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
1020	**APPROX. SURFACE ELEV. (ft):**1020		0								
	ROOT ZONE *organic (corn) rich silty clay, dark brown, moist* **1.0'**										
	LEAN CLAY *with silt and sand and gravel, firm to stiff, mottled reddish brown and gray brown, moist (CL) [Glacial Till]* **3.0'**			SS 1		3-3-4 N=7					PP = 2.5 tsf
	SILTY CLAY			SS 2		3-4-5 N=9					PP = 2.5* tsf
1015	*with sand and gravel, stiff to very stiff, mottled reddish brown and gray brown, moist (CL/ML) [Glacial Till]*		5								
	grades to firm to stiff, dark reddish brown			SS 3		4-3-3 N=6		12.6		19/5	PP = 2.0 tsf
1010	*grades to very stiff to hard*		10	U 4				12.5	138.9		PP = 4.5 tsf
	Driller's Note: Cave-in to 11.2 feet immediately following drilling **12.5'**										
	SILTY SAND *with gravel, dense, dark gray brown, moist (SM) [Alluvium]*			SS 5		10-16-16 N=32					PP = 1.0* tsf
1005	**18.5'**		15								
	SILTY CLAY			SS 6		4-5-5 N=10		14.2			PP = 1.5 tsf
1000	*with sand and gravel, stiff, dark gray brown, moist (CL/ML) [Alluvium]* **20.0'**		20								

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	∇ 6.0 ft
IAD	▼ 6.0 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/22/20	FINISHED:	4/22/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. GEO-13

olsson

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Split Spoon / Shelby Tube

APPROX. SURFACE ELEV. (ft): 1012

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE organic (grass) heavy silty clay topsoil, dark reddish brown — **1.0'**	0								
1010	***LEAN CLAY*** with gravel and trace organics, stiff, reddish yellow brown, moist (CL) [Glacial Till]		SS 1		3-4-5 N=9					PP = 2.5 tsf
	grades to brown to reddish brown	5	SS 2		5-6-6 N=12					PP = 3.0 tsf
1005	**8.0'**		SS 3		4-5-9 N=14		11.8			PP = 2.5 tsf
	SILTY CLAY with sand and gravel, very stiff, brown, moist (CL/ML) [Glacial Till]	10	SS 4		5-7-13 N=20					PP = 3.5 tsf
1000										
	grades to stiff, brown to gray brown	15	SS 5		4-6-7 N=13					PP = 1.0 tsf
995			U 6			2.1	9.9	142.8		PP = 3.0 tsf
	grades to dark gray brown — **20.0'**	20	SS 7		4-5-6 N=11					PP = 2.0 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ Not Encountered
IAD	▼ Not Encountered
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/16/20	FINISHED:	4/16/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. GEO-14

olsson

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Legend: Split Spoon; Shelby Tube

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
1015	APPROX. SURFACE ELEV. (ft):1015	0								
	ROOT ZONE organic (grass) heavy silty clay topsoil, reddish brown	1.0'								
	LEAN CLAY with silt and trace organics, stiff, brown to reddish yellow brown, moist (CL) [Glacial Till]		SS 1		3-4-5 N=9		27.2			PP = 2.0 tsf
1010	grades to with gravel, firm, reddish yellow brown with some gray	5	SS 2		3-3-4 N=7					PP = 0.5 tsf
	∇	6.0'								
	SILTY CLAY with gravel, stiff, brown, moist (CL/ML) [Glacial Till] ▼		SS 3		4-5-6 N=11					PP = 2.0 tsf
1005	grades very stiff, to reddish yellow and dark gray brown	10	SS 4		8-11-18 N=29					
	grades to dark gray brown		U 5			3.0				PP = 2.0 tsf
1000	Driller's Note: Cave-in to 13 feet immediately after drilling	15	SS 6		7-10-13 N=23					PP = 2.5 tsf
995		20.0' / 20	SS 7		6-7-9 N=16					PP = 4.0 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	∇ 5.5 ft
IAD	▼ 7.0 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/15/20	FINISHED:	4/15/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

olsson	BOREHOLE REPORT NO. GEO-15	Sheet 1 of 1

PROJECT NAME **Madison Fields Solar**	CLIENT **Savion, LLC**
PROJECT NUMBER **020-0986**	LOCATION **Madison County, Ohio**

Split Spoon ☒   Shelby Tube ■

APPROX. SURFACE ELEV. (ft): 1016

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE		0								
1015	1.0'										
	organic (corn) heavy silty clay topsoil, dark reddish brown			SS 1		2-4-4 N=8					PP = 1.5 tsf
	LEAN CLAY										
	with trace organics, firm, dark brown to brown, moist (CL) [Glacial Till]										
	grades to reddish yellow brown and gray brown		5	SS 2		2-3-3 N=6		27.3			PP = 1.5 tsf
1010	▽										
	grades to with gravel, very stiff, brown			U 3				25.3	110.0		PP = 2.5 tsf
	grades to with sand and gravel, stiff to very stiff, dark gray brown, moist		10	SS 4		3-5-6 N=11					PP = 3.0 tsf
1005	▼										
	Driller's Note: Cave-in to 11.6 feet immediately following drilling										
	grades to with gravel, brown to reddish brown		15	SS 5		7-9-12 N=21					PP = 2.5 tsf
1000											
	grades to hard, dark gray brown										
	20.0'		20	SS 6		18-19-18 N=37					PP = >4.5 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 5.5 ft
IAD	▼ 10.0 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/16/20	FINISHED:	4/16/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. GEO-16

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Split Spoon | Shelby Tube

APPROX. SURFACE ELEV. (ft):1011

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE *organic (grass) heavy silty clay topsoil, dark brown* **1.0'**	0								
1010	***LEAN CLAY*** *with sand and gravel and trace organics, stiff, dark brown to brown, moist (CL) [Glacial Till]*		SS 1		2-4-6 N=10					PP = 1.5 tsf
	grades to reddish yellow brown	5	SS 2		7-6-8 N=14		13.4			PP = 3.5 tsf
1005	*grades to brown* **8.0'**		SS 3		4-4-7 N=11					PP = 3.0 tsf
	SILTY CLAY *with gravel, very stiff, brown to gray brown, moist (CL/ML) [Glacial Till]*	10	SS 4		5-6-8 N=14					PP = 3.5 tsf
1000	▽		U 5				12.4	129.0		PP = 1.5 tsf
		15	SS 6		4-5-9 N=14					PP = 3.0 tsf
995	▼									
	grades to with sand and gravel *Driller's Note: Cave-in to 17.9 feet immediately following drilling* **20.0'**	20	SS 7		7-8-8 N=16					PP = 4.0 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 11.0 ft
IAD	▼ 17.2 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/16/20	FINISHED:	4/16/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

olsson	BOREHOLE REPORT NO. GEO-17	Sheet 1 of 1

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Split Spoon (SS) — Shelby Tube (U)

APPROX. SURFACE ELEV. (ft): 1012

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE organic (grass) heavy silty clay topsoil, dark brown **1.0'**		0								
1010	***LEAN CLAY*** with silt and trace organics, firm, dark brown, moist (CL) [Glacial Till]			SS 1		2-3-3 N=6		27.4			PP = 1.5 tsf
	grades to with gravel, stiff, reddish yellow brown with gray **6.0'**		5	SS 2		3-5-4 N=9					PP = 4.5 tsf
1005	***SILTY CLAY*** with gravel, stiff to very stiff, reddish yellow brown, moist (CL/ML) [Glacial Till]			SS 3		4-4-5 N=9					PP = 2.5 tsf
	10.0'		10	SS 4		5-6-8 N=14					PP = 4.0 tsf
1000	***CLAYEY SAND*** with silt, dense, brown, moist (SC) [Glacial Till] *Driller's Note: Cave-in to 11.3 feet immediately following drilling* **13.0'**			U 5				13.1	127.5		PP = >4.5 tsf
	SILTY CLAY with gravel, very stiff to hard, dark gray brown, moist (CL/ML) [Glacial Till]		15	SS 6		7-9-11 N=20					PP = 4.5 tsf
995											
	20.0'		20	SS 7		22-16-15 N=31					PP = >4.5 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 6.5 ft
IAD	▼ 4.0 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/15/20	FINISHED:	4/15/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD:	CONTINUOUS FLIGHT AUGER		

BOREHOLE REPORT NO. GEO-18

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	**LOCATION**
020-0986	Madison County, Ohio

Split Spoon / Shelby Tube

APPROX. SURFACE ELEV. (ft):1008

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE *organic (corn) heavy silty clay topsoil, dark brown* — 1.0'	0								
	LEAN CLAY *with trace organics, firm to stiff, dark brown, moist (CL) [Glacial Till]*		SS 1		3-3-4 N=7					PP = 1.5 tsf
1005	*grades to with trace gravel, brown to reddish brown*	5	SS 2		10-8-4 N=12		19.1			PP = 1.5 tsf
	grades to with silt and gravel, very stiff, light brown to gray brown		SS 3		10-8-9 N=17					PP = 2.0 tsf
1000		10	SS 4		10-15-18 N=33					PP = >4.5 tsf
	11.0' ***SILTY CLAY*** *with gravel, stiff, dark brown to gray brown, moist (CL/ML) [Glacial Till]*									
995	14.0' ***POORLY GRADED SAND WITH CLAY*** *medium dense, gray brown, moist (SP/SC) [Glacial Till]* *Driller's Note: Cave-in to 14.5 feet immediately following drilling* — 15.0'	15	SS 5		5-7-4 N=11					PP = 2.5 tsf
	SILTY CLAY *very stiff, brown, moist (CL/ML) [Glacial Till]*		U 6				12.7	136.8		PP = 2.0 tsf
990	18.7' ***LEAN CLAY*** *with gravel and trace sand, very stiff to hard, brown, moist (CL) [Glacial Till]* — 20.0'	20	SS 7		7-11-18 N=29					PP = 3.5 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	5.5 ft
IAD	6.5 ft after 0 Hrs
AD	Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/15/20	FINISHED:	4/15/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. GEO-19

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Split Spoon — No Recovery

APPROX. SURFACE ELEV. (ft): 1009

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE *organic (corn) heavy silty clay topsoil, dark brown* **1.0'**	0								
	LEAN CLAY *with trace organics, stiff, dark brown, moist (CL) [Glacial Till]*		SS 1		4-4-5 N=9					PP = 2.0 tsf
1005	*grades to with gravel, firm, brown to dark gray brown*	5	SS 2		4-2-3 N=5		31.2			PP = 1.5 tsf
	grades to stiff, brown to dark brown **8.0'**		SS 3		5-5-6 N=11					PP = 1.5 tsf
1000	***SILTY CLAY*** *with gravel, stiff to very stiff, reddish yellow brown, moist (CL/ML) [Glacial Till]* **13.0'**	10	SS 4		5-7-9 N=16		12.5			PP = 1.5 tsf
995	***CLAYEY SAND WITH GRAVEL*** *with silt, medium dense, dark gray brown, moist (SC) [Glacial Till]*	15	SS 5		4-9-14 N=23					PP = 3.5 tsf
	Driller's Note: Cave-in to 14 feet immediately following drilling **18.0'**		NR 6							
990	***SILTY CLAY*** *with gravel, very stiff, dark gray brown, moist (CL/ML) [Glacial Till]* **20.0'**	20	SS 7		10-14-16 N=30		14.2			PP = 1.5 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	∇ 6.5 ft
IAD	▼ 9.3 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/15/20	FINISHED:	4/15/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD:	CONTINUOUS FLIGHT AUGER		

olsson

BOREHOLE REPORT NO. GEO-20

PROJECT NAME	CLIENT
Madison Fields Solar	**Savion, LLC**
PROJECT NUMBER	LOCATION
020-0986	**Madison County, Ohio**

Split Spoon   Shelby Tube

APPROX. SURFACE ELEV. (ft): 1012

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE *organic (corn) heavy silty clay topsoil, dark brown*	0								
	1.0'									
1010	***LEAN CLAY*** *with silt and trace organics, stiff, dark brown to reddish yellow brown, moist (CL) [Glacial Till]*		SS 1		4-4-6 N=10					PP = 2.5 tsf
	grades to with gravel, firm, mottled light brown, dark brown and reddish yellow brown	5	SS 2		3-3-4 N=7		25.6			PP = 2.0 tsf
	6.0'									
1005	***SILTY CLAY*** *with sand and gravel, stiff, brown to dark gray brown, moist (CL/ML) [Glacial Till]*		SS 3		7-7-7 N=14					PP = 2.5 tsf
			SS 4		7-8-10 N=18					PP = 2.5 tsf
	9.5' *Driller's Note: Cave-in to 9.2 feet immediately following drilling*	10								
1000	***SILTY SAND*** *medium dense, brown, moist (SM) [Glacial Till]*									
	12.5'									
	SILTY CLAY *with sand and gravel, very stiff, dark brown, moist (CL/ML) [Glacial Till]*	15	SS 5		5-6-8 N=14					PP = 2.5 tsf
995			U 6				13.6			
	grades to very stiff to hard, dark gray brown		SS 7		11-12-15 N=27					PP = >4.5 tsf
	20.0'	20								

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 6.5 ft
IAD	▼ 3.5 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/15/20	FINISHED:	4/15/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

olsson

BOREHOLE REPORT NO. GEO-21

PROJECT NAME: **Madison Fields Solar**	CLIENT: **Savion, LLC**
PROJECT NUMBER: **020-0986**	LOCATION: **Madison County, Ohio**

Split Spoon

APPROX. SURFACE ELEV. (ft): 1012

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 1.0'	0								
1010	*organic (corn) heavy silty clay topsoil, dark reddish brown*		SS 1		4-5-6 N=11					PP = 3.5 tsf
	SILTY CLAY *with sand and gravel, stiff to very stiff, reddish brown, moist (CL/ML) [Glacial Till]*									
	grades to with trace sand	5	SS 2		5-7-9 N=16		17.6			P-200 = 89.8% PP = 4.5 tsf
1005			SS 3		4-4-7 N=11		15.9		22/7	PP = 2.0 tsf
	grades to with sand and gravel, dark reddish brown 10.5'	10	SS 4		4-6-7 N=13					PP = 3.5 tsf
1000	***SILTY SAND*** *with gravel, medium dense, dark gray brown, moist (SM) [Alluvium]* 14.0'									
	SILTY CLAY *with sand and gravel, very stiff to hard, dark gray brown, moist (CL/ML) [Alluvium]*	15	SS 5		6-7-10 N=17					PP = 4.0 tsf
995			SS 6							PP = 3.5 tsf
	Driller's Note: Cave-in to 17.8 feet immediately following drilling									
	grades to stiff to very stiff 20.0'	20	SS 7		4-5-6 N=11		14.4			PP = 2.0 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	9.0 ft
IAD	7.0 ft after 0 Hrs
AD	Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/18/20	FINISHED:	4/18/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD:	CONTINUOUS FLIGHT AUGER		

BOREHOLE REPORT NO. GEO-22

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Legend: Split Spoon (X box); Shelby Tube (solid box)

APPROX. SURFACE ELEV. (ft): 1010

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
1010	***ROOT ZONE*** organic (corn) heavy silty clay topsoil, dark brown — *1.0'*	0								
	LEAN CLAY with gravel and trace organics, stiff, light reddish yellow brown to dark brown, moist (CL) [Glacial Till]		SS 1		3-5-7 N=12					PP = 0.5 tsf
1005	*grades to light brown to yellowish brown* — *6.0'*	5	SS 2		5-5-6 N=11		12.0			PP = 3.5 tsf
	SILTY CLAY with gravel, stiff, brown to yellowish brown, moist (CL/ML) [Glacial Till]		SS 3		4-5-7 N=12					PP = 0.5 tsf
1000	*grades to very stiff* — *11.0'*	10	SS 4		6-7-12 N=19					PP = 2.0 tsf
	LEAN CLAY with gravel, very stiff, brown to dark brown, moist (CL) [Glacial Till] — *13.5'*		U 5							PP = 3.0 tsf
995	***SILTY CLAY WITH SAND*** with gravel, very stiff to hard, dark gray brown, moist (CL/ML) [Glacial Till] *Driller's Note: Cave-in to 15 feet immediately following drilling* — *17.0'*	15	SS 6		6-8-12 N=20					PP = 4.0 tsf
990	***LEAN CLAY*** with silt and sand, very stiff, dark gray brown, moist (CL) [Glacial Till] — *20.0'*	20	SS 7		5-5-9 N=14					PP = 2.5 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 6.0 ft
IAD	▼ 11.3 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/15/20	FINISHED:	4/15/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. GEO-23

PROJECT NAME	CLIENT
Madison Fields Solar	**Savion, LLC**
PROJECT NUMBER	LOCATION
020-0986	**Madison County, Ohio**

Split Spoon / Shelby Tube

APPROX. SURFACE ELEV. (ft): 1011

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE 0.5'	0								
1010	*organic (grass) rich silty clay, dark brown, moist*									
	LEAN CLAY		SS 1		2-3-5 N=8		29.4			PP = 1.75 tsf
	with trace sand and organics, firm to stiff, dark gray brown, moist (CL) [Glacial Till]									
	grades to with sand and gravel, firm, mottled reddish brown and gray 5.0'	5	SS 2		2-2-3 N=5					PP = 1.0 tsf
1005	***SILTY CLAY***									
	with sand and gravel, firm to stiff, mottled reddish-brown and gray, moist (CL) [Glacial Till] 7.5'		U 3			1.6	14.5	122.2		PP = 1.5 tsf
	Driller's Note: Cave-in to 7 feet immediately following drilling									
	SILTY SAND									
	with gravel, medium dense, reddish brown, moist (SM) [Alluvium]	10	SS 4		6-11-15 N=26					
1000	13.0'									
	SILTY CLAY									
	with sand and gravel, very stiff to hard, dark gray brown, moist (CL/ML) [Glacial Till]	15	SS 5		23-37-23 N=60					PP = 2.5 tsf
995										
	grades to with silty sand (SM) seams 20.0'	20	SS 6		33-41-41 N=82					PP = 2.0 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	6.5 ft
IAD	0.6 ft after 0 Hrs
AD	Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/20/20	FINISHED:	4/20/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. GEO-24

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Split Spoon / Shelby Tube

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
1015	**APPROX. SURFACE ELEV. (ft):**1015	0								
	ROOT ZONE *organic (corn) rich clay, brown, moist* **1.0'**									
	SILTY CLAY *with sand and trace organics, firm to stiff, dark gray brown, moist (CL) [Glacial Till]*		SS 1		2-4-3 N=7					PP = 2.0 tsf
1010	*grades to mottled reddish brown and gray brown*	5	SS 2		3-3-3 N=6					PP = 2.5* tsf
	grades to with gravel, dark reddish brown		U 3				14.3	102.7		
1005	*grades to stiff to very stiff, dark gray brown*	10	SS 4		4-7-8 N=15					PP = 2.5* tsf
1000	*grades to with silty sand (SM) lenses* *Driller's Note: Cave-in to 15 feet immediately following drilling* **15.0'**	15	SS 5		15-14-10 N=24		10.1			PP = 2.5* tsf
995	***SILTY SAND*** *with gravel, loose, dark gray brown, moist (SM) [Alluvium]* **20.0'**	20	SS 6		6-4-5 N=9					PP = 1.5 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	∇ 7.0 ft
IAD	▼ 8.0 ft after 0 Hrs
AD	Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/24/20	FINISHED:	4/24/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD:	CONTINUOUS FLIGHT AUGER		

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BOREHOLE REPORT NO. GEO-25

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Split Spoon / Shelby Tube

APPROX. SURFACE ELEV. (ft):1017

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE organic (corn) heavy silty clay topsoil, dark reddish brown	1.0'								
1015	***LEAN CLAY*** with sand and trace organics, firm to stiff, reddish brown, moist (CL) [Glacial Till]		SS 1		2-3-3 N=6					PP = 2.5 tsf
		3.0'								
	SILTY CLAY with sand, very stiff, reddish brown, moist (CL/ML) [Glacial Till]	5	U 2			0.8	13.4	122.9		PP = 4.0 tsf
1010	*grades to with gravel, stiff*		SS 3		4-4-7 N=11					PP = 2.0 tsf
		10	SS 4		4-4-5 N=9					PP = 1.5 tsf
1005	*grades to stiff to very stiff, dark gray brown*									
		15	SS 5		4-4-7 N=11		10.1			PP = 3.5 tsf
1000	*Driller's Note: Cave-in to 16.5 feet immediately following drilling*									
		19.0'								
	SILTY SAND with trace gravel, medium dense, dark gray brown, moist (SM) [Alluvium]	20.0' / 20	SS 6		8-11-11 N=22					

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 6.5 ft
IAD	▼ 15.0 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/18/20	FINISHED:	4/18/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. GEO-26

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Legend: Split Spoon; Shelby Tube

APPROX. SURFACE ELEV. (ft): 1017

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE *organic (corn) heavy silty clay topsoil, dark reddish brown* — 1.0'	0								
1015	***LEAN CLAY*** *with sand and gravel, stiff, dark brown to reddish brown, moist (CL) [Glacial Till]* — 3.8'		SS 1		3-4-7 N=11		14.6			PP = 1.0 tsf
	SILTY CLAY *with sand and gravel, stiff to very stiff, reddish brown, moist (CL/ML) [Glacial Till]*	5	SS 2		6-6-7 N=13					PP = 3.5 tsf
1010			SS 3		4-4-4 N=8					PP = 2.5 tsf
	grades to dark brown	10	SS 4		5-7-8 N=15					PP = 2.5 tsf
1005			U 5				8.2			PP = 3.5 tsf
	grades to hard, dark gray brown	15	SS 6		7-20-27 N=47					PP = 1.5 tsf
1000	*Driller's Note: Cave-in to 16.5 feet immediately following drilling*									
	grades to with sand and without gravel, increased silt content noted — 20.0'	20	SS 7		8-8-12 N=20					PP = 4.5 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	9.0 ft
IAD	12.0 ft after 0 Hrs
AD	Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/18/20	FINISHED:	4/18/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD:	CONTINUOUS FLIGHT AUGER		

olsson

BOREHOLE REPORT NO. GEO-27

PROJECT NAME: **Madison Fields Solar**	CLIENT: **Savion, LLC**
PROJECT NUMBER: **020-0986**	LOCATION: **Madison County, Ohio**

Split Spoon (SS) / Shelby Tube (U)

APPROX. SURFACE ELEV. (ft): 1018

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE *organic (corn) rich silty clay, dark brown, moist* — 1.0'	0								
1015	***SILTY CLAY*** *with sand and gravel and trace organics, stiff, dark brown to reddish brown, moist (CL/ML) [Glacial Till]*		SS 1		3-5-7 N=12					PP = 1.5 tsf
	grades to very stiff, reddish brown	5	SS 2		8-9-15 N=24					PP = 3.0 tsf
1010			SS 3		5-14-13 N=27		12.2			PP = 1.25 tsf
	11.5'	10	SS 4		5-8-12 N=20					PP = 2.0 tsf
1005	***SILTY CLAYEY SAND*** *with gravel, very dense, dark gray brown, moist (SC/SM) [Alluvium]*		SS 5		15-50					PP = 3.5 tsf
		15	U 6			4.1	12.3	127.4		PP = >4.5 tsf
1000	18.0' ***SILTY CLAY*** *with sand and gravel, very stiff to hard, dark gray brown, moist (CL/ML) [Alluvium]* — 20.0'	20	SS 7		8-12-15 N=27					PP = >4.5 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	14.5 ft
IAD	16.0 ft after 0 Hrs
AD	Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/20/20	FINISHED:	4/20/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD:	CONTINUOUS FLIGHT AUGER		

olsson	BOREHOLE REPORT NO. GEO-28	Sheet 1 of 1

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Legend: Split Spoon; Shelby Tube

APPROX. SURFACE ELEV. (ft):1017

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE *organic (corn) rich silty clay, dark brown, moist* — 1.0'	0								
1015	***LEAN CLAY*** *with sand and trace organics, firm to stiff, dark gray brown, moist (CL) [Glacial Till]* — 3.0'		SS 1		2-3-3 N=6					PP = 1.75 tsf
	SILTY CLAY *grades to with gravel*	5	U 2				11.9			PP = >4.5 tsf
	with sand and gravel, very stiff to hard, reddish brown, moist (CL/ML) [Glacial Till]									
1010	*grades to stiff to very stiff, dark reddish brown*		SS 3		6-6-7 N=13					PP = 2.25 tsf
	grades to very stiff to hard	10	SS 4		5-8-12 N=20					PP = 4.0 tsf
1005	*grades to dark gray brown*									
		15	SS 5		6-7-10 N=17		8.2			PP = >4.5 tsf
1000	*grades to stiff to very stiff*									
	20.0'	20	SS 6		4-3-6 N=9		10.9			PP = 2.0 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Encountered
AD	Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/20/20	FINISHED:	4/20/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD:	CONTINUOUS FLIGHT AUGER		

olsson	BOREHOLE REPORT NO. GEO-29	Sheet 1 of 1

PROJECT NAME: Madison Fields Solar	CLIENT: Savion, LLC
PROJECT NUMBER: 020-0986	LOCATION: Madison County, Ohio

Legend: Split Spoon; Shelby Tube

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
1015	APPROX. SURFACE ELEV. (ft):1015	0								
	ROOT ZONE *organic (grass) poor clay, dark brown, moist* (0.5')									
	LEAN CLAY *with sand and gravel and trace organics, firm to stiff, mottled dark gray brown and reddish brown, moist (CL) [Glacial Till]*		SS 1		2-3-5 N=8		28.4			PP = 2.25 tsf
1010	*grades to stiff to very stiff, mottled reddish brown and gray*	5	SS 2		5-5-6 N=11					PP = 3.0* tsf
	grades to mottled reddish brown and dark brown (7.5')		SS 3		5-6-11 N=17					PP = 2.5* tsf
	SILTY CLAYEY SAND *with gravel, medium dense, dark gray brown, moist (SC/SM) [Alluvium]* (9.5')		SS 4		6-6-7 N=13					PP = 3.0 tsf
1005	*Driller's Note: Cave-in to 8.2 feet immediately following drilling*	10								
	SILTY CLAY *with sand and gravel, very stiff to hard, dark gray brown, moist (CL/ML) [Alluvium]*		U 5				11.0	138.1		PP = 4.5 tsf
1000		15	SS 6		6-8-10 N=18					PP = 3.5 tsf
995	(20.0')	20	SS 7		2-9-13 N=22					PP = 1.5 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	6.0 ft
IAD	5.5 ft after 0 Hrs
AD	Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/21/20	FINISHED:	4/21/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. GEO-30

PROJECT NAME: **Madison Fields Solar**	CLIENT: **Savion, LLC**
PROJECT NUMBER: **020-0986**	LOCATION: **Madison County, Ohio**

Split Spoon (SS) / Shelby Tube (U)

APPROX. SURFACE ELEV. (ft): 1014

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE *organic-poor clay, brown and gray, moist* **0.2'**	0								
	LEAN CLAY *with silt and sand and trace organics, firm, mottled reddish brown and gray, moist (CL) [Glacial Till]* **3.0'**		SS 1		2-3-2 N=5		19.1			PP = 1.0 tsf
1010	***SILTY CLAY*** *with sand and gravel, firm, reddish brown, moist (CL/ML) [Glacial Till]* **6.5'**	5	U 2			0.3	20.5	114.1		PP = 1.0 tsf
	SANDY SILTY CLAY *firm to very stiff, dark gray brown, moist (CL/ML) [Glacial Till]*		SS 3		2-4-5 N=9					PP = 0.25 tsf
1005		10	SS 4		2-5-11 N=16		19.1			P-200 = 62.3% PP = 0.5 tsf
1000	*increased sand content noted* *Driller's Note: Cave-in to 14 feet immediately following drilling* **16.0'**	15	SS 5		5-16-16 N=32					PP = 3.0 tsf
995	***SILTY SAND*** *with gravel, dense, dark gray brown, moist (SM) [Alluvium]* **20.0'**	20	SS 6		6-17-21 N=38					

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 4.5 ft
IAD	▼ 4.0 ft after 0 Hrs
AD	Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/21/20	FINISHED:	4/21/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. GEO-31

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Split Spoon — Shelby Tube

APPROX. SURFACE ELEV. (ft):1014

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE	0								
	organic (corn) heavy silty clay topsoil, dark reddish brown **1.0'**		SS 1		2-3-3 N=6					PP = 2.0 tsf
1010	***LEAN CLAY*** *with gravel and trace organics, firm, dark brown to reddish yellow brown, moist (CL) [Glacial Till]*									
	grades stiff, reddish brown	5	U 2			1.5	14.3	119.8		PP = 3.0 tsf
	∇ (water level at 6.0 ft)									
	grades to with sand and gravel, reddish yellow brown **8.0'**		SS 3		3-4-6 N=10					PP = 1.5 tsf
1005	***SILTY CLAY*** *with gravel, very stiff, brown, moist (CL/ML) [Glacial Till]*	10	SS 4		7-11-14 N=25					PP = 1.5 tsf
1000	*grades to firm, dark gray brown*	15	SS 5		3-3-5 N=8		11.5			PP = 1.0 tsf
	▼ (water level at 17.2 ft)									
	Driller's Note: Cave-in to 17.6 feet immediately following drilling									
995	**20.0'**	20	SS 6		4-5-6 N=11					PP = 4.5 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	∇ 6.0 ft
IAD	▼ 17.2 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/16/20	FINISHED:	4/16/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. GEO-32

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Split Spoon / Shelby Tube

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
1015	APPROX. SURFACE ELEV. (ft):1015	0								
	ROOT ZONE — *organic (corn) heavy silty clay topsoil, dark reddish brown*	1.0'								
	LEAN CLAY — *with silt and trace sand and organics, firm, dark gray brown to reddish brown, moist (CL) [Glacial Till]*		SS 1		3-3-3 N=6					PP = 1.5 tsf
1010	*grades to with gravel*	5	U 2			0.5	20.3	131.3		PP = 1.0 tsf
		5.5'								
	SILTY CLAY — *with sand and gravel, stiff, reddish brown, moist (CL/ML) [Glacial Till]*		SS 3		4-5-8 N=13					
1005		10	SS 4		5-8-11 N=19					PP = 1.0 tsf
	Driller's Note: Cave-in to 13.9 feet immediately following drilling	14.0'	SS 5		12-50		7.5			PP = 1.5 tsf
1000	*SILTY CLAYEY SAND* — *with gravel, very dense, dark gray brown, moist (SC/SM) [Alluvium]*	15								
		19.3'	SS 6		29-50					PP = >4.5 tsf
995	*SILTY CLAY* — *with sand and gravel, very hard, dark gray brown, moist (CL/ML) [Alluvium]*	20.0'								

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	∇ 3.5 ft
IAD	▼ 1.3 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/18/20	FINISHED:	4/18/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. GEO-33

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Split Spoon | Shelby Tube

APPROX. SURFACE ELEV. (ft):1015

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
1015		0								
	▼ *ROOT ZONE*									
	organic (corn) rich silty clay, dark brown, moist **1.0'**									
	LEAN CLAY		SS 1		2-4-3 N=7					PP = 1.25 tsf
	▽ *with sand and trace organics, firm, dark gray brown, moist (CL) [Glacial Till]*									
	grades to reddish-brown		SS 2		1-1-2 N=3		16.8		28/11	PP = 1.0 tsf
1010	*grades to with silt, soft to firm*	5								
	grades to with gravel, hard		U 3							PP = >4.5 tsf
1005	*grades to dark reddish brown*	10	SS 4		8-10-20 N=30					PP = >4.5 tsf
1000		15	SS 5		15-14-18 N=32		11.0			PP = 0.5 tsf
995	*grades to dark gray brown* **20.0'**	20	SS 6		9-15-20 N=35					PP = 3.0 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 3.0 ft
IAD	▼ 0.5 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/20/20	FINISHED:	4/20/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. GEO-34

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	**LOCATION**
020-0986	Madison County, Ohio

Legend: Split Spoon (X box) / Shelby Tube (solid box)

APPROX. SURFACE ELEV. (ft): 1016

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE	0								
1015	*organic (corn) rich silty clay, dark brown, moist* — ***1.0'***									
	SILTY CLAY		SS 1		3-4-5 N=9					PP = 2.5 tsf
	with sand and trace organics, firm to stiff, mottled reddish brown and gray brown, moist (CL/ML) [Glacial Till]									
	grades to soft, with silty sand (SM) lenses	5	SS 2		2-2-2 N=4					PP = 0.5 tsf
1010										
	grades to very stiff to hard, dark reddish brown		U 3				16.4			PP = 4.0 tsf
	Driller's Note: Cave-in to 9 feet immediately following drilling	10	SS 4		17-16-20 N=36					PP = 2.75* tsf
1005										
	grades to stiff to very stiff	15	SS 5		8-13-16 N=29		26.2			PP = 1.5 tsf
1000	***16.0'***									
	SILTY SAND									
	with gravel, medium dense, dark gray brown, moist (SM) [Alluvium]									
	20.0'	20	SS 6		5-9-14 N=23					

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 6.5 ft
IAD	▼ 6.5 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/22/20	FINISHED:	4/22/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD:	CONTINUOUS FLIGHT AUGER		

BOREHOLE REPORT NO. GEO-35

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Split Spoon (SS) · Shelby Tube (U)

APPROX. SURFACE ELEV. (ft): 1016

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
1015	***ROOT ZONE*** *organic (corn) rich silty clay, dark brown, moist* **1.0'**	0								
	LEAN CLAY *with silt and sand and gravel and trace organics, firm to stiff, mottled reddish brown and gray brown, moist (CL) [Glacial Till]* **3.0'**		SS 1		3-3-5 N=8		29.8		36/19	PP = 1.75 tsf
1010	***SILTY CLAY*** *with sand and gravel, stiff to very stiff, mottled reddish brown and gray brown, moist (CL/ML) [Glacial Till]*	5	SS 2		3-5-7 N=12					PP = 2.75* tsf
	grades to dark reddish brown		SS 3		5-8-6 N=14					PP = 2.0* tsf
1005		10	SS 4		5-9-11 N=20					PP = 2.0* tsf
			U 5							
1000	*grades to with silty sand (SM) lenses, very stiff to hard, dark gray brown* *Driller's Note: Cave-in to 13 feet immediately following drilling*	15	SS 6		15-22-29 N=51		11.6			PP = 1.5 tsf
	20.0'	20	SS 7		10-27-14 N=41					PP = >4.5 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 12.0 ft
IAD	▼ 6.5 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/22/20	FINISHED:	4/22/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD:	CONTINUOUS FLIGHT AUGER		

BOREHOLE REPORT NO. GEO-36

Sheet 1 of 1

PROJECT NAME: **Madison Fields Solar**	CLIENT: **Savion, LLC**
PROJECT NUMBER: **020-0986**	LOCATION: **Madison County, Ohio**

Split Spoon | Shelby Tube

APPROX. SURFACE ELEV. (ft): 1018

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE organic (corn) rich silty clay, dark brown, moist — 1.0'		0								
	LEAN CLAY with sand and silt and trace gravel and organics, stiff to very stiff, reddish brown, moist (CL) [Glacial Till] — 3.0'			SS 1		3-4-6 N=10					PP = 2.5 tsf
1015	***SILTY CLAY*** with sand and trace gravel, very stiff, reddish brown, moist (CL/ML) [Glacial Till]		5	SS 2		5-8-11 N=19		13.2			PP = 3.0 tsf
	grades to with sand and gravel			SS 3		5-6-7 N=13					PP = 3.0 tsf
1010	▽										
	grades to very stiff, dark reddish brown		10	SS 4		12-15-13 N=28					PP = 3.5 tsf
	grades to very stiff to hard, dark gray brown			U 5				11.7	123.6		PP = >4.5 tsf
1005											
			15	SS 6		7-12-16 N=28					PP = 4.5 tsf
1000	▼										
	20.0'		20	SS 7		7-9-12 N=21					PP = 4.0 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 8.0 ft
IAD	▼ 17.5 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/20/20	FINISHED:	4/20/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

olsson

BOREHOLE REPORT NO. GEO-37

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Split Spoon | Shelby Tube

APPROX. SURFACE ELEV. (ft):1019

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	0.2' *ROOT ZONE* *organic-poor clay, dark brown, moist*	0								
	LEAN CLAY *with silt and sand and trace organics, firm to stiff, mottled reddish brown and gray, moist (CL) [Glacial Till]*		SS 1		2-12-4 N=16		27.2		47/30	PP = 0.75 tsf
1015	*grades to with sand and gravel, stiff to very stiff, dark reddish brown*	5	SS 2		6-8-8 N=16					PP = 2.5* tsf
			SS 3		4-5-6 N=11		17.4			PP = 2.5 tsf
1010		10	SS 4		4-4-6 N=10					PP = 3.0* tsf
			U 5				14.7			
1005	*grades to very stiff to hard, dark gray brown*	15	SS 6		12-15-18 N=33					PP = 4.5 tsf
1000	*Driller's Note: Cave-in to 18 feet immediately following drilling* 20.0'	20	SS 7		5-6-8 N=14					PP = 3.5 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 12.0 ft
IAD	▼ 13.2 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/22/20	FINISHED:	4/22/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. GEO-38

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Split Spoon / Shelby Tube

APPROX. SURFACE ELEV. (ft): 1016

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE organic (corn) rich clay, brown, moist	0								
1015	***1.0'***									
	LEAN CLAY with silt and sand and trace organics, firm to stiff, dark gray brown, moist (CL) [Glacial Till]		SS 1		1-2-3 N=5					PP = 1.5 tsf
	4.0'									
	SILTY CLAY with sand and gravel, stiff, mottled reddish brown and gray brown, moist (CL/ML) [Glacial Till]	5	U 2				14.7	118.0		PP = 2.5 tsf
1010	*grades to reddish brown*		SS 3		4-5-7 N=12					PP = 2.5 tsf
	grades to very stiff to hard	10	SS 4		8-12-14 N=26					PP = 3.5* tsf
1005	*grades to dark gray brown*									
	Driller's Note: Cave-in to 14 feet immediately following drilling	15	SS 5		6-9-10 N=19		12.3			PP = 4.0 tsf
1000										
	grades to with silty sand (SM) seams ***20.0'***	20	SS 6		7-13-18 N=31					PP = 4.0 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 5.0 ft
IAD	▼ 4.4 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/24/20	FINISHED:	4/24/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. GEO-39

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Legend: Split Spoon; Shelby Tube

APPROX. SURFACE ELEV. (ft): 1015

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
1015		0								
	ROOT ZONE *organic (corn) rich clay, brown, moist* — ***1.0'***									
	LEAN CLAY *with silt and sand and trace organics, firm, dark gray brown, moist (CL) [Glacial Till]* (top at ***1.5'***)		SS 1		3-3-4 N=7					PP = 1.25 tsf
	SILTY CLAY *with sand and gravel, firm, mottled reddish brown and gray brown, moist (CL/ML) [Glacial Till]*		SS 2		3-4-5 N=9					PP = 2.0* tsf
1010		5								
	grades to stiff									
	grades to very stiff to hard, dark reddish brown		U 3							PP = >4.5 tsf
			SS 4		6-9-12 N=21					PP = 3.0* tsf
1005		10								
	grades to dark gray brown									
			SS 5		7-7-9 N=16		11.3			PP = 3.5 tsf
1000		15								
	Driller's Note: Cave-in to 18.5 feet immediately following drilling		SS 6		6-7-8 N=15					PP = >4.5 tsf
995	***20.0'***	20								

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	14.0 ft
IAD	17.5 ft after 0 Hrs
AD	Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/27/20	FINISHED:	4/27/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD:	CONTINUOUS FLIGHT AUGER		

BOREHOLE REPORT NO. GEO-40

PROJECT NAME	CLIENT
Madison Fields Solar	**Savion, LLC**
PROJECT NUMBER	LOCATION
020-0986	**Madison County, Ohio**

Split Spoon — Shelby Tube

APPROX. SURFACE ELEV. (ft): 1012

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE organic (corn) rich clay, brown, moist — 1.0'	0								
1010	***LEAN CLAY*** with silt and sand and trace organics, firm, dark gray brown, moist (CL) [Glacial Till] — 3.0'		SS 1		2-3-4 N=7					PP = 1.5 tsf
	SILTY CLAY grades to mottled reddish brown and gray brown	5	U 2			0.2	18.7	111.6		PP = 1.5 tsf
1005	*with sand, firm to stiff, mottled reddish brown and gray brown, moist (CL/ML) [Glacial Till]* *grades to with sand and gravel, stiff to very stiff*		SS 3		3-4-6 N=10					PP = 2.5* tsf
	grades to very stiff to hard, dark gray brown	10	SS 4		5-8-11 N=19					PP = >4.5 tsf
1000										
	Driller's Note: Cave-in to 13 feet immediately following drilling	15	SS 5		5-6-10 N=16					PP = >4.5 tsf
995										
	— 20.0'	20	SS 6		5-7-9 N=16		10.2			PP = >4.5 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	3.5 ft
IAD	1.0 ft after 0 Hrs
AD	Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/27/20	FINISHED:	4/27/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD:	CONTINUOUS FLIGHT AUGER		

BOREHOLE REPORT NO. GEO-41

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	**LOCATION**
020-0986	Madison County, Ohio

Split Spoon

APPROX. SURFACE ELEV. (ft):1009

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE organic (corn) rich clay, brown, moist **1.0'**	0								
	LEAN CLAY with silt and sand and trace organics, firm to stiff, mottled dark gray brown and dark reddish brown, moist (CL) [Glacial Till]		SS 1		2-3-4 N=7		17.1			PP = 1.5 tsf
1005	**4.0'**									
	SILTY CLAY with sand and gravel, stiff to very stiff, mottled reddish brown and gray brown, moist (CL/ML) [Glacial Till]	5	SS 2		10-10-10 N=20					PP = 1.0 tsf
			SS 3		2-4-10 N=14					PP = 2.25 tsf
1000	grades to with silty sand (SM) lenses	10	SS 4		6-7-7 N=14		10.4			PP = 3.0 tsf
	grades to very stiff to hard, dark gray brown									
995	Driller's Note: Cave-in to 12.5 feet immediately following drilling	15	SS 5		8-14-15 N=29					PP = >4.5 tsf
	17.0'									
990	***SILTY SAND*** with gravel, medium dense, dark gray brown, moist (SM) [Alluvium] **20.0'**	20	SS 6		9-8-11 N=19					

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 4.0 ft
IAD	▼ 2.5 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/28/20	FINISHED:	4/28/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. GEO-42

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	**LOCATION**
020-0986	Madison County, Ohio

Legend: Split Spoon; Shelby Tube

APPROX. SURFACE ELEV. (ft):1016

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
		0								
1015	***ROOT ZONE*** *organic-poor clay, dark brown, moist* (0.2')									
	LEAN CLAY *with silt and trace sand and organics, firm to stiff, dark gray brown, moist (CL) [Glacial Till]*		SS 1		2-3-3 N=6					PP = 1.75 tsf
	▼	5	U 2			0.4*	32.3	100.4		*UU Compressive StrengthPP = 0.5 tsf
1010	▽									
	grades to with sand and gravel, soft to firm, reddish brown		SS 3		1-2-2 N=4					PP = 1.5* tsf
	Driller's Note: Cave-in to 7.5 feet immediately following drilling									
	grades to dark gray brown	10	SS 4		3-3-7 N=10		19.2			PP = 1.0* tsf
1005										
	grades to with sand and gravel, very stiff to hard	15	SS 5		6-9-11 N=20					PP = 4.0* tsf
1000	(17.0')									
	SILTY CLAYEY SAND *with trace gravel, dense, dark gray brown, moist (SC/SM) [Alluvium]* (20.0')	20	SS 6		6-13-18 N=31					

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 6.0 ft
IAD	▼ 4.5 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/21/20	FINISHED:	4/21/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

olsson

BOREHOLE REPORT NO. GEO-43

PROJECT NAME: **Madison Fields Solar**	CLIENT: **Savion, LLC**
PROJECT NUMBER: **020-0986**	LOCATION: **Madison County, Ohio**

Split Spoon (SS) / Shelby Tube (U)

APPROX. SURFACE ELEV. (ft): 1019

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE *organic-poor clay, reddish brown, moist* — 0.2'		0								
	LEAN CLAY *with silt and sand and trace organics, firm, reddish brown, moist (CL) [Glacial Till]* — 2.5'			SS 1		2-3-4 N=7					PP = 1.0 tsf
1015	***SILTY CLAY*** *with sand and gravel, mottled reddish brown and gray, firm to stiff, moist (CL/ML) [Glacial Till]*		5	SS 2		4-4-5 N=9					PP = 1.5 tsf
				SS 3		3-3-5 N=8		13.2			PP = 3.0 tsf
1010	*grades to dark reddish brown*		10	SS 4		3-5-7 N=12					PP = 1.25 tsf
	grades to very stiff to hard, dark gray brown										
	Driller's Note: Cave-in to 12.2 feet immediately following drilling										
1005			15	SS 5		10-12-21 N=33					
				U 6				11.6			PP = >4.5 tsf
1000	— 20.0'		20	SS 7		11-14-16 N=30					PP = >4.5 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 6.5 ft
IAD	▼ 4.8 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/21/20	FINISHED:	4/21/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

olsson

BOREHOLE REPORT NO. GEO-44

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	**LOCATION**
020-0986	Madison County, Ohio

Legend: Split Spoon; Shelby Tube

APPROX. SURFACE ELEV. (ft): 1018

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE *organic-poor clay, brown, moist* **0.5'**	0								
1015	***LEAN CLAY*** *with silt and sand and trace organics, firm to stiff, mottled reddish brown and gray brown, moist (CL) [Glacial Till]*		SS 1		3-3-4 N=7					PP = 1.5 tsf
	▽ *grades to without organics*	5	SS 2		2-2-3 N=5					PP = 1.0 tsf
	grades to with gravel, stiff to very stiff, dark reddish brown		U 3				16.8	113.0		PP = 3.5 tsf
1010	**10.0'**	10	SS 4		6-7-10 N=17					PP = 4.0 tsf
1005	***SILTY CLAY*** ▼ *with sand and gravel, stiff to very stiff, dark reddish brown, moist (CL/ML) [Glacial Till]* *Driller's Note: Cave-in to 11.5 immediately following drilling*									
	grades to very stiff to hard, dark gray brown	15	SS 5		9-13-16 N=29					PP = >4.5 tsf
1000	**20.0'**	20	SS 6		6-9-11 N=20		12.8			PP = >4.5 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 4.5 ft
IAD	▼ 11.0 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/25/20	FINISHED:	4/25/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD:	CONTINUOUS FLIGHT AUGER		

olsson

BOREHOLE REPORT NO. GEO-45

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Split Spoon | Shelby Tube

APPROX. SURFACE ELEV. (ft):1020

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
1020		0								
	ROOT ZONE organic-poor clay, dark gray brown, moist *0.2'*									
	LEAN CLAY with silt and trace sand and organics, firm, dark gray brown, moist (CL) [Glacial Till]		SS 1		2-3-4 N=7					PP = 1.5 tsf
1015	grades to with sand and trace gravel, mottled reddish brown and gray	5	SS 2	CL	2-2-3 N=5		27.2		39/21	P-200 = 83.1% PP = 1.0 tsf
	grades to dark reddish brown		U 3			1.3	16.4	126.9		PP = 1.5 tsf
1010	grades to very stiff	10	SS 4		6-9-9 N=18					PP = 2.0 tsf
	13.0'									
1005	**SILTY CLAY** with sand and gravel, very stiff to hard, dark gray brown, moist (CL/ML) [Glacial Till]	15	SS 5		8-9-11 N=20		10.9			PP = 4.0 tsf
	Driller's Note: Cave-in to 16 feet immediately following drilling									
1000	grades to hard *20.0'*	20	SS 6		15-30-30 N=60					PP = >4.5 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	5.5 ft
IAD	3.0 ft after 0 Hrs
AD	Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/21/20	FINISHED:	4/21/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. GEO-46

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Split Spoon ☒ Shelby Tube ■

APPROX. SURFACE ELEV. (ft):1018

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE *organic-poor clay, dark brown, moist* — 0.2'	0								
	LEAN CLAY *with silt and sand and trace organics, firm to stiff, mottled dark brown and reddish brown, moist (CL) [Glacial Till]*		SS 1		3-4-4 N=8					PP = 2.0 tsf
1015	— 3.5'									
	SILTY CLAY *with sand and gravel, firm to stiff, mottled reddish brown and gray, moist (CL/ML) [Glacial Till]*	5	SS 2		2-2-3 N=5					PP = 2.0 tsf
			U 3				13.6			PP = 2.0 tsf
1010	*grades to stiff to very stiff* — 9.5'									
	LEAN CLAY *with sand, very stiff to hard, mottled dark gray and brown, moist (CL) [Glacial Till]*	10	SS 4		8-10-13 N=23					PP = 4.0* tsf
1005	*grades to with gravel*	15	SS 5		25-37-40 N=77					PP = 1.0 tsf
	Driller's Note: Cave-in to 16.5 feet immediately following drilling — 17.0'									
1000	***SILTY CLAY*** *with sand and gravel, very stiff, mottled dark gray and brown, moist (CL/ML) [Glacial Till]* — 20.0'	20	SS 6		7-8-9 N=17		12.7			PP = 2.0 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 5.5 ft
IAD	▼ 3.5 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/21/20	FINISHED:	4/21/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. GEO-47

PROJECT NAME: **Madison Fields Solar**

CLIENT: **Savion, LLC**

PROJECT NUMBER: **020-0986**

LOCATION: **Madison County, Ohio**

Legend: Split Spoon (X box); Shelby Tube (solid box)

APPROX. SURFACE ELEV. (ft): 1017

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE organic (corn) rich clay, dark brown, moist — **1.0'**	0								
1015	***LEAN CLAY*** with silt and sand and trace organics, firm to stiff, mottled dark brown and reddish brown, moist (CL) [Glacial Till]		SS 1		2-3-3 N=6					PP = 1.75 tsf
	grades to with sand and gravel, stiff, reddish brown	5	U 2				30.6			PP = 2.5 tsf
1010	*grades to dark reddish brown*		SS 3		5-6-8 N=14					PP = 2.75 tsf
	grades to firm to very stiff, dark gray brown	10	SS 4		7-7-13 N=20					PP = 2.5 tsf
1005										
		15	SS 6		5-7-12 N=19					PP = 1.0 tsf
1000	*Driller's Note: Cave-in to 17.5 feet immediately following drilling*									
	grades to very stiff to hard — **20.0'**	20	SS 7		13-24-30 N=54		13.5			PP = 1.5* tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 4.0 ft
IAD	▼ 12.0 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/21/20	FINISHED:	4/21/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD:	CONTINUOUS FLIGHT AUGER		

BOREHOLE REPORT NO. GEO-48

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Split Spoon / Shelby Tube

APPROX. SURFACE ELEV. (ft):1018

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE organic-poor clay, dark gray brown, moist — 0.2'	0								
	LEAN CLAY with silt and trace sand and organics, firm, dark gray brown, moist (CL) [Glacial Till] — 1.5'		SS 1		2-4-4 N=8					PP = 1.75 tsf
1015	**SILTY CLAY** with sand and trace organics, firm to stiff, mottled reddish brown and gray, moist (CL/ML) [Glacial Till]	5	SS 2		2-3-3 N=6					PP = 2.0 tsf
	grades to with sand and gravel, stiff to very stiff, dark reddish brown		U 3				12.9	126.5		PP = >4.5 tsf
1010		10	SS 4		6-8-12 N=20					PP = 2.0* tsf
1005	grades to very stiff to hard, dark gray brown									
	Driller's Note: Cave-in to 14.5 feet immediately following drilling	15	SS 5		8-11-12 N=23		11.8			PP = >4.5 tsf
1000	increased gravel content noted — 20.0'	20	SS 6		12-15-28 N=43					PP = 3.0* tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	∇ 12.0 ft
IAD	▼ 9.5 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/21/20	FINISHED:	4/21/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. GEO-49

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Split Spoon / Shelby Tube

APPROX. SURFACE ELEV. (ft): 1016

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
1015	***ROOT ZONE*** *organic (corn) rich silty clay, dark brown, moist*	1.0'								
	LEAN CLAY *with sand and silt and trace gravel and organics, stiff, reddish brown, moist (CL) [Glacial Till]*		SS 1		3-3-6 N=9					PP = 2.0 tsf
	grades to with sand, stiff to very stiff	5	U 2		3-6-8 N=14		17.4			PP = 3.5 tsf
1010	*grades to very stiff*		SS 3		6-8-10 N=18					PP = 3.5 tsf
		10	SS 4		3-7-7 N=14					PP = 2.0 tsf
1005	*grades to with gravel, dark reddish brown*		U 5				13.8			PP = >4.5 tsf
		14.5' / 15	SS 6		7-9-17 N=26					
1000	***SILTY CLAYEY SAND*** *medium dense, dark gray brown, moist (SC/SM) [Alluvium]*									
		20.0' / 20	SS 7		7-10-15 N=25					

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 14.5 ft
IAD	▼ 7.8 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/20/20	FINISHED:	4/20/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD:	CONTINUOUS FLIGHT AUGER		

BOREHOLE REPORT NO. GEO-50

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Split Spoon / Shelby Tube

APPROX. SURFACE ELEV. (ft): 1013

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)
	ROOT ZONE *organic (corn) rich silty clay, dark brown, moist*	0–1.0'
1010	***LEAN CLAY*** *with silt and sand and gravel and trace organics, firm, mottled dark gray brown and reddish brown, moist (CL) [Glacial Till]* *grades to with sand and gravel, stiff to very stiff*	1.0'–6.0'
	SANDY SILTY CLAY *with gravel, very stiff, reddish brown, moist (CL/ML) [Glacial Till]*	6.0'–7.0'
1005 / 1000 / 995	***SILTY CLAY*** *with sand and gravel, very stiff to hard, reddish brown, moist (CL/ML) [Glacial Till]* *grades to dark reddish brown* *grades to dark gray brown*	7.0'–20.0'

BASE OF BORING AT 20.0 FEET

SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
SS 1		2-3-3 N=6					PP = 1.5 tsf
U 2				20.9	108.3		PP = 3.5 tsf
SS 3		10-8-7 N=15					PP = 1.0 tsf
SS 4		10-14-20 N=34					PP = 3.5 tsf
SS 5		10-33-37 N=70		11.3			PP = 3.5 tsf
SS 6		15-15-17 N=32					PP = >4.5 tsf

WATER LEVEL OBSERVATIONS	
WD	▽ 6.0 ft
IAD	▼ 5.5 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/20/20	FINISHED:	4/20/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD:	CONTINUOUS FLIGHT AUGER		

BOREHOLE REPORT NO. GEO-51

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	**LOCATION**
020-0986	Madison County, Ohio

Split Spoon / Shelby Tube

APPROX. SURFACE ELEV. (ft): 1014

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE *organic (corn) rich clay, brown, moist* — 1.0'	0								
	LEAN CLAY *with sand and trace organics, firm to stiff, mottled reddish brown and gray brown, moist (CL) [Glacial Till]*		SS 1		2-4-4 N=8					PP = 1.75 tsf
1010		5	SS 2		2-3-3 N=6					PP = 0.75 tsf
	grades to with gravel, very stiff to hard, dark reddish brown — 8.5'		U 3			2.1	12.3	136.0		PP = 4.0 tsf
1005	***SILTY CLAYEY SAND*** *with gravel, medium dense, dark reddish brown, moist (SC/SM) [Alluvium]* *Driller's Note: Cave-in to 9.6 feet immediately following drilling* — 11.5'	10	SS 4		13-12-16 N=28		11.1			
1000	***SILTY CLAY*** *with sand and gravel, very stiff to hard, dark gray brown, moist (CL/ML) [Glacial Till]*	15	SS 5		6-8-12 N=20					PP = 3.5 tsf
995	— 20.0'	20	SS 6		7-7-10 N=17					PP = >4.5 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 3.5 ft
IAD	▼ 3.5 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/24/20	FINISHED:	4/24/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD:	CONTINUOUS FLIGHT AUGER		

BOREHOLE REPORT NO. GEO-52

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Legend: Split Spoon (X box); Shelby Tube (solid box)

APPROX. SURFACE ELEV. (ft): 1017

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE *organic (corn) rich clay, dark brown, moist* — 0.5'	0								
1015	***LEAN CLAY*** *with silt and sand and trace organics, firm to stiff, dark gray brown, moist (CL) [Glacial Till]*		SS 1		3-3-4 N=7					PP = 2.0 tsf
	grades to with sand and gravel, mottled reddish brown to gray	5	SS 2		2-4-6 N=10		18.3			PP = 1.25 tsf
1010	*grades to stiff to very stiff, dark reddish brown* — 8.0'		SS 3		4-5-5 N=10					PP = 3.5* tsf
	SILTY CLAY *with sand and gravel, stiff to very stiff, dark reddish brown, moist (CL/ML) [Glacial Till]*	10	SS 4		5-7-11 N=18					PP = 3.0* tsf
1005			U 5				11.5	131.3		PP = 4.0 tsf
	grades to dark gray brown — 18.0'	15	SS 6		5-8-12 N=20					PP = 2.5 tsf
1000	***SILTY SAND*** *with gravel, dense, dark gray brown, moist (SM) [Glacial Till]* — 20.0'	20	SS 7		5-13-19 N=32					

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	∇ 12.0 ft
IAD	▼ 8.5 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/22/20	FINISHED:	4/22/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD:	CONTINUOUS FLIGHT AUGER		

olsson

BOREHOLE REPORT NO. GEO-53

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	**LOCATION**
020-0986	Madison County, Ohio

Legend: Split Spoon (☒) — Shelby Tube (■)

APPROX. SURFACE ELEV. (ft): 1016

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)
1016 – 1015	***ROOT ZONE*** *organic (corn) rich clay, brown, moist*	0 – 1.0'
1015 – 996	***LEAN CLAY*** *with silt and sand and trace organics, firm, mottled dark gray brown and reddish brown, moist (CL) [Glacial Till]*	1.0' – 20.0'
	grades to with sand and gravel, stiff to very stiff, mottled reddish brown and gray	
	grades to dark reddish brown	
	grades to very stiff to hard	
	grades to dark gray brown	
	Driller's Note: Cave-in to 15.3 feet immediately following drilling	

BASE OF BORING AT 20.0 FEET

SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
SS 1		2-3-3 N=6					PP = 1.5 tsf
U 2			0.8	23.7	107.6		PP = 3.0 tsf
SS 3		4-6-10 N=16					PP = 2.75* tsf
SS 4		12-18-13 N=31					PP = 4.0* tsf
SS 5		25-37-38 N=75					PP = 2.0* tsf
SS 6		7-9-12 N=21		15.0			PP = 4.0 tsf

WATER LEVEL OBSERVATIONS	
WD	▽ 12.0 ft
IAD	▼ 13.0 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/27/20	FINISHED:	4/27/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD:	CONTINUOUS FLIGHT AUGER		

BOREHOLE REPORT NO. GEO-54

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	**LOCATION**
020-0986	Madison County, Ohio

Legend: Shelby Tube; Split Spoon

APPROX. SURFACE ELEV. (ft): 1012

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE *organic (corn) rich clay, brown, moist* — **1.0'**	0								
1010	***LEAN CLAY*** *with silt and sand and trace organics, firm to stiff, mottled reddish brown and gray brown, moist (CL) [Glacial Till]* — **3.0'**		U 1				25.8			PP = 1.5 tsf
	SILTY CLAY *with sand and gravel, firm to stiff, mottled reddish brown and gray brown, moist (CL/ML) [Glacial Till]*	5	U 2			1.2	14.8	121.5		PP = 2.0 tsf
1005	*grades to very stiff, dark reddish brown*		SS 3		6-8-8 N=16					PP = 3.0 tsf
	grades to very stiff to hard, dark gray brown	10	SS 4		6-8-15 N=23					PP = 3.5 tsf
1000										
	grades to with silty sand (SM) lenses	15	SS 5		13-14-20 N=34					PP = 3.0* tsf
995	*Driller's Note: Cave-in to 15 feet immediately following drilling* — **19.0'**									
	SILTY SAND *with gravel, dense, dark gray brown, moist (SM) [Alluvium]* — **20.0'**	20	SS 6		6-14-20 N=34					PP = 0.75 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	3.5 ft
IAD	4.0 ft after 0 Hrs
AD	Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/27/20	FINISHED:	4/27/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD:	CONTINUOUS FLIGHT AUGER		

olsson

BOREHOLE REPORT NO. GEO-55

PROJECT NAME **Madison Fields Solar**	CLIENT **Savion, LLC**
PROJECT NUMBER **020-0986**	LOCATION **Madison County, Ohio**

Split Spoon ☒   Shelby Tube ■

APPROX. SURFACE ELEV. (ft): 1013

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE *organic (corn) rich silty clay, dark brown, moist* — **1.0'**	0								
	LEAN CLAY *with silt and trace sand and organics, firm to stiff, dark gray brown, moist (CL) [Glacial Till]*		SS 1		2-3-4 N=7					PP = 2.0 tsf
1010	*grades to reddish brown* — **3.5'**		SS 2		2-2-2 N=4					PP = 1.0 tsf
	SILTY CLAY *with sand, soft to firm, mottled reddish brown to light brown, moist (CL/ML) [Glacial Till]*	5								
	grades to with gravel, very stiff to hard		U 3				13.4	123.8		PP = 4.5 tsf
1005	**8.5'**									
	SILTY CLAYEY SAND *with trace gravel, medium dense, reddish brown, moist (SC/SM) [Alluvium]*	10	SS 4		6-11-14 N=25					
1000	*grades to with gravel, dense to very dense*	15	SS 5		4-17-35 N=52					
995	*grades to medium dense* — **20.0'**	20	SS 6		5-5-6 N=11		11.5			

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 6.0 ft
IAD	▼ 3.5 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/20/20	FINISHED:	4/20/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

olsson	BOREHOLE REPORT NO. GEO-56	Sheet 1 of 1

PROJECT NAME	CLIENT
Madison Fields Solar	**Savion, LLC**
PROJECT NUMBER	LOCATION
020-0986	**Madison County, Ohio**

Legend: Split Spoon (X box); Shelby Tube (solid box)

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
1010	**APPROX. SURFACE ELEV. (ft):**1010		0								
	ROOT ZONE organic (corn) heavy silty clay topsoil, dark reddish brown		***1.0'***								
	SILTY CLAY with sand and gravel and trace organics, firm, dark brown to reddish brown, moist (CL/ML) [Glacial Till]			SS 1		2-3-3 N=6					PP = 2.0 tsf
1005	∇ *grades to very stiff to hard, reddish brown*		5	U 2				13.2	126.3		PP = 4.0 tsf
	▼			SS 3		4-5-6 N=11					PP = 3.5 tsf
1000			10	SS 4		3-7-12 N=19					PP = 4.0 tsf
	grades to dark gray brown										
995			15	SS 5		6-5-7 N=12		13.0			PP = >4.5 tsf
	grades to dark reddish brown										
990			20 (***20.0'***)	SS 6		6-10-12 N=22					PP = 3.5 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	∇ 4.0 ft
IAD	▼ 6.6 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/18/20	FINISHED:	4/18/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. GEO-57

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Legend: Split Spoon; Shelby Tube

APPROX. SURFACE ELEV. (ft):1012

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE	0								
	organic (grass) rich clay, brown, moist **0.8'**									
1010	***LEAN CLAY*** *with silt and sand and trace organics, firm, dark gray brown, moist (CL) [Glacial Till]* **1.5'**		SS 1		3-3-5 N=8					PP = 1.5 tsf
	SILTY CLAY *with sand, firm to stiff, mottled reddish brown and gray brown, moist (CL/ML) [Glacial Till]*	5	U 2				15.9			PP = 1.0 tsf
1005	*grades to with sand and gravel, dark reddish brown*		SS 3		3-3-3 N=6					PP = 2.5 tsf
		10	U 4			1.7				PP = 2.5 tsf
1000	*grades to stiff to very stiff, dark gray brown*									
	Driller's Note: Cave-in to 13.7 feet immediately following drilling	15	SS 5		6-7-8 N=15					PP = 4.0 tsf
995	**17.5'**									
	SILTY SAND *with gravel, medium dense, dark gray brown, moist (SM) [Alluvium]* **20.0'**	20	SS 6		15-14-13 N=27					

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 4.0 ft
IAD	▼ 3.6 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/27/20	FINISHED:	4/27/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. GEO-58

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Split Spoon | Shelby Tube

APPROX. SURFACE ELEV. (ft): 1012

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE *organic (corn) rich clay, brown, moist* **1.0'**	0								
1010	***LEAN CLAY*** *with silt and sand and trace organics, firm to stiff, mottled reddish brown and gray brown, moist (CL) [Glacial Till]* **3.0'**		SS 1		4-3-3 N=6					PP = 1.5 tsf
	SILTY CLAY *with sand, very stiff, moist (CL/ML) [Glacial Till]*	5	U 2			0.6	14.8	118.0		PP = 3.0 tsf
1005	*grades to with sand and gravel, with silty sand (SM) lenses, dark reddish brown*		SS 3		7-7-13 N=20					PP = 3.0* tsf
		10	SS 4		4-4-6 N=10		11.1		17/4	PP = 4.5 tsf
1000	*grades to very stiff to hard, dark gray brown*									
	Driller's Note: Cave-in to 13.1 feet immediately following drilling	15	SS 5		10-14-17 N=31					PP = 4.0* tsf
995	*grades to very stiff* **20.0'**	20	SS 6		5-8-9 N=17		13.1			PP = 2.5 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 3.5 ft
IAD	▼ 3.5 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/28/20	FINISHED:	4/28/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD:	CONTINUOUS FLIGHT AUGER		

olsson

BOREHOLE REPORT NO. GEO-59

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Split Spoon / Shelby Tube

APPROX. SURFACE ELEV. (ft):1009

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	APPROX. SURFACE ELEV. (ft):1009	0								
	ROOT ZONE 1.0'									
	organic (corn) rich clay, brown, moist 1.5'		SS 1		2-2-3 N=5					PP = 1.0 tsf
	LEAN CLAY *with silt and sand and trace organics, soft to firm, dark gray brown, moist (CL) [Glacial Till]*									
1005	***SILTY CLAY*** *with sand and gravel, soft to firm, mottled reddish brown and gray brown, moist (CL/ML) [Glacial Till]* 5.0'	5	U 2							PP = 1.0 tsf
	SANDY SILTY CLAY *with gravel, with silty clayey sand (SC/SM) lenses, soft to stiff, dark reddish brown, moist (CL/ML) [Glacial Till]* 8.0'		SS 3		3-6-4 N=10		19.2			P-200 = 50.9% PP = 0.5 tsf
1000	***SILTY CLAY*** *with sand and gravel, stiff, dark reddish brown, moist (CL/ML) [Glacial Till]*	10	SS 4		4-9-5 N=14					PP = 1.75 tsf
995	*grades to very stiff to hard, dark gray brown* *Driller's Note: Cave-in to 12.5 feet immediatley following drilling*	15	SS 5		6-10-12 N=22					PP = >4.5 tsf
990	20.0'	20	SS 6		5-7-8 N=15		13.5			PP = 3.75 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 3.0 ft
IAD	▼ 1.0 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/28/20	FINISHED:	4/28/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

olsson | **BOREHOLE REPORT NO. GEO-60** | **Sheet 1 of 1**

PROJECT NAME: **Madison Fields Solar**

CLIENT: **Savion, LLC**

PROJECT NUMBER: **020-0986**

LOCATION: **Madison County, Ohio**

Legend: Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
1010	**APPROX. SURFACE ELEV. (ft):**1010		0								
	ROOT ZONE *organic (grass) rich clay, brown, moist* — ***0.8'***										
	LEAN CLAY *with sand and trace organics, firm to stiff, mottled reddish brown and gray brown, moist (CL) [Glacial Till]*			SS 1		3-3-9 N=12					PP = 1.25 tsf
1005	***5.0'***		5	SS 2		3-3-7 N=10		14.6			PP = 2.0* tsf
	SILTY CLAYEY SAND *with gravel, medium dense, reddish brown, moist (SC/SM) [Alluvium]* — ***7.0'***			SS 3		10-10-9 N=19					PP = 2.75 tsf
	LEAN CLAY *with sand and gravel, stiff to very stiff, dark reddish brown, moist (CL) [Glacial Till]*										
1000	*grades to dark gray brown*		10	SS 4		3-4-8 N=12					PP = 3.0 tsf
	Driller's Note: Cave-in to 11 feet immediately following drilling										
995	*grades to firm to stiff*		15	SS 5		4-6-8 N=14		14.6			PP = 1.0 tsf
990	*grades to with silty sand (SM) lenses* — ***20.0'***		20	SS 6		3-5-6 N=11					PP = 1.5 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 3.0 ft
IAD	▼ 3.5 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/27/20	FINISHED:	4/27/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD:	CONTINUOUS FLIGHT AUGER		

olsson

BOREHOLE REPORT NO. GEO-61

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Legend: Split Spoon; Shelby Tube

APPROX. SURFACE ELEV. (ft): 1009

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
		0								
	ROOT ZONE *organic (grass) rich clay, brown, moist* **0.8'**									
	LEAN CLAY *with silt and sand and trace organics, firm to stiff, mottled reddish brown and gray brown, moist (CL) [Glacial Till]*		SS 1		3-3-4 N=7					PP = 2.5 tsf
1005		5	SS 2		3-2-3 N=5		22.9		45/28	PP = 2.0 tsf
	5.5'									
	SANDY CLAY *with silt and trace gravel, soft, dark reddish brown, moist (CL) [Glacial Till]*		U 3				15.4	111.5		P-200 = 63.8% PP = 0.25 tsf
1000	**9.0'**									
	SILTY CLAY *with sand and gravel, soft, mottled dark reddish brown and gray brown, moist (CL/ML) [Glacial Till]*	10	SS 4		1-2-2 N=4					PP = 0.5 tsf
995	*grades to very stiff to hard, dark gray*	15	SS 5		8-10-15 N=25					PP = >4.5 tsf
	Driller's Note: Cave-in to 15 feet immediately following drilling **17.0'**									
990	***SILTY SAND*** *with gravel, very dense, dark gray brown, moist (SM) [Alluvium]* **20.0'**	20	SS 6		10-22-29 N=51					

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 5.5 ft
IAD	▼ 5.0 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/27/20	FINISHED:	4/27/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. GEO-62

Sheet 1 of 1

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Shelby Tube / Split Spoon

APPROX. SURFACE ELEV. (ft):1009

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE	0								
	organic (corn) rich clay, brown, moist **1.0'**									
	SILTY CLAY		U 1				20.4			PP = >4.5 tsf
1005	*with sand and gravel, very stiff to hard, mottled reddish brown and gray brown, moist (CL/ML) [Glacial Till]*									
	grades to stiff to very stiff, reddish brown	5	SS 2		5-8-6 N=14					PP = 3.5 tsf
			SS 3		5-8-10 N=18					
1000	*grades to dark reddish brown*	10	SS 4		9-11-10 N=21					PP = 1.75 tsf
995	*grades to very stiff to hard, dark gray brown*	15	SS 5		13-15-15 N=30					PP = >4.5 tsf
	Driller's Note: Cave-in to 15 feet immediately following drilling **16.5'**									
	SILTY SAND									
990	*with gravel, medium dense, dark gray brown, moist (SM) [Alluvium]* **20.0'**	20	SS 6		8-19-7 N=26		3.0			PP = 2.0 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	9.0 ft
IAD	6.5 ft after 0 Hrs
AD	Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/28/20	FINISHED:	4/28/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

olsson

BOREHOLE REPORT NO. GEO-63

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	**LOCATION**
020-0986	Madison County, Ohio

Split Spoon (SS) / Shelby Tube (U)

APPROX. SURFACE ELEV. (ft): 1009

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE organic (corn) rich clay, brown, moist	0 – 1.0'								
	LEAN CLAY with silt and sand and trace organics, firm to stiff, mottled reddish brown and gray brown, moist (CL) [Glacial Till]		SS 1		2-2-4 N=6					PP = 1.75 tsf
1005	grades to with sand and gravel; stiff	5	U 2			0.9	20.0			PP = 2.0 tsf
			SS 3		3-4-6 N=10					PP = 2.0 tsf
1000	grades to very stiff to hard, dark reddish brown	10	SS 4		6-7-15 N=22					PP = 4.0 tsf
995	grades to stiff to very stiff, dark gray brown	15	SS 5		3-5-6 N=11		13.4			PP = 2.5 tsf
	Driller's Note: Cave-in to 14 feet immediately following drilling	18.6'	SS 6		50/1"					

REFUSAL AT 18.6 FEET

WATER LEVEL OBSERVATIONS	
WD	∇ 4.5 ft
IAD	▼ 9.1 ft after 0 Hrs
AD	Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/28/20	FINISHED:	4/28/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

olsson	BOREHOLE REPORT NO. GEO-64	Sheet 1 of 1

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Legend: Split Spoon; Shelby Tube

APPROX. SURFACE ELEV. (ft):1016

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE	0								
1015	*organic (corn) rich clay, brown, moist* **1.0'**									
	LEAN CLAY		SS 1		2-3-3 N=6					PP = 1.5 tsf
	with sand and trace organics, firm to stiff, mottled reddish brown and gray brown, moist (CL) [Glacial Till]									
	grades to with sand and gravel, stiff to very stiff	5	U 2			2.0	14.4	122.5		PP = 3.0 tsf
1010			SS 3		4-6-8 N=14		14.5		25/9	PP = 3.0 tsf
	grades to dark reddish brown	10	SS 4		6-8-15 N=23					PP = 2.5* tsf
1005	*grades to hard, dark gray brown*									
		15	SS 5		16-17-14 N=31					PP = 4.0* tsf
1000	*Driller's Note: Cave-in to 16 feet immediately following drilling* **18.0'**									
	SILTY SAND									
	with gravel, loose, dark gray brown, moist (SM) [Alluvium] **20.0'**	20	SS 6		2-4-5 N=9					PP = 1.0 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	∇ 4.0 ft
IAD	▼ 8.0 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/24/20	FINISHED:	4/24/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD:	CONTINUOUS FLIGHT AUGER		

BOREHOLE REPORT NO. GEO-65

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Shelby Tube ■ Split Spoon ☒

APPROX. SURFACE ELEV. (ft):1012

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE		0								
	organic (corn) rich clay, brown, moist **1.0'**										
1010	***SILTY CLAY***			U 1							PP = >4.5 tsf
	with sand and gravel, very stiff to hard, reddish brown, moist (CL/ML) [Glacial Till]										
			5	SS 2		6-8-9 N=17					PP = 3.5* tsf
	grades to stiff, mottled reddish brown and gray brown										
1005				SS 3		5-4-5 N=9		14.0			PP = 1.5 tsf
	grades to stiff to very stiff, dark reddish brown		10	SS 4		4-10-8 N=18					PP = 1.5 tsf
1000	*Driller's Note: Cave-in to 12 feet immediately following drilling* **12.5'**										
	SILTY SAND										
	with gravel, with silty clay (CL/ML) lenses, very dense, dark reddish brown, moist (SM) [Glacial Till]		15	SS 5		17-31-50/4"					PP = 1.5 tsf
995	*grades to dark gray brown [Alluvium]*										
	20.0'		20	SS 6		4-14-50/3"		6.0			

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 6.5 ft
IAD	▼ 6.5 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/28/20	FINISHED:	4/28/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD:	CONTINUOUS FLIGHT AUGER		

BOREHOLE REPORT NO. GEO-66

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

☒ Split Spoon ■ Shelby Tube

APPROX. SURFACE ELEV. (ft): 1017

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE organic-poor clay, brown, moist — 0.2'	0								
1015	*SILTY CLAY* with sand and gravel and trace organics, firm to stiff, mottled reddish brown and gray brown, moist (CL/ML) [Glacial Till]		SS 1		2-3-3 N=6					PP = 1.5 tsf
	grades to stiff to very stiff	5	U 2			1.3	19.9	115.1		PP = 3.0 tsf
1010			SS 3		3-6-7 N=13					PP = 3.0* tsf
	grades to dark reddish brown, very stiff to hard	10	SS 4		7-12-50/4.5"					PP = 2.0 tsf
1005										
	Driller's Note: Cave-in to 13 feet immediately following drilling; grades to dark gray brown	15	SS 5		21-32-32 N=64		9.8			PP = 1.0* tsf
1000	— 20.0'	20	SS 6		6-9-14 N=23					PP = >4.5 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 3.0 ft
IAD	▼ 8.0 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/22/20	FINISHED:	4/22/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. GEO-67

PROJECT NAME: **Madison Fields Solar**	CLIENT: **Savion, LLC**
PROJECT NUMBER: **020-0986**	LOCATION: **Madison County, Ohio**

Legend: Split Spoon (X box); Shelby Tube (solid box)

APPROX. SURFACE ELEV. (ft): 1014

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE *organic-poor clay, grayish brown, moist* — 0.2'		0								
	LEAN CLAY *with silt and trace sand, soft to firm, mottled reddish brown and gray, moist (CL) [Glacial Till]* — 3.5'			SS 1		2-2-2 N=4					PP = 1.5 tsf
1010	***SILTY CLAY*** *with sand, soft to firm, mottled reddish brown and dark gray, moist (CL/ML) [Glacial Till]* — 5.5'		5	U 2			0.5	13.8	119.2		PP = 1.0 tsf
	SILTY SAND *with gravel, medium dense, dark gray brown, moist (SM) [Alluvium]* — 8.0'			SS 3		4-6-7 N=13					PP = 2.0 tsf
1005	*Driller's Note: Cave-in to 7.5 feet immediately following drilling* ***POORLY GRADED SAND*** *with silt and gravel, medium dense, dark gray brown, moist (SP/SM) [Alluvium]*		10	SS 4		5-6-8 N=14					
1000			15	SS 5		4-5-12 N=17		9.1			P-200 = 5.5%
995	— 20.0'		20	SS 6							Cave-in - sample not recovered

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	5.0 ft
IAD	3.5 ft after 0 Hrs
AD	Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/21/20	FINISHED:	4/21/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD:	CONTINUOUS FLIGHT AUGER		

BOREHOLE REPORT NO. GEO-68

PROJECT NAME: Madison Fields Solar	CLIENT: Savion, LLC
PROJECT NUMBER: 020-0986	LOCATION: Madison County, Ohio

Split Spoon / Shelby Tube

APPROX. SURFACE ELEV. (ft):1017

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE organic (corn) rich silty clay, dark brown, moist	0 – 1.0'								
1015	*LEAN CLAY* with silt and sand and trace organics, firm to stiff, dark brown to reddish brown, moist (CL) [Glacial Till]		SS 1		3-3-5 N=8					PP = 1.5 tsf
		5	SS 2		2-5-5 N=10		22.9			PP = 2.0 tsf
1010	*SILTY CLAY* with silt and sand and gravel, stiff to very stiff, mottled dark reddish brown and gray, moist (CL/ML) [Glacial Till]	6.0'	SS 3		3-6-6 N=12					PP = 3.25 tsf
	grades to firm, reddish brown	10	SS 4		3-3-3 N=6					PP = 1.0 tsf
1005	grades to very stiff, dark reddish brown		U 5				10.4			PP = 3.5 tsf
	grades to dark gray brown	15	SS 6		5-8-11 N=19					PP = 3.5 tsf
1000										
	grades to with silty sand (SM) seams	20 / 20.0'	SS 7		7-13-25 N=38					PP = 2.0 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	∇ 9.0 ft
IAD	▼ 15.0 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/20/20	FINISHED:	4/20/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD:	CONTINUOUS FLIGHT AUGER		

BOREHOLE REPORT NO. GEO-69

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Legend: Shelby Tube; Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
1015	**APPROX. SURFACE ELEV. (ft):**1015		0								
	ROOT ZONE *organic (corn) rich clay, brown, moist* **1.0'**										
	LEAN CLAY *with silt and sand and gravel and trace organics, very stiff, mottled reddish brown and gray brown, moist (CL) [Glacial Till]* **3.0'**			U 1			0.4	27.3	91.8		PP = 3.0 tsf
1010	***SILTY CLAY*** *with sand and gravel, firm, mottled reddish brown and gray brown, moist (CL/ML) [Glacial Till]*		5	SS 2		5-4-4 N=8					PP = 0.5 tsf
	grades to stiff, dark reddish brown			SS 3		3-3-6 N=9					PP = 2.5* tsf
1005			10	SS 4		4-8-10 N=18					PP = 3.0 tsf
	grades to very stiff, dark gray brown										
1000	*Driller's Note: Cave-in to 12.5 feet immediately following drilling*		15	SS 5		9-9-9 N=18					PP = 3.5* tsf
995	*grades to with silty sand (SM) seams, very stiff to hard* **20.0'**		20	SS 6		9-12-14 N=26					PP = >4.5 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 6.0 ft
IAD	▼ 5.5 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/24/20	FINISHED:	4/24/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD:	CONTINUOUS FLIGHT AUGER		

BOREHOLE REPORT NO. GEO-70

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	**LOCATION**
020-0986	Madison County, Ohio

Shelby Tube ■ Split Spoon ☒

APPROX. SURFACE ELEV. (ft):1016

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE organic (corn) rich clay, brown, moist	0								
1015	1.0'									
	LEAN CLAY with silt and sand and trace organics, stiff to very stiff, mottled reddish brown and gray brown, moist (CL) [Glacial Till]		U 1				25.4	94.0		PP = 2.5 tsf
	3.0'									
	SILTY CLAY with sand and gravel, stiff to very stiff, mottled reddish brown and gray brown, moist (CL/ML) [Glacial Till]	5	SS 2		6-7-8 N=15					PP = 3.0 tsf
1010	*grades to dark reddish brown*		U 3		3-4-5 N=9					PP = 1.5* tsf
	grades to very stiff, dark gray brown	10	SS 4		5-7-10 N=17					PP = 3.0 tsf
1005										
	grades to hard, with silty sand (SM) lenses *Driller's Note: Cave-in to 13 feet immediately following drilling*	15	SS 5		13-16-19 N=35		8.6			PP = >4.5 tsf
1000	17.0'									
	SILTY SAND with gravel, very dense, dark gray brown, moist (SM) [Alluvium]									
	20.0'	20	SS 6		6-17-25 N=42					

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 3.5 ft
IAD	▼ 5.0 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/27/20	FINISHED:	4/27/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. GEO-71

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Split Spoon ☒   Shelby Tube ■

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	APPROX. SURFACE ELEV. (ft):1011	0								
1010	***ROOT ZONE*** *organic (corn) rich clay, brown, moist* **1.0'**									
	LEAN CLAY *with silt and sand and trace organics, firm to stiff, mottled reddish brown and gray brown, moist (CL) [Glacial Till]*		SS 1		3-3-4 N=7					PP = 2.0 tsf
	▽ *with silt and sand and gravel, stiff to very stiff*	5	U 2			0.3	17.5	107.6		PP = 2.5 tsf
1005	▼ *grades to reddish brown*									
	Driller's Note: Cave-in to 6 feet immediately following drilling		SS 3		3-3-6 N=9					PP = 2.0 tsf
	grades to stiff, with silty sand (SM) lenses	10	SS 4		5-6-6 N=12		13.4			PP = 1.25 tsf
1000										
	grades to very stiff to hard, dark gray brown	15	SS 5		8-8-11 N=19					PP = 4.0 tsf
995										
	20.0'	20	SS 6		4-6-10 N=16		13.7			PP = 4.5 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 4.5 ft
IAD	▼ 6.0 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/28/20	FINISHED:	4/28/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

olsson	BOREHOLE REPORT NO. GEO-72	Sheet 1 of 1

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Split Spoon

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
1015	APPROX. SURFACE ELEV. (ft):1015	0								
	ROOT ZONE *organic (corn) rich clay, brown, moist* **1.0'**									
	LEAN CLAY *with silt and sand and gravel and trace organics, stiff to very stiff, mottled reddish brown and gray brown, moist (CL) [Glacial Till]*		SS 1		3-5-7 N=12		14.6			PP = 3.0* tsf
1010		5	SS 2		6-10-9 N=19					PP = 3.0* tsf
	grades to dark reddish brown		SS 3		6-6-12 N=18					PP = 2.5 tsf
	Driller's Note: Cave-in to 6.5 feet immediately following drilling **8.0'**									
1005	***SILTY SAND*** *with gravel, medium dense, dark reddish brown, moist (SM) [Alluvium]* **14.0'**	10	SS 4		11-12-13 N=25		9.6			P-200 = 16.3%
1000	***SILTY CLAY*** *with sand and gravel and silty sand (SM) lenses, medium dense to dense, dark gray brown, moist (CL/ML) [Alluvium]*	15	SS 5		12-15-16 N=31					PP = 4.5 tsf
995	**20.0'**	20	SS 6		12-19-20 N=39					

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 6.5 ft
IAD	▼ 1.0 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/22/20	FINISHED:	4/22/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

olsson	BOREHOLE REPORT NO. GEO-73	Sheet 1 of 2

PROJECT NAME: Madison Fields Solar	CLIENT: Savion, LLC
PROJECT NUMBER: 020-0986	LOCATION: Madison County, Ohio

Legend: Split Spoon (boxed X); Shelby Tube (solid black box)

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
1015	**APPROX. SURFACE ELEV. (ft):**1015		0								
	ROOT ZONE organic (corn) rich silty clay, dark brown, moist — *1.0'*										
	LEAN CLAY *with silt and sand and trace organics, firm, reddish brown, moist (CL) [Glacial Till]*			SS 1		2-3-3 N=6					PP = 1.0 tsf
1010	*grades to with sand, very stiff to hard, mottled reddish brown and gray* (▽ 4.5 ft)		5	U 2				21.3	111.4		PP = 4.5 tsf
	grades to with gravel, stiff to very stiff, reddish brown (▼ 7.5 ft)			SS 3		3-5-6 N=11					PP = 1.75 tsf
1005	*grades to very stiff to hard, dark reddish brown*		10	SS 4		8-8-14 N=22		15.0			PP = 4.0 tsf
1000	*grades to stiff to very stiff, dark gray brown*		15	SS 5		5-5-5 N=10					PP = 3.5 tsf
	17.5'										
995	***SILTY CLAY*** *with sand and gravel, firm, dark gray brown, moist (CL/ML) [Glacial Till]* *Driller's Note: Cave-in to 19 feet immediately following drilling*		20	SS 6		2-3-4 N=7		14.3			PP = 1.0 tsf
990	*25.0'*		25	SS 7		3-5-5 N=10					PP = 2.5 tsf

CONTINUED NEXT PAGE

WATER LEVEL OBSERVATIONS	
WD	▽ 4.5 ft
IAD	▼ 7.5 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/20/20	FINISHED:	4/29/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD:	CTS FLIGHT AUGER / HOLLOW STEM		

BOREHOLE REPORT NO. GEO-73

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Legend: Split Spoon; Shelby Tube

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
990		25								
	SILTY CLAY *with sand and gravel, firm to stiff, dark gray brown, moist (CL/ML) [Glacial Till]*									
985		30	SS 8		6-6-9 N=15					PP = 1.75 tsf
	31.5'									
	SILTY CLAYEY SAND *varies to sandy silt (ML), dense, dark gray brown, moist (SC/SM) [Glacial Till]*									
980		35	SS 9		15-21-15 N=36		17.4			
	37.5'									
	SILTY CLAY *with sand and gravel, very stiff to hard, dark gray brown, moist (CL/ML) [Glacial Till]*									
975		40	SS 10		12-18-34 N=52					PP = 2.5* tsf
	41.0'									
	SILTY CLAYEY SAND *with gravel, very dense, dark gray brown, moist (SC/SM) [Alluvium]*									
			SS 11		50/4"		10.2			P-200 = 23.9%
970		45								
965	***50.0'***	50	SS 12		25-30-38 N=68					
	BASE OF BORING AT 50.0 FEET									

WATER LEVEL OBSERVATIONS	
WD	4.5 ft
IAD	7.5 ft after 0 Hrs
AD	Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/20/20	FINISHED:	4/29/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD:	CTS FLIGHT AUGER / HOLLOW STEM		

BOREHOLE REPORT NO. GEO-74

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Legend: Split Spoon; Shelby Tube

APPROX. SURFACE ELEV. (ft): 1011

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE organic (grass) rich silty clay, dark brown, moist	0.8'								
1010	***LEAN CLAY*** with silt and sand and trace organics, firm, dark gray brown, moist (CL) [Glacial Till]		SS 1		3-3-5 N=8					PP = 1.75 tsf
	∇ grades to with silt and sand and gravel, stiff to very stiff, mottled reddish brown and gray brown	5	U 2			0.8	14.8	118.3	34/16	PP = 4.0 tsf
1005	grades to dark reddish brown		SS 3		7-9-10 N=19					PP = 3.0 tsf
		10	SS 4		10-14-20 N=34		12.8			PP = 3.0* tsf
1000										
	grades to sandy, stiff, dark gray brown	15	SS 5		3-7-6 N=13					PP = 1.75 tsf
995										
	grades to firm to very stiff, wet	20	SS 6		14-15-16 N=31		22.8			P-200 = 59.5% PP = 0.25 tsf
990										
		25.0' / 25	SS 7		12-14-17 N=31		22.0			PP = 0.25 tsf

CONTINUED NEXT PAGE

WATER LEVEL OBSERVATIONS	
WD	∇ 4.0 ft
IAD	▼ Not Performed
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/29/20	FINISHED:	4/30/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: HOLLOW STEM AUGER			

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Split Spoon / Shelby Tube

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
985	***LEAN CLAY*** *with sand and gravel, stiff to hard, dark gray brown, wet (CL) [Glacial Till]* **27.5'**	25								
	SILTY CLAYEY SAND *with gravel, very dense, dark gray brown, wet (SC/SM) [Alluvium]*	30	SS 8		10-43-50/5"					
980										
	grades to medium dense, varies to poorly graded sand with silt (SP/SM)	35	SS 9		4-12-16 N=28		10.1			
975										
		40	SS 10		8-11-12 N=23					
970	*grades to very dense*									
	Driller's Note: Auger refusal encountered at 43.5 feet on an apparent cobble or boulder; drilling terminated due to refusal and inclimate weather **43.5'**		SS 11		15-33-35 N=68					

REFUSAL AT 43.5 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 4.0 ft
IAD	▼ Not Performed
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/29/20	FINISHED:	4/30/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: HOLLOW STEM AUGER			

olsson

BOREHOLE REPORT NO. GEO-75

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Split Spoon — Shelby Tube

APPROX. SURFACE ELEV. (ft):1018

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE *organic (corn) rich clay, brown, moist* **1.0'**	0								
1015	***LEAN CLAY*** *with silt and sand and trace organics, firm to stiff, dark gray brown, moist (CL) [Glacial Till]*		SS 1		2-2-3 N=5					PP = 2.0 tsf
	grades to with gravel, mottled reddish brown and gray brown **5.5'**	5	U 2			2.1	12.8	124.2		PP = 3.0 tsf
1010	***SILTY CLAY*** *with sand and gravel, stiff to very stiff, dark reddish brown, moist (CL/ML) [Glacial Till]* **8.0'**		SS 3		5-5-10 N=15					PP = 1.5* tsf
	SILTY SAND *with gravel, medium dense, dark reddish brown, moist (SM) [Alluvium]*	10	SS 4		11-12-15 N=27					PP = 1.0* tsf
	Driller's Note: Cave-in to 10 feet immediately following drilling **11.5'**									
1005	***SILTY CLAY*** *with sand and gravel, very stiff to hard, dark gray brown, moist (CL/ML) [Glacial Till]*	15	SS 5		8-8-12 N=20					PP = 4.5 tsf
1000	**20.0'**	20	SS 6		8-8-13 N=21					PP = >4.5 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	4.0 ft
IAD	10.0 ft after 0 Hrs
AD	Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/24/20	FINISHED:	4/24/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. GEO-76

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	**LOCATION**
020-0986	Madison County, Ohio

Legend: Split Spoon (X box), Shelby Tube (solid box)

APPROX. SURFACE ELEV. (ft): 1017

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE organic (corn) rich silty clay, dark brown, moist — **1.0'**	0								
1015	***LEAN CLAY*** with silt and sand and trace organics, firm to stiff, dark gray brown, moist (CL) [Glacial Till]		SS 1		2-2-4 N=6					PP = 2.5 tsf
	grades to stiff, mottled reddish brown and gray brown	5	U 2			0.7	26.1	102.8		PP = 1.5 tsf
1010	*grades to dark reddish brown* — **8.0'**		SS 3							PP = 2.5* tsf
	SILTY CLAY with sand and gravel, stiff, dark gray brown, moist (CL/ML) [Glacial Till]	10	SS 4		8-12-13 N=25		11.8			PP = 2.0* tsf
1005	*grades to firm to stiff*	15	SS 5		4-4-10 N=14					PP = 1.0 tsf
1000	*grades to stiff to very stiff* — **20.0'**	20	SS 6		7-9-13 N=22					PP = 2.5* tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 5.0 ft
IAD	▼ 5.5 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/23/20	FINISHED:	4/23/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. GEO-77

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	**LOCATION**
020-0986	Madison County, Ohio

Split Spoon | Shelby Tube

APPROX. SURFACE ELEV. (ft): 1021

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
1020	***ROOT ZONE*** *organic (corn) rich clay, brown, moist* — 1.0'	0								
	LEAN CLAY *with sand and trace organics, firm to stiff, mottled reddish brown and gray brown, moist (CL) [Glacial Till]* — 3.0'		SS 1		3-3-4 N=7					PP = 2.0 tsf
	SILTY CLAY *with sand and gravel, firm to stiff, mottled reddish brown and gray brown, moist (CL/ML) [Glacial Till]*	5	SS 2		3-3-3 N=6					PP = 3.0* tsf
1015	*grades to very stiff to hard, dark reddish brown*		U 3				11.6	121.3	21/6	PP = >4.5 tsf
		10	SS 4		6-11-7 N=18					PP = 2.0* tsf
1010	*Driller's Note: Cave-in to 11 feet immediately following drilling* — 12.5'									
	SILTY SAND *with gravel, medium dense, dark gray brown, moist (SM) [Alluvium]*	15	SS 5		4-10-18 N=28					
1005	— 19.0'									
	SILTY CLAY *with sand and gravel, very stiff to hard, dark gray brown, moist (CL/ML) [Glacial Till]* — 20.0'	20	SS 6		6-9-11 N=20					PP = >4.5 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 6.5 ft
IAD	▼ 5.0 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/24/20	FINISHED:	4/24/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD:	CONTINUOUS FLIGHT AUGER		

olsson	BOREHOLE REPORT NO. GEO-78	Sheet 1 of 1

PROJECT NAME: Madison Fields Solar	CLIENT: Savion, LLC
PROJECT NUMBER: 020-0986	LOCATION: Madison County, Ohio

Legend: Split Spoon (SS); Shelby Tube (U)

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
1020	APPROX. SURFACE ELEV. (ft):1020	0								
	ROOT ZONE organic (corn) rich clay, brown, moist *1.0'*									
	LEAN CLAY with sand and trace organics, firm to stiff, mottled reddish brown and gray brown, moist (CL) [Glacial Till] *3.0'*		SS 1		3-3-4 N=7		22.2			PP = 1.5 tsf
1015	*SILTY CLAY* with sand and gravel, stiff to very stiff, mottled reddish brown and gray brown, moist (CL/ML) [Glacial Till]	5	SS 2		3-4-5 N=9					PP = 2.5* tsf
	grades to dark reddish brown		SS 3		4-4-5 N=9					PP = 2.0 tsf
1010	*grades to very stiff to hard, dark gray brown*	10	U 4				11.1	129.1		PP = 4.25 tsf
	Driller's Note: Cave-in to 11.5 feet immediately following drilling									
1005	*grades to with silty sand (SM) lenses, stiff to very stiff*	15	SS 5		5-7-8 N=15					PP = 2.5 tsf
1000	*grades to very stiff to hard* *20.0'*	20	SS 6		4-7-13 N=20					PP = 4.5 tsf

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 4.5 ft
IAD	▼ 5.5 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/23/20	FINISHED:	4/23/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

olsson	BOREHOLE REPORT NO. GEO-79	Sheet 1 of 1

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

Split Spoon ☒ Shelby Tube ■

APPROX. SURFACE ELEV. (ft):1017

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE *organic (corn) rich clay, brown, moist* — ***1.0'***		0								
1015	***LEAN CLAY*** *with silt and sand and trace organics, firm to stiff, mottled reddish brown and gray brown, moist (CL) [Glacial Till]*			SS 1		2-2-4 N=6					PP = 2.0 tsf
	▽ *grades to with sand and gravel; very stiff to hard*		5	U 2				17.1	112.3		PP = >4.5 tsf
1010				SS 3		5-7-9 N=16					PP = 3.0* tsf
	▼ *grades to dark reddish brown*		10	SS 4		10-14-15 N=29					PP = 3.0* tsf
1005	*Driller's Note: Cave-in to 13 feet immediately following drilling* — ***13.5'***										
	SILTY CLAY *with sand and gravel, stiff to very stiff, dark gray brown, moist (CL/ML) [Glacial Till]*		15	SS 5		2-5-6 N=11		10.4			PP = 3.5* tsf
1000	***18.0'***										
	SILTY SAND *dense, dark gray brown, moist (SM) [Alluvium]* — ***20.0'***		20	SS 6		6-14-16 N=30					

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 4.5 ft
IAD	▼ 9.5 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED: 4/25/20	FINISHED: 4/25/20
DRILL CO.: OLSSON	DRILL RIG: DIEDRICH D50
DRILLER: M. WENTLAND	LOGGED BY: J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER	

BOREHOLE REPORT NO. GEO-80

PROJECT NAME: **Madison Fields Solar**	CLIENT: **Savion, LLC**
PROJECT NUMBER: **020-0986**	LOCATION: **Madison County, Ohio**

Split Spoon · Shelby Tube

APPROX. SURFACE ELEV. (ft): 1015

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)
1015	***ROOT ZONE*** *organic (corn) rich clay, brown, moist*	0–1.0'
	LEAN CLAY *with silt and sand and gravel, firm to stiff, reddish brown, moist (CL) [Glacial Till]*	1.0'
	grades to stiff to very stiff, mottled reddish brown and gray brown	
	grades to dark reddish brown (▽)	
	grades to very stiff to hard, dark gray brown	
	grades to stiff to very stiff (▼)	
995		20.0'

BASE OF BORING AT 20.0 FEET

SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
SS 1		3-4-6 N=10					PP = 1.0* tsf
SS 2		7-8-9 N=17					PP = 3.0* tsf
SS 3		5-5-5 N=10					PP = 3.5 tsf
U 4				13.3	123.1	23/8	PP = >4.5 tsf
SS 5		9-11-12 N=23					PP = 4.0* tsf
SS 6		3-5-6 N=11					PP = 2.75 tsf

WATER LEVEL OBSERVATIONS	
WD	▽ 7.0 ft
IAD	▼ 18.5 ft after 0 Hrs
AD	Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/27/20	FINISHED:	4/27/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

BOREHOLE REPORT NO. GEO-81

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER: 020-0986	LOCATION: Madison County, Ohio

Split Spoon

APPROX. SURFACE ELEV. (ft): 1015

ELEVATION (ft)	MATERIAL DESCRIPTION	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
1015	*ROOT ZONE* organic (corn) rich clay, brown, moist (1.0')	0								
	LEAN CLAY with silt and sand and trace organics, firm to stiff, dark gray brown, moist (CL) [Glacial Till] (1.5'–)		SS 1		3-4-4 N=8					PP = 2.5 tsf
1010	*SILTY CLAY* with sand, stiff to very stiff, mottled reddish brown and gray brown, moist (CL/ML) [Glacial Till] (to 6.0')	5	SS 2		4-8-8 N=16					PP = 1.75 tsf
	SILTY SAND with gravel, medium dense, dark reddish brown, moist (SM) [Alluvium]		SS 3		10-12-13 N=25		7.5			P-200 = 25.6%
1005	Driller's Note: Cave-in to 6.8 feet immediately following drilling (to 13.0')	10	SS 4		8-10-13 N=23					
1000	*SILTY CLAY* with sand and gravel, very stiff to hard, dark gray brown, moist (CL/ML) [Glacial Till] (to 17.5')	15	SS 5		9-11-21 N=32					PP = 3.5* tsf
995	*SILTY SAND* with trace gravel, medium dense, dark gray brown, moist (SM) [Alluvium] (to 20.0')	20	SS 6		5-6-15 N=21		16.0			

BASE OF BORING AT 20.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 4.0 ft
IAD	▼ 5.5 ft after 0 Hrs
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	4/25/20	FINISHED:	4/25/20
DRILL CO.:	OLSSON	DRILL RIG:	DIEDRICH D50
DRILLER:	M. WENTLAND	LOGGED BY:	J. FOSTER
METHOD: CONTINUOUS FLIGHT AUGER			

APPENDIX D

TEST PIT LOGS

TEST PIT REPORT NO. TP-12

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE *organic (corn) rich silty clay, dark brown, moist* ***1.5'***		0								
	LEAN CLAY *with silt, sand, and gravel, moist (CL) [Glacial Till]*		5								
	grades to with sand, trace gravel, moist to wet ***10.0'***		10								

BASE OF TEST PIT AT 10.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Performed
AD	Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	5/12/20	FINISHED:	5/12/20
DRILL CO.:	DYNAHOE	DRILL RIG:	CAT 316
DRILLER:	DYNAHOE	LOGGED BY:	B. TABOR
METHOD: BACKHOE			

TEST PIT REPORT NO. TP-19

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE *organic (corn) heavy silty clay topsoil, dark brown* **1.0'**		0								
	LEAN CLAY *trace sand and gravel, brown, moist (CL) [Glacial Till]*										
			5								
	grades to with sand and gravel **10.0'**		10								

BASE OF TEST PIT AT 10.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ Not Encountered
IAD	▼ Not Performed
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	5/14/20	FINISHED:	5/14/20
DRILL CO.:	DYNAHOE	DRILL RIG:	CAT 316
DRILLER:	DYNAHOE	LOGGED BY:	B. TABOR
METHOD: BACKHOE			

TEST PIT REPORT NO. TP-23

olsson

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE *organic (grass) rich silty clay, dark brown, moist* **2.0'**		0								
	LEAN CLAY *trace sand and gravel, brown, moist (CL) [Glacial Till]* **7.0'**		5								
	WELL-GRADED GRAVEL *sandy with clay, trace cobbles, wet (GW) [Glacial Till]* **10.0'**		10								

BASE OF TEST PIT AT 10.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 7.1 ft
IAD	▼ Not Performed
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	5/14/20	FINISHED:	5/14/20
DRILL CO.:	DYNAHOE	DRILL RIG:	CAT 316
DRILLER:	DYNAHOE	LOGGED BY:	B. TABOR
METHOD: BACKHOE			

olsson	TEST PIT REPORT NO. TP-25	Sheet 1 of 1

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE organic (corn) heavy silty clay topsoil, dark grayish brown		0								
	1.0'										
	LEAN CLAY trace sand and gravel, light brown with gray, moist (CL) [Glacial Till]										
			5								
	grades to with sand and gravel, trace cobbles										
	9.0'										
	GRAVEL sandy with clay, light brown, wet to moist (GW) [Glacial Till]										
	10.0'		10								

BASE OF TEST PIT AT 10.0 FEET

WATER LEVEL OBSERVATIONS	
WD	∇ Not Encountered
IAD	▼ Not Performed
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED: 5/11/20	FINISHED: 5/11/20
DRILL CO.: DYNAHOE	DRILL RIG: CAT 316
DRILLER: DYNAHOE	LOGGED BY: B. TABOR
METHOD: BACKHOE	

TEST PIT REPORT NO. TP-31

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	**LOCATION**
020-0986	Madison County, Ohio

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE organic (corn) heavy silty clay topsoil, dark reddish brown **2.0'**		0								
	LEAN CLAY with trace sand and gravel light brown with gray, moist (CL) [Glacial Till]		5								
	grades to with sand, trace gravel and cobbles **10.0'**		10								

BASE OF TEST PIT AT 10.0 FEET

WATER LEVEL OBSERVATIONS	
WD	∇ Not Encountered
IAD	▼ Not Performed
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	5/12/20	FINISHED:	5/12/20
DRILL CO.:	DYNAHOE	DRILL RIG:	CAT 316
DRILLER:	DYNAHOE	LOGGED BY:	B. TABOR
METHOD: BACKHOE			

olsson

TEST PIT REPORT NO. TP-32

PROJECT NAME	CLIENT
Madison Fields Solar	**Savion, LLC**
PROJECT NUMBER	LOCATION
020-0986	**Madison County, Ohio**

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE *organic (corn) heavy silty clay topsoil, dark reddish brown* **1.0'**		0								
	LEAN CLAY *with sand, trace gravel, gray, brown to reddish brown, moist (CL) [Glacial Till]*		5								
	grades to with gravel ▽ **10.0'**		10								

BASE OF TEST PIT AT 10.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 7.5 ft
IAD	Not Performed
AD	Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	5/11/20	FINISHED:	5/11/20
DRILL CO.:	DYNAHOE	DRILL RIG:	CAT 316
DRILLER:	DYNAHOE	LOGGED BY:	B. TABOR
METHOD: BACKHOE			

TEST PIT REPORT NO. TP-34

Sheet 1 of 1

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE organic (corn) rich silty clay, dark brown, moist ***1.0'***		0								
	LEAN CLAY trace sand and gravel, brown, moist (CL) [Glacial Till]		5								
	large boulder noted at 6.5 feet ***10.0'***		10								

BASE OF TEST PIT AT 10.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Performed
AD	Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	5/14/20	FINISHED:	5/14/20
DRILL CO.:	DYNAHOE	DRILL RIG:	CAT 316
DRILLER:	DYNAHOE	LOGGED BY:	B. TABOR
METHOD: BACKHOE			

TEST PIT REPORT NO. TP-35

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE *organic (corn) rich silty clay, dark brown, moist* **1.4'**		0								
	LEAN CLAY *trace sand and gravel, brown, moist (CL) [Glacial Till]*										
			5								
	grades to with sand and gravel, trace cobbles **10.0'**		10								

BASE OF TEST PIT AT 10.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Performed
AD	Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	5/21/20	FINISHED:	5/21/20
DRILL CO.:	DYNAHOE	DRILL RIG:	CAT 316
DRILLER:	DYNAHOE	LOGGED BY:	B. TABOR
METHOD: BACKHOE			

TEST PIT REPORT NO. TP-36

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE *organic (corn) rich silty clay, dark brown, moist* **1.6'**		0								
	LEAN CLAY *trace sand and gravel, brown, moist (CL) [Glacial Till]*										
			5								
	grades to with sand and gravel, trace cobbles **10.0'**		10								

BASE OF TEST PIT AT 10.0 FEET

WATER LEVEL OBSERVATIONS	
WD	∇ Not Encountered
IAD	▼ Not Performed
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	5/21/20	FINISHED:	5/21/20
DRILL CO.:	DYNAHOE	DRILL RIG:	CAT 316
DRILLER:	DYNAHOE	LOGGED BY:	B. TABOR
METHOD: BACKHOE			

TEST PIT REPORT NO. TP-39

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE *organic (corn) rich clay, brown, moist* ***1.0'***		0								
	LEAN CLAY *trace sand and gravel, brown with gray, moist (CL) [Glacial Till]*										
			5								
	grades to with sand, gravel, and cobbles										
	boulder noted at 8.5 feet ***10.0'***		10								

BASE OF TEST PIT AT 10.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Performed
AD	Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	5/20/20	FINISHED:	5/20/20
DRILL CO.:	DYNAHOE	DRILL RIG:	CAT 316
DRILLER:	DYNAHOE	LOGGED BY:	B. TABOR
METHOD: BACKHOE			

TEST PIT REPORT NO. TP-48

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE organic-poor clay, dark gray brown, moist **2.0'**		0								
	LEAN CLAY with sand, trace gravel, dark gray brown, moist (CL) [Glacial Till]		5								
	▽ grades to with gravel, trace cobbles **10.0'**		10								

BASE OF TEST PIT AT 10.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 6.0 ft
IAD	Not Performed
AD	Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	5/20/20	FINISHED:	5/20/20
DRILL CO.:	DYNAHOE	DRILL RIG:	CAT 316
DRILLER:	DYNAHOE	LOGGED BY:	B. TABOR
METHOD: BACKHOE			

olsson

TEST PIT REPORT NO. TP-51

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE *organic (corn) rich clay, brown, moist* **1.5'**		0								
	LEAN CLAY *trace sand, gravel, and cobbles, brown, moist (CL) [Glacial Till]*		5								
	∇ *grades to with sand, trace gravel, cobbles, and boulders, dark brown, wet* **10.0'**		10								

BASE OF TEST PIT AT 10.0 FEET

WATER LEVEL OBSERVATIONS	
WD	∇ 7.5 ft
IAD	Not Performed
AD	Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	5/14/20	FINISHED:	5/14/20
DRILL CO.:	DYNAHOE	DRILL RIG:	CAT 316
DRILLER:	DYNAHOE	LOGGED BY:	B. TABOR
METHOD: BACKHOE			

olsson	TEST PIT REPORT NO. TP-59	Sheet 1 of 1

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE *organic (corn) rich clay, brown, moist* **1.6'**		0								
	LEAN CLAY *trace sand, gravel, and cobbles, brown, moist (CL) [Glacial Till]* ∇ **7.0'**		5								
	SILTY CLAY *with sand and gravel, soft to firm, mottled reddish brown and gray brown, moist (CL/ML) [Glacial Till]* **10.0'**		10								

BASE OF TEST PIT AT 10.0 FEET

WATER LEVEL OBSERVATIONS	
WD	∇ 6.5 ft
IAD	▼ Not Performed
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	5/16/20	FINISHED:	5/16/20
DRILL CO.:	DYNAHOE	DRILL RIG:	CAT 316
DRILLER:	DYNAHOE	LOGGED BY:	B. TABOR
METHOD: BACKHOE			

TEST PIT REPORT NO. TP-64

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE *organic (corn) rich clay, brown, moist* ***1.4'***		0								
	LEAN CLAY *trace sand and gravel, brown, moist (CL) [Glacial Till]*										
			5								
	grades to trace cobbles and boulders ***10.0'***		10								

BASE OF TEST PIT AT 10.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ Not Encountered
IAD	▼ Not Performed
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	5/16/20	FINISHED:	5/16/20
DRILL CO.:	DYNAHOE	DRILL RIG:	CAT 316
DRILLER:	DYNAHOE	LOGGED BY:	B. TABOR
METHOD: BACKHOE			

olsson

TEST PIT REPORT NO. TP-66

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE organic-poor clay, brown, moist — ***1.0'***		0								
	LEAN CLAY trace sand and gravel, grayish brown, moist (CL) [Glacial Till]		5								
	▽ *grades to with sand and gravel, trace cobbles* — ***10.0'***		10								

BASE OF TEST PIT AT 10.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ 6.5 ft
IAD	Not Performed
AD	Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	5/21/20	FINISHED:	5/21/20
DRILL CO.:	DYNAHOE	DRILL RIG:	CAT 316
DRILLER:	DYNAHOE	LOGGED BY:	B. TABOR
METHOD: BACKHOE			

TEST PIT REPORT NO. TP-68

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE organic (corn) rich silty clay, dark brown, moist **1.0'**		0								
	LEAN CLAY trace silt and sand and gravel, trace organics, brown, moist (CL) [Glacial Till]										
	grades to with silt, sand, and gravel, trace cobbles		5								
	10.0'		10								

BASE OF TEST PIT AT 10.0 FEET

WATER LEVEL OBSERVATIONS	
WD	Not Encountered
IAD	Not Performed
AD	Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	5/11/20	FINISHED:	5/11/20
DRILL CO.:	DYNAHOE	DRILL RIG:	CAT 316
DRILLER:	DYNAHOE	LOGGED BY:	B. TABOR
METHOD: BACKHOE			

olsson	TEST PIT REPORT NO. TP-70	Sheet 1 of 1

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE		0								
	organic (corn) rich clay, brown, moist ***1.5'***										
	LEAN CLAY										
	trace sand and gravel, brown, moist (CL) [Glacial Till]										
			5								
	grades to with sand and gravel, trace cobbles										
	boulders noted at 8.5 feet										
	10.0'		10								

BASE OF TEST PIT AT 10.0 FEET

WATER LEVEL OBSERVATIONS	
WD	▽ Not Encountered
IAD	▼ Not Performed
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	5/16/20	FINISHED:	5/16/20
DRILL CO.:	DYNAHOE	DRILL RIG:	CAT 316
DRILLER:	DYNAHOE	LOGGED BY:	B. TABOR
METHOD: BACKHOE			

olsson	TEST PIT REPORT NO. TP-71	Sheet 1 of 1

PROJECT NAME	CLIENT
Madison Fields Solar	Savion, LLC
PROJECT NUMBER	LOCATION
020-0986	Madison County, Ohio

ELEVATION (ft)	MATERIAL DESCRIPTION	GRAPHIC LOG	DEPTH (ft)	SAMPLE TYPE NUMBER	CLASSIFICATION (USCS)	BLOWS/6" N-VALUE	UNC. STR. (tsf)	MOISTURE (%)	DRY DENSITY (pcf)	LL/PI (%)	ADDITIONAL DATA/ REMARKS
	ROOT ZONE *organic (corn) rich clay, brown, moist* ***1.5'***		0								
	LEAN CLAY *trace sand, gravel, and cobbles, light brown, moist (CL) [Glacial Till]*										
	grades to with sand and gravel		5								
	10.0'		10								

boulder noted at 9.7 feet

BASE OF TEST PIT AT 10.0 FEET

WATER LEVEL OBSERVATIONS	
WD	∇ Not Encountered
IAD	▼ Not Performed
AD	▼ Not Performed

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

STARTED:	5/16/20	FINISHED:	5/16/20
DRILL CO.:	DYNAHOE	DRILL RIG:	CAT 316
DRILLER:	DYNAHOE	LOGGED BY:	B. TABOR
METHOD: BACKHOE			

APPENDIX E

SUMMARY OF LABORATORY TEST RESULTS

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

SUMMARY OF LABORATORY RESULTS

PROJECT NAME: Madison Fields Solar
CLIENT: Savion, LLC
PROJECT NUMBER: 020-0986
PROJECT LOCATION: Madison County, Ohio

BORING NUMBER	SAMPLE I.D.	SAMPLE DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	VOID RATIO	SATURATION (%)	UNCONFINED STRENGTH (tsf)	STRAIN (%)	ATTERBERG LIMITS			P-200	USCS CLASS.
									LIQUID LIMIT	PLASTIC LIMIT	PLASTIC INDEX		
GEO-01	SS-1	1.0 - 2.5'	24.0									82.2	
GEO-01	SS-2	3.5 - 5.0'	26.4										
GEO-01	U-3	6.0 - 8.0'	17.2	113.6	0.483	96.0			30	18	12		
GEO-02	SS-2	3.5 - 5.0'	21.5										
GEO-03	SS-6	18.5 - 20.0'	13.6										
GEO-04	SS-1	1.0 - 2.5'	14.9										
GEO-05	SS-2	3.5 - 5.0'	33.7						30	17	13	67.4	CL
GEO-05	U-3	6.0 - 8.0'	13.9										
GEO-05	SS-6	18.5 - 20.0'	8.2										
GEO-06	U-2	3.5 - 5.5'	18.4	114.2	0.476	100.0	0.4	3.7					
GEO-06	SS-4	8.5 - 10.0'	15.2										
GEO-07	U-2	3.5 - 5.5'	19.8	105.9	0.591	90.6							
GEO-07	SS-5	13.5 - 15.0'	17.1										
GEO-08	U-2	3.5 - 5.0'	14.9	125.3	0.345	100.0							
GEO-08	SS-3	6.0 - 7.5'	11.3						20	14	6		
GEO-08	SS-4	8.5 - 10.0'	11.6									46.7	
GEO-08	SS-6	18.5 - 20.0'	11.2										
GEO-09	U-3	6.0 - 7.5'	13.8	131.2	0.285	100.0	1.4	9.7					
GEO-09	SS-5	13.5 - 15.0'	11.7										
GEO-10	U-2	3.5 - 5.0'	13.7	112.8	0.494	74.7							
GEO-10	SS-5	13.5 - 15.0'	14.2										
GEO-11	U-2	3.5 - 5.0'	14.8	126.3	0.334	100.0							
GEO-11	SS-5	13.5 - 15.0'	11.9										
GEO-12	SS-3	6.0 - 7.5'	12.6						19	14	5		
GEO-12	U-4	8.5 - 10.0'	12.5	138.9	0.213	100.0							
GEO-12	SS-6	18.5 - 20.0'	14.2										
GEO-13	SS-3	6.0 - 7.5'	11.8										
GEO-13	U-6	15.0 - 17.0'	9.9	142.8	0.181	100.0	2.1	12.9					
GEO-14	SS-1	1.0 - 2.5'	27.2										
GEO-14	U-5	10.0 - 12.0'					3.0	15.0					

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

SUMMARY OF LABORATORY RESULTS

PROJECT NAME: Madison Fields Solar

CLIENT: Savion, LLC

PROJECT NUMBER: 020-0986

PROJECT LOCATION: Madison County, Ohio

BORING NUMBER	SAMPLE I.D.	SAMPLE DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	VOID RATIO	SATURATION (%)	UNCONFINED STRENGTH (tsf)	STRAIN (%)	ATTERBERG LIMITS			P-200	USCS CLASS.
									LIQUID LIMIT	PLASTIC LIMIT	PLASTIC INDEX		
GEO-15	SS-2	3.5 - 5.0'	27.3										
GEO-15	U-3	6.0 - 8.0'	25.3	110.0	0.533	100.0							
GEO-16	SS-2	3.5 - 5.0'	13.4										
GEO-16	U-5	10.5 - 12.5'	12.4	129.0	0.307	100.0							
GEO-17	SS-1	1.0 - 2.5'	27.4										
GEO-17	U-5	10.0 - 12.0'	13.1	127.5	0.322	100.0							
GEO-18	SS-2	3.5 - 5.0'	19.1										
GEO-18	U-6	15.0 - 17.0'	12.7	136.8	0.232	100.0							
GEO-19	SS-2	3.5 - 5.0'	31.2										
GEO-19	SS-4	8.5 - 10.0'	12.5										
GEO-19	SS-7	18.5 - 20.0'	14.2										
GEO-20	SS-2	3.5 - 5.0'	25.6										
GEO-20	U-6	16.0 - 18.0'	13.6										
GEO-21	SS-2	3.5 - 5.0'	17.6									89.8	
GEO-21	SS-3	6.0 - 7.5'	15.9						22	15	7		
GEO-21	SS-7	18.5 - 20.0'	14.4										
GEO-22	SS-2	3.5 - 5.0'	12.0										
GEO-23	SS-1	1.0 - 2.5'	29.4										
GEO-23	U-3	6.0 - 7.5'	14.5	122.2	0.379	100.0	1.6	12.4					
GEO-24	U-3	6.0 - 7.5'	14.3	102.7	0.642	60.2							
GEO-24	SS-5	13.5 - 15.0'	10.1										
GEO-25	U-2	3.5 - 5.5'	13.4	122.9	0.371	97.4	0.8	2.6					
GEO-25	SS-5	13.5 - 15.0'	10.1										
GEO-26	SS-1	1.0 - 2.5'	14.6										
GEO-26	U-5	10.5 - 12.5'	8.2										
GEO-27	SS-3	6.0 - 7.5'	12.2										
GEO-27	U-6	15.5 - 17.5'	12.3	127.4	0.323	100.0	4.1	9.1					
GEO-28	U-2	3.5 - 5.5'	11.9										
GEO-28	SS-5	13.5 - 15.0'	8.2										
GEO-28	SS-6	18.5 - 20.0'	10.9										

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

SUMMARY OF LABORATORY RESULTS

PROJECT NAME: Madison Fields Solar

CLIENT: Savion, LLC

PROJECT NUMBER: 020-0986

PROJECT LOCATION: Madison County, Ohio

BORING NUMBER	SAMPLE I.D.	SAMPLE DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	VOID RATIO	SATURATION (%)	UNCONFINED STRENGTH (tsf)	STRAIN (%)	ATTERBERG LIMITS			P-200	USCS CLASS.
									LIQUID LIMIT	PLASTIC LIMIT	PLASTIC INDEX		
GEO-29	SS-1	1.0 - 2.5'	28.4										
GEO-29	U-5	10.5 - 12.5'	11.0	138.1	0.221	100.0							
GEO-30	SS-1	1.0 - 2.5'	19.1										
GEO-30	U-2	3.5 - 5.0'	20.5	114.1	0.477	100.0	0.3	13.8					
GEO-30	SS-4	8.5 - 10.0'	19.1									62.3	
GEO-31	U-2	3.5 - 5.5'	14.3	119.8	0.407	95.1	1.5	9.3					
GEO-31	SS-5	13.5 - 15.0'	11.5										
GEO-32	U-2	3.5 - 5.5'	20.3	131.3	0.284	100.0	0.5	9.1					
GEO-32	SS-5	13.5 - 14.5'	7.5										
GEO-33	SS-2	3.5 - 5.0'	16.8						28	17	11		
GEO-33	SS-5	13.5 - 15.0'	11.0										
GEO-34	U-3	6.0 - 7.5'	16.4										
GEO-34	SS-5	13.5 - 15.0'	26.2										
GEO-35	SS-1	1.0 - 2.5'	29.8						36	17	19		
GEO-35	SS-6	13.5 - 15.0'	11.6										
GEO-36	SS-2	3.5 - 5.0'	13.2										
GEO-36	U-5	10.5 - 12.5'	11.7	123.6	0.364	86.6							
GEO-37	SS-1	1.0 - 2.5'	27.2						47	17	30		
GEO-37	SS-3	6.0 - 7.5'	17.4										
GEO-37	U-5	10.5 - 12.5'	14.7										
GEO-38	U-2	3.5 - 5.0'	14.7	118.0	0.428	92.5							
GEO-38	SS-5	13.5 - 15.0'	12.3										
GEO-39	SS-5	13.5 - 15.0'	11.3										
GEO-40	U-2	3.5 - 5.0'	18.7	111.6	0.511	99.1	0.2	5.3					
GEO-40	SS-6	18.5 - 20.0'	10.2										
GEO-41	SS-1	1.0 - 2.5'	17.1										
GEO-41	SS-4	8.5 - 10.0'	10.4										
GEO-42	U-2	3.5 - 5.0'	32.3	100.4	0.679	100.0	0.4 (UU)	15.6					
GEO-42	SS-4	8.5 - 10.0'	19.2										
GEO-43	SS-3	6.0 - 7.5'	13.2										

OLSSON, INC.
3990 FOX STREET
DENVER, COLORADO 80216

SUMMARY OF LABORATORY RESULTS

PROJECT NAME: Madison Fields Solar

CLIENT: Savion, LLC

PROJECT NUMBER: 020-0986

PROJECT LOCATION: Madison County, Ohio

BORING NUMBER	SAMPLE I.D.	SAMPLE DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	VOID RATIO	SATURATION (%)	UNCONFINED STRENGTH (tsf)	STRAIN (%)	ATTERBERG LIMITS			P-200	USCS CLASS.
									LIQUID LIMIT	PLASTIC LIMIT	PLASTIC INDEX		
GEO-43	U-6	15.5 - 17.5'	11.6										
GEO-44	U-3	6.0 - 7.5'	16.8	113.0	0.492	92.3							
GEO-44	SS-6	18.5 - 20.0'	12.8										
GEO-45	SS-2	3.5 - 5.0'	27.2						39	18	21	83.1	CL
GEO-45	U-3	6.0 - 7.5'	16.4	126.9	0.328	100.0	1.3	11.1					
GEO-45	SS-5	13.5 - 15.0'	10.9										
GEO-46	U-3	6.0 - 7.5'	13.6										
GEO-46	SS-6	18.5 - 20.0'	12.7										
GEO-47	U-2	3.5 - 5.0'	30.6										
GEO-47	SS-7	18.5 - 20.0'	13.5										
GEO-48	U-3	6.0 - 7.5'	12.9	126.5	0.332	100.0							
GEO-48	SS-5	13.5 - 15.0'	11.8										
GEO-49	U-2	3.5 - 5.0'	17.4										
GEO-49	U-5	10.5 - 12.5'	13.8										
GEO-50	U-2	3.5 - 5.0'	20.9	108.3	0.556	100.0							
GEO-50	SS-5	13.5 - 15.0'	11.3										
GEO-51	U-3	6.0 - 7.5'	12.3	136.0	0.239	100.0	2.1	14.8					
GEO-51	SS-4	8.5 - 10.0'	11.1										
GEO-52	SS-2	3.5 - 5.0'	18.3										
GEO-52	U-5	10.5 - 12.5'	11.5	131.3	0.284	100.0							
GEO-53	U-2	3.5 - 5.0'	23.7	107.6	0.567	100.0	0.8	6.1					
GEO-53	SS-6	18.5 - 20.0'	15.0										
GEO-54	U-1	1.0 - 2.5'	25.8										
GEO-54	U-2	3.5 - 5.0'	14.8	121.5	0.388	100.0	1.2	8.9					
GEO-55	U-3	6.0 - 7.5'	13.4	123.8	0.362	99.9							
GEO-55	SS-6	18.5 - 20.0'	11.5										
GEO-56	U-2	3.5 - 5.5'	13.2	126.3	0.334	100.0							
GEO-56	SS-5	13.5 - 15.0'	13.0										
GEO-57	U-2	3.5 - 5.0'	15.9										
GEO-57	U-4	8.5 - 10.0'					1.7	14.9					

OLSSON, INC.
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DENVER, COLORADO 80216

SUMMARY OF LABORATORY RESULTS

PROJECT NAME: Madison Fields Solar

CLIENT: Savion, LLC

PROJECT NUMBER: 020-0986

PROJECT LOCATION: Madison County, Ohio

BORING NUMBER	SAMPLE I.D.	SAMPLE DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	VOID RATIO	SATURATION (%)	UNCONFINED STRENGTH (tsf)	STRAIN (%)	ATTERBERG LIMITS			P-200	USCS CLASS.
									LIQUID LIMIT	PLASTIC LIMIT	PLASTIC INDEX		
GEO-58	U-2	3.5 - 5.0'	14.8	118.0	0.429	93.4	0.6	13.6					
GEO-58	SS-4	8.5 - 10.0'	11.1						17	13	4		
GEO-58	SS-6	18.5 - 20.0'	13.1										
GEO-59	SS-3	6.0 - 7.5'	19.2									50.9	
GEO-59	SS-6	18.5 - 20.0'	13.5										
GEO-60	SS-2	3.5 - 5.0'	14.6										
GEO-60	SS-5	13.5 - 15.0'	14.6										
GEO-61	SS-2	3.5 - 5.0'	22.9						45	17	28		
GEO-61	U-3	6.0 - 7.5'	15.4	111.5	0.512	81.1						63.8	
GEO-62	U-1	1.0 - 2.5'	20.4										
GEO-62	SS-6	18.5 - 20.0'	3.0										
GEO-63	U-2	3.5 - 5.0'	20.0				0.9	6.3					
GEO-63	SS-5	13.5 - 15.0'	13.4										
GEO-64	U-2	3.5 - 5.0'	14.4	122.5	0.376	100.0	2.0	6.1					
GEO-64	SS-3	6.0 - 7.5'	14.5						25	16	9		
GEO-65	SS-3	6.0 - 7.5'	14.0										
GEO-65	SS-6	18.5 - 19.8'	6.0										
GEO-66	U-2	3.5 - 5.0'	19.9	115.1	0.464	100.0	1.3	3.8					
GEO-66	SS-5	13.5 - 15.0'	9.8										
GEO-67	U-2	3.5 - 5.0'	13.8	119.2	0.414	90.1	0.5	7.6					
GEO-67	SS-5	13.5 - 15.0'	9.1									5.5	
GEO-68	SS-2	3.5 - 5.0'	22.9										
GEO-68	U-5	10.5 - 12.5'	10.4										
GEO-69	U-1	1.0 - 2.5'	27.3	91.8	0.835	88.1	0.4	2.3					
GEO-70	U-1	1.0 - 2.5'	25.4	94.0	0.792	86.7							
GEO-70	SS-5	13.5 - 15.0'	8.6										
GEO-71	U-2	3.5 - 5.0'	17.5	107.6	0.567	83.2	0.3	3.8					
GEO-71	SS-4	8.5 - 10.0'	13.4										
GEO-71	SS-6	18.5 - 20.0'	13.7										
GEO-72	SS-1	1.0 - 2.5'	14.6										

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SUMMARY OF LABORATORY RESULTS

PROJECT NAME: Madison Fields Solar
CLIENT: Savion, LLC
PROJECT NUMBER: 020-0986
PROJECT LOCATION: Madison County, Ohio

BORING NUMBER	SAMPLE I.D.	SAMPLE DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	VOID RATIO	SATURATION (%)	UNCONFINED STRENGTH (tsf)	STRAIN (%)	ATTERBERG LIMITS			P-200	USCS CLASS.
									LIQUID LIMIT	PLASTIC LIMIT	PLASTIC INDEX		
GEO-72	SS-4	8.5 - 10.0'	9.6									16.3	
GEO-73	U-2	3.5 - 5.5'	21.3	111.4	0.512	100.0							
GEO-73	SS-4	8.5 - 10.0'	15.0										
GEO-73	SS-6	18.5 - 20.0'	14.3										
GEO-73	SS-9	33.5 - 35.0'	17.4										
GEO-73	SS-11	43.5 - 43.8'	10.2									23.9	
GEO-74	U-2	3.5 - 5.0'	14.8	118.3	0.425	93.9	0.8	3.0	34	18	16		
GEO-74	SS-4	8.5 - 10.0'	12.8										
GEO-74	SS-6	18.5 - 20.0'	22.8									59.5	
GEO-74	SS-7	23.5 - 25.0'	22.0										
GEO-74	SS-9	33.5 - 35.0'	10.1										
GEO-75	U-2	3.5 - 5.0'	12.8	124.2	0.357	96.4	2.1	7.2					
GEO-76	U-2	3.5 - 5.0'	26.1	102.8	0.640	100.0	0.7	14.9					
GEO-76	SS-4	8.5 - 10.0'	11.8										
GEO-77	U-3	6.0 - 7.5'	11.6	121.3	0.390	80.4			21	15	6		
GEO-78	SS-1	1.0 - 2.5'	22.2										
GEO-78	U-4	8.5 - 10.0'	11.1	129.1	0.306	97.7							
GEO-79	U-2	3.5 - 5.0'	17.1	112.3	0.501	92.3							
GEO-79	SS-5	13.5 - 15.0'	10.4										
GEO-80	U-4	8.5 - 10.0'	13.3	123.1	0.369	97.4			23	15	8		
GEO-81	SS-3	6.0 - 7.5'	7.5									25.6	
GEO-81	SS-6	18.5 - 20.0'	16.0										

OLSSON, INC.
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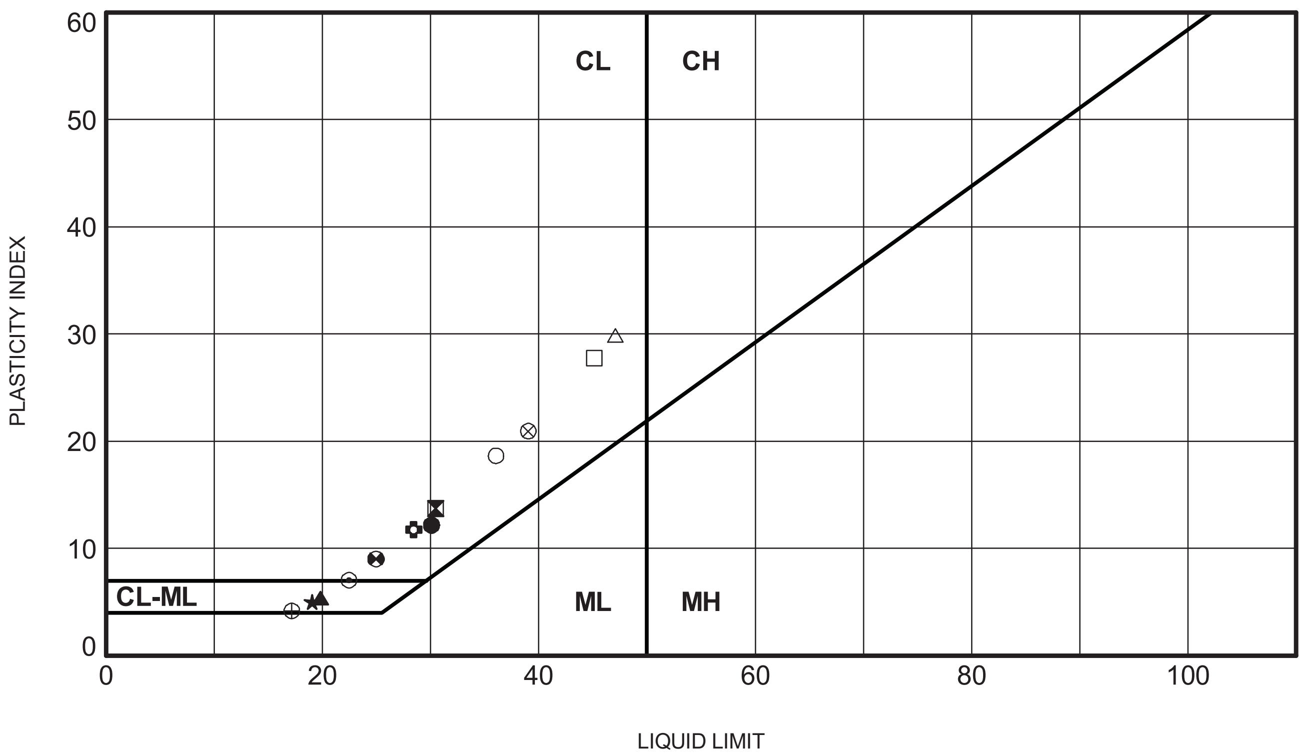
ATTERBERG LIMITS RESULTS

PROJECT NAME: Madison Fields Solar **CLIENT:** Savion, LLC
PROJECT NUMBER: 020-0986 **PROJECT LOCATION:** Madison County, Ohio



	Boring No.	Sample ID	Depth (ft)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Fines (%)	Classification (USCS)
●	GEO-01	U-3	6.0 - 8	30	18	12		
⧗	GEO-05	SS-2	3.5 - 5	30	17	13	67.4	CL
▲	GEO-08	SS-3	6.0 - 7.5	20	14	6		
★	GEO-12	SS-3	6.0 - 7.5	19	14	5		
⊙	GEO-21	SS-3	6.0 - 7.5	22	15	7		
✿	GEO-33	SS-2	3.5 - 5	28	17	11		
○	GEO-35	SS-1	1.0 - 2.5	36	17	19		
△	GEO-37	SS-1	1.0 - 2.5	47	17	30		
⊗	GEO-45	SS-2	3.5 - 5	39	18	21	83.1	CL
⊕	GEO-58	SS-4	8.5 - 10	17	13	4		
□	GEO-61	SS-2	3.5 - 5	45	17	28		
⊗	GEO-64	SS-3	6.0 - 7.5	25	16	9		

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olsson

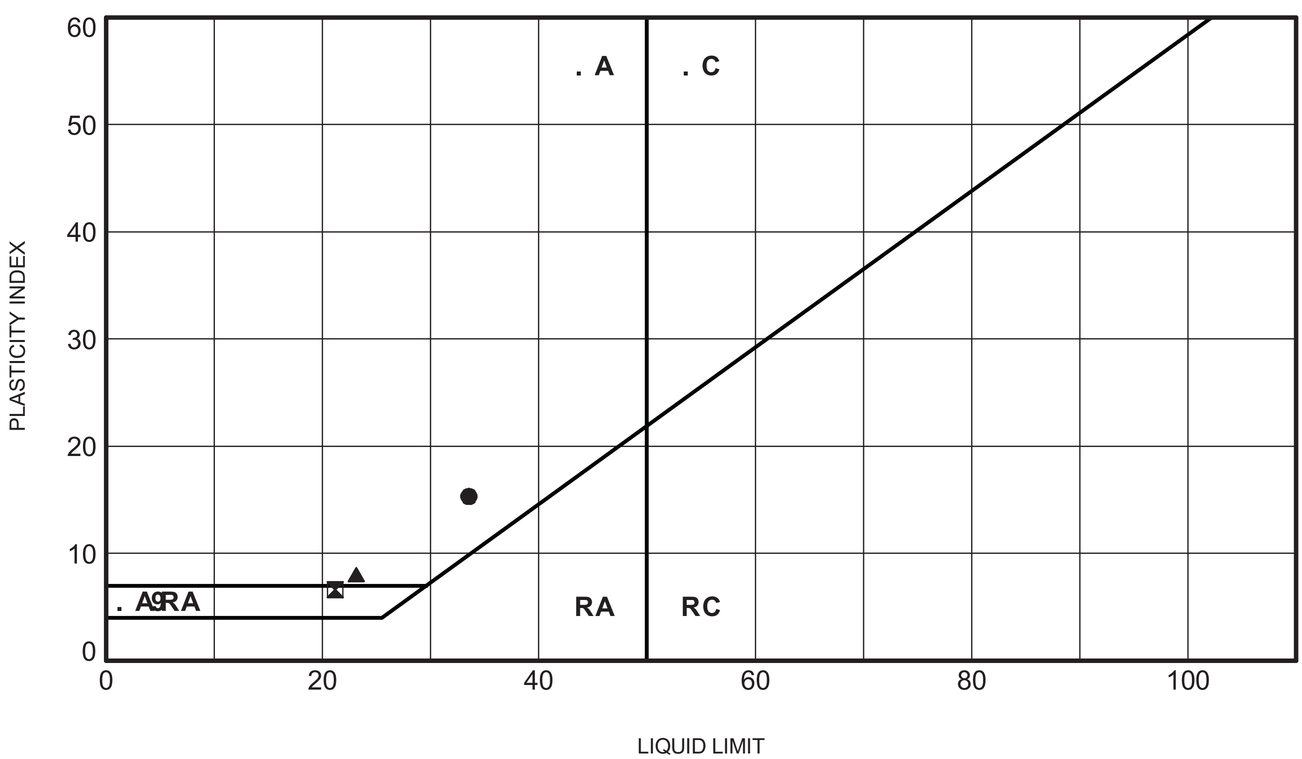
GEE5O- 5O6 ATRTEB O5BLAEB

HO7 P5. E J GR5N Madison Fields Solar

. AT5J EN Savion, LLC

HO7 P5. E J LR- 5ON 020-0986

HO7 P5. E A7 . GET7 J N Madison County, Ohio



	Boring No.	Sample ID	Depth (ft)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Fines (%)	Classification (USCS)
●	6 57 904	L9U	I M69S	I 4	13	12		
⊠	6 57 900	L9I	2M 90M6	U1	1S	2		
▲	6 57 938	L94	3M6 918	UI	1S	3		

OLSSON, INC.
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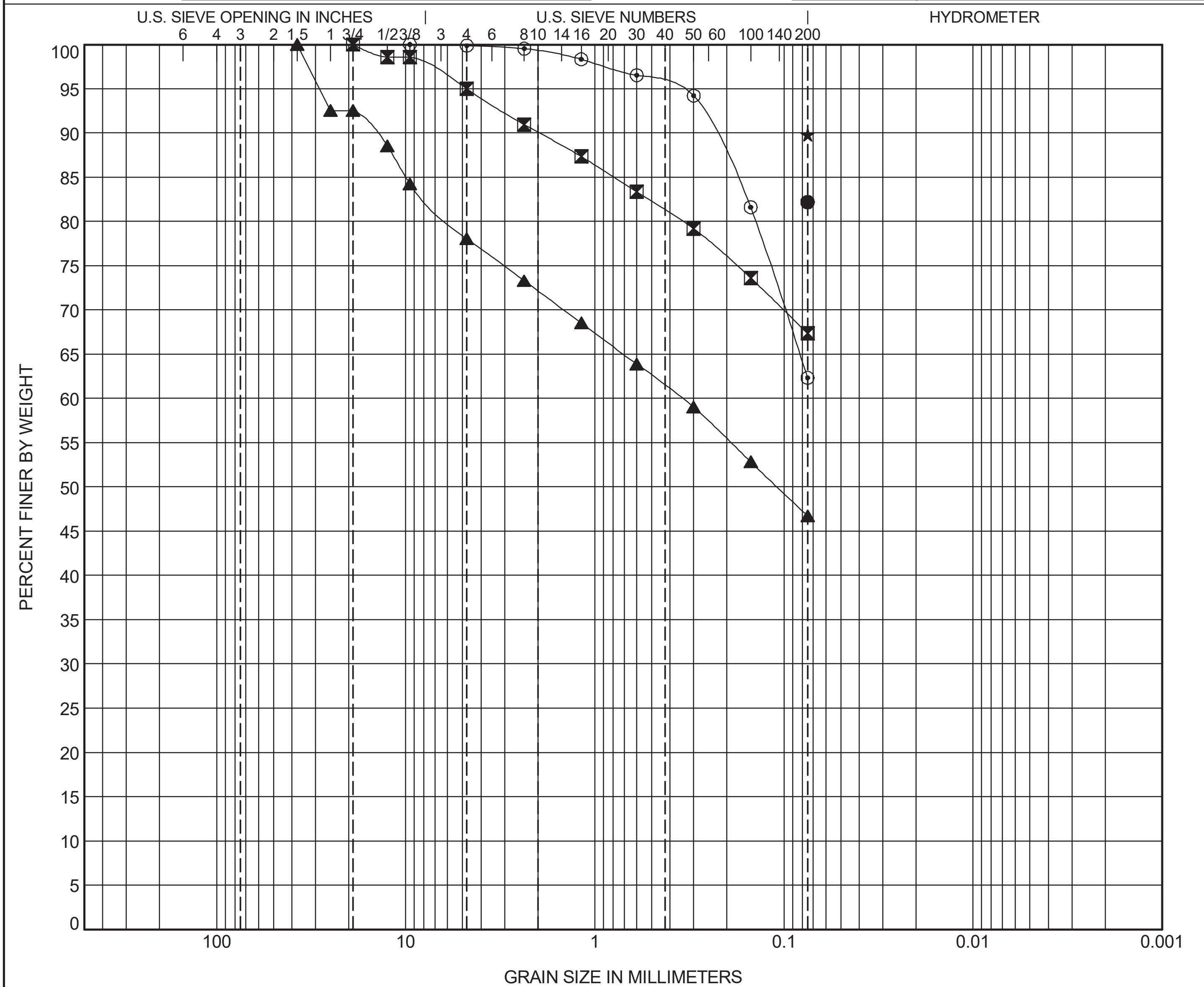
GRAIN SIZE DISTRIBUTION

PROJECT NAME: Madison Fields Solar
CLIENT: Savion, LLC
PROJECT NUMBER: 020-0986
PROJECT LOCATION: Madison County, Ohio



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring No.	Sample ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
● GEO-01	SS-1	1.0 - 2.5	Lean clay with sand (CL)					
⧗ GEO-05	SS-2	3.5 - 5.0	Sandy Lean clay (CL)	30	17	13		
▲ GEO-08	SS-4	8.5 - 10.0	Silty, clayey sand (SC/SM)					
★ GEO-21	SS-2	3.5 - 5.0	Silty clay (CL/ML)					
⊙ GEO-30	SS-4	8.5 - 10.0	Sandy silty clay (CL/ML)					

Boring No.	Sample ID	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● GEO-01	SS-1							82.2	
⧗ GEO-05	SS-2	19				5.0	27.7	67.4	
▲ GEO-08	SS-4	37.5	0.345			21.9	31.3	46.7	
★ GEO-21	SS-2							89.8	
⊙ GEO-30	SS-4	9.5				0.1	37.5	62.3	

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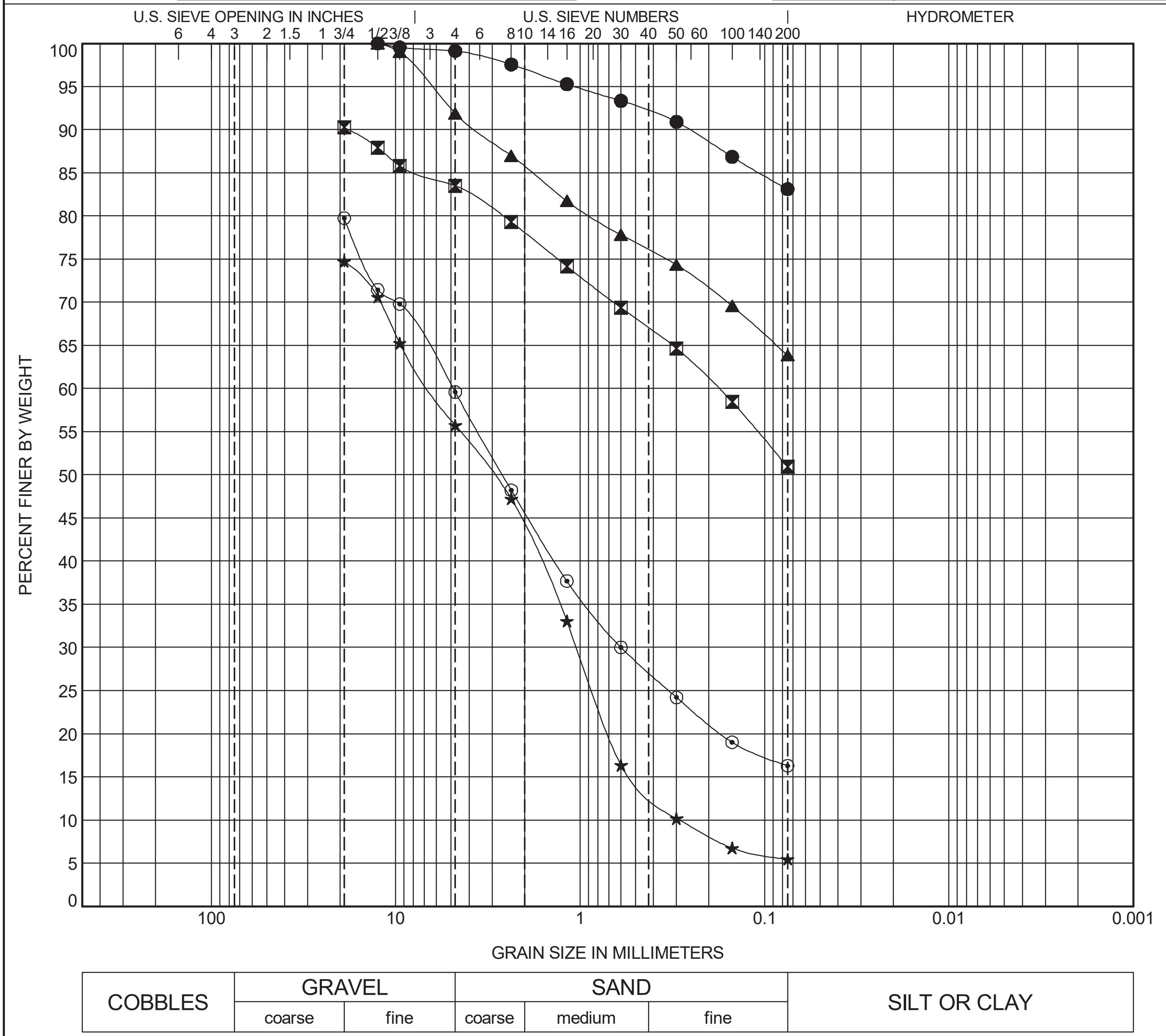
GRAIN SIZE DISTRIBUTION

PROJECT NAME: Madison Fields Solar **CLIENT:** Savion, LLC

PROJECT NUMBER: 020-0986 **PROJECT LOCATION:** Madison County, Ohio



Boring No.	Sample ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
● GEO-45	SS-2	3.5 - 5.0	Lean clay with sand (CL)	39	18	21		
⊠ GEO-59	SS-3	6.0 - 7.5	Sandy silty clay with gravel (CL/ML)					
▲ GEO-61	U-3	6.0 - 7.5	Sandy Lean clay (CL)					
★ GEO-67	SS-5	13.5 - 15.0	Poorly graded sand with silt and gravel (SP/SM)				0.58	22.33
⊙ GEO-72	SS-4	8.5 - 10.0	SIlty sand with gravel (SM)					

Boring No.	Sample ID	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● GEO-45	SS-2	12.5				0.9	16.0	83.1	
⊠ GEO-59	SS-3	19	0.178			6.8	32.6	50.9	
▲ GEO-61	U-3	12.5				8.1	28.0	63.8	
★ GEO-67	SS-5	19	6.477	1.043	0.29	19.0	50.3	5.5	
⊙ GEO-72	SS-4	19	4.884	0.6		20.2	43.3	16.3	

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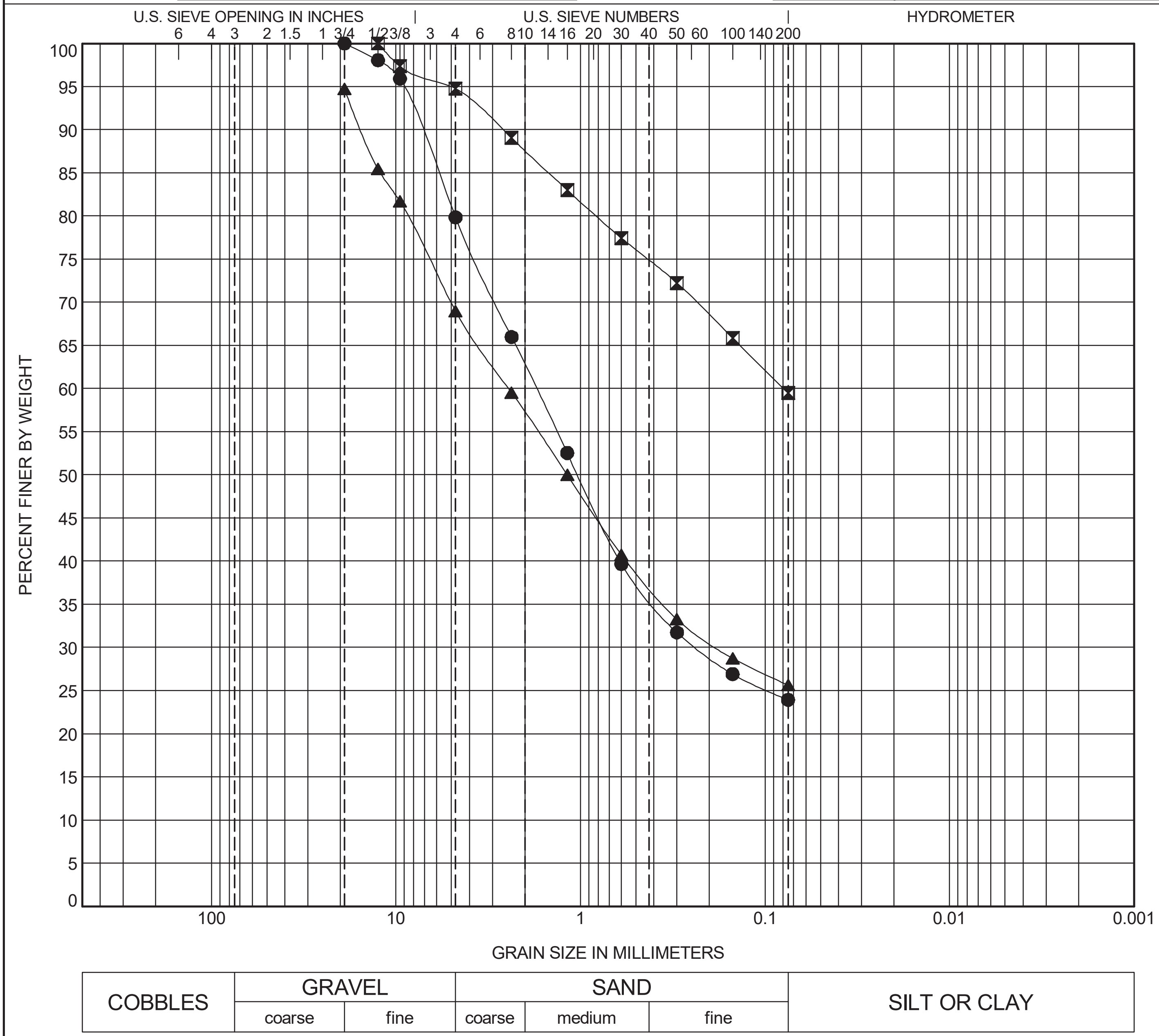
GRAIN SIZE DISTRIBUTION

PROJECT NAME: Madison Fields Solar **CLIENT:** Savion, LLC

PROJECT NUMBER: 020-0986 **PROJECT LOCATION:** Madison County, Ohio



Boring No.	Sample ID	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
● GEO-73	SS-11	43.5 - 43.8	SIlty, clayey sand with gravel (SC/SM)					
⊠ GEO-74	SS-6	18.5 - 20.0	Sandy Lean clay (CL)					
▲ GEO-81	SS-3	6.0 - 7.5	SIlty sand with gravel (SM)					

Boring No.	Sample ID	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● GEO-73	SS-11	19	1.734	0.234		20.2	55.9	23.9	
⊠ GEO-74	SS-6	12.5	0.079			5.2	35.3	59.5	
▲ GEO-81	SS-3	19	2.446	0.182		25.7	43.3	25.6	

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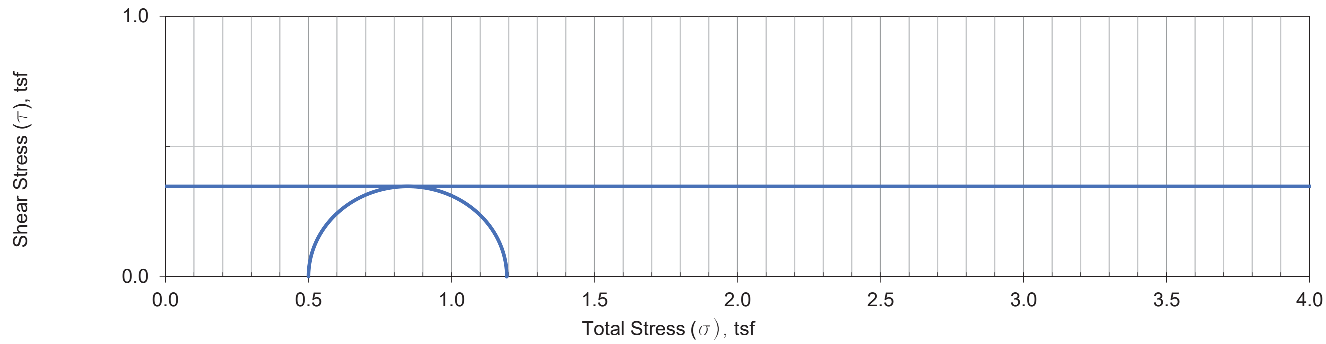
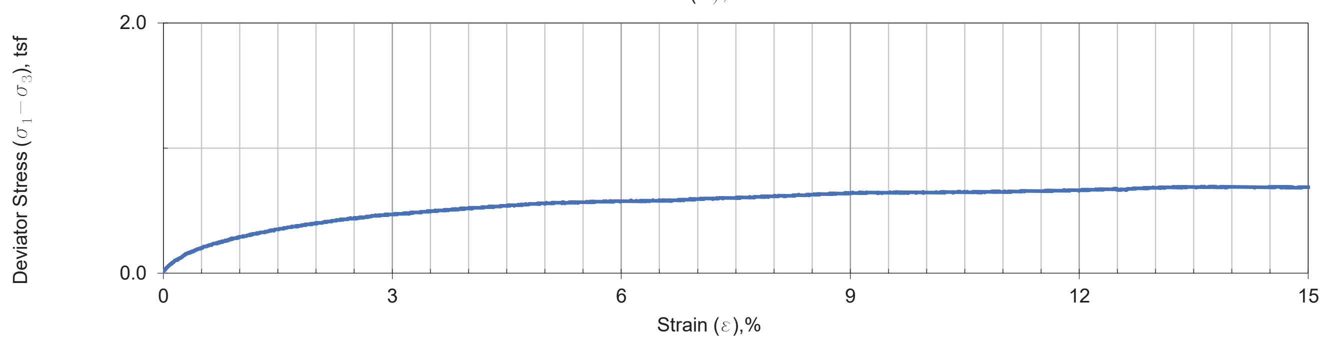
Unconsolidated Undrained Triaxial Test (ASTM D2850)





Project Information

Project Name:	Savion Madison Fields Solar Project
Project Number:	020-0986
Client Name:	Savion LLC.
Project Location:	London, Ohio

Test Information

Boring		B-42		
Sample		U-2		
Initial	**Diameter (in)**	2.832		
	Height, (in)	4.817		
	Water Content, (%)	27.3		
	Dry Density, (pcf)	97.4		
	Saturation, (%)	100.0		
	Void Ratio	0.729		
Rate of Axial Strain, (%/min)		1.0		
@ Failure	**Axial Strain, (%)**	15.6		
	Shear Stress, (tsf)	0.35		
	Minor Principal Stress, (σ_3)	0.50		
	Major Principal Stress, (σ_1)	1.19		
Liquid Limit		N/A		
Plastic Limit		N/A		
Plasticity Index		N/A		
Remarks				

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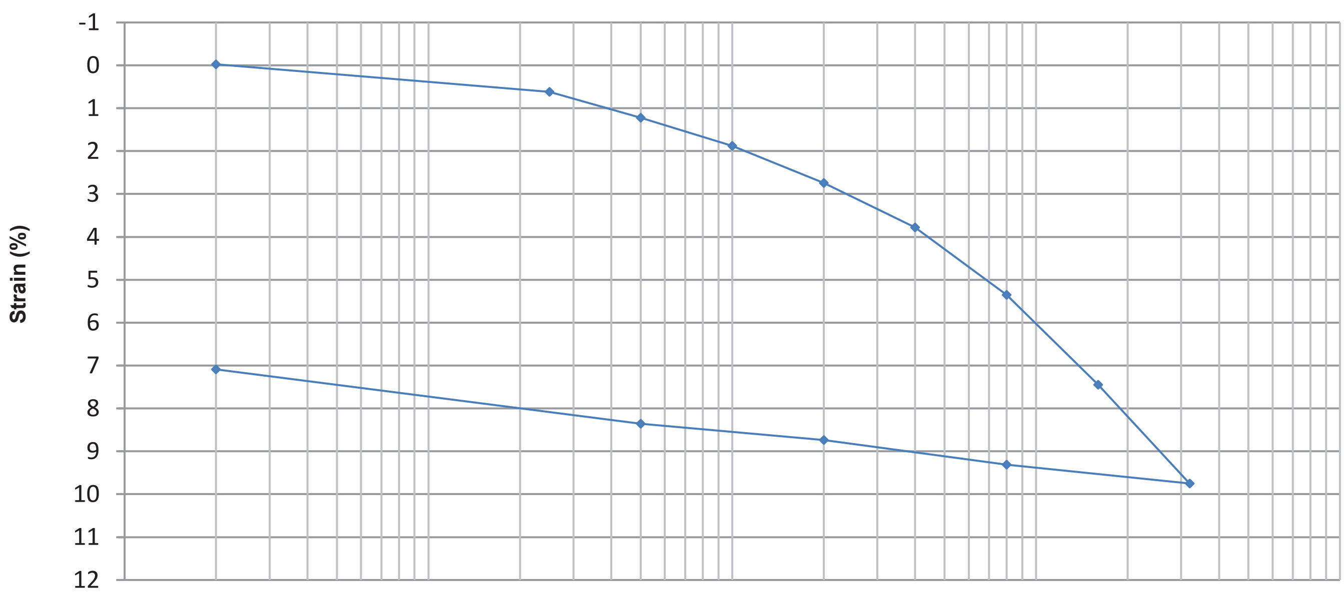
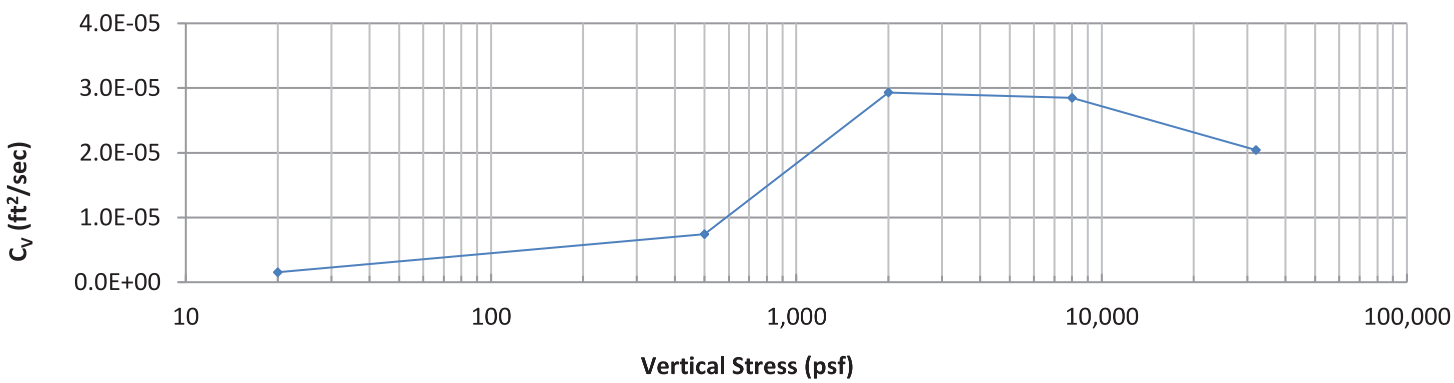
Consolidation Test Data Summary Report

Project Information	
Project Name:	Savion Madison Fields Solar Project
Project Number:	020-0986
Client Name:	Savion LLC
Project Location:	London, Ohio

Sample Information			
Boring No.:	Geo-73	**Depth:.**	N/A
Sample No.:	U-2	**Elevation.:**	N/A
Test No.:	1	**Tested By:**	JC
Date Tested:	26-May-20	**Apparatus:**	LoadTrac II
Sample Description:	Yellowish brown to brown clayey sand, wet, trace fine grained gravel, silt		

Soil Condition			Test Procedure	
	Inintial	Final	**Preparation:**	Cutting Shoe
Moisture Content (%):	18.1	14.0	**Condition:**	Inundated
Dry Density (pcf):	111.1	120.6	**Inundation Stress (psf):**	500
Void Ratio:	0.516	0.397	**Method:**	B
Saturation (%):	94.7	95.1	**Interpretation Procedure:**	1
Height (in.)	1.00	0.93	**Est. Preconsolidation Stress:**	2,100 psf





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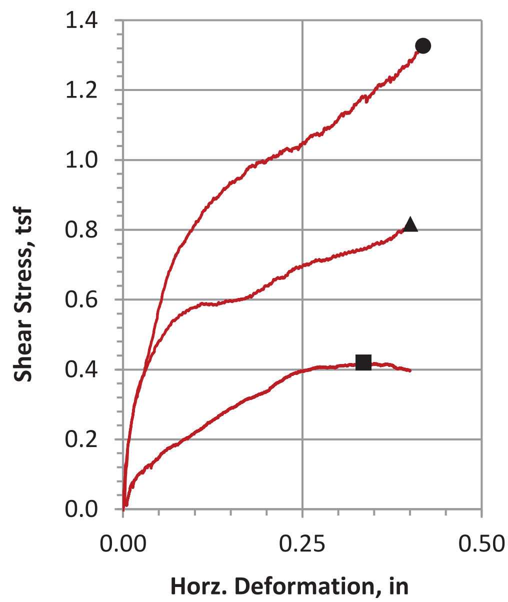
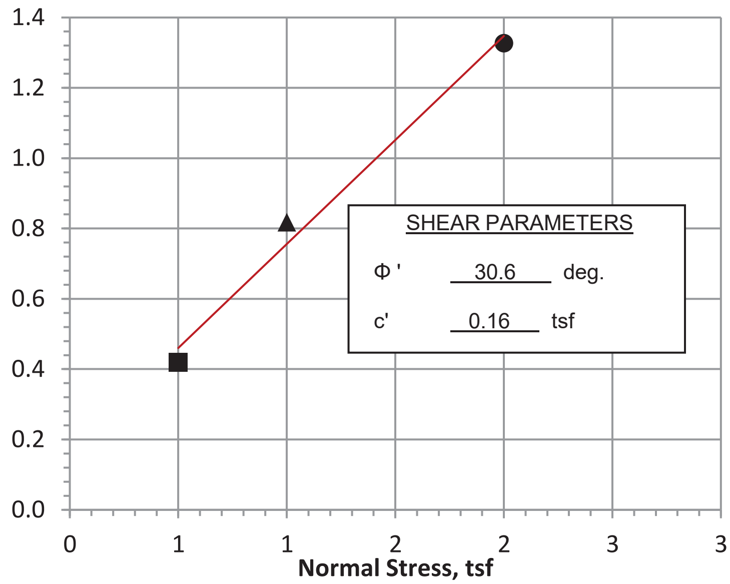
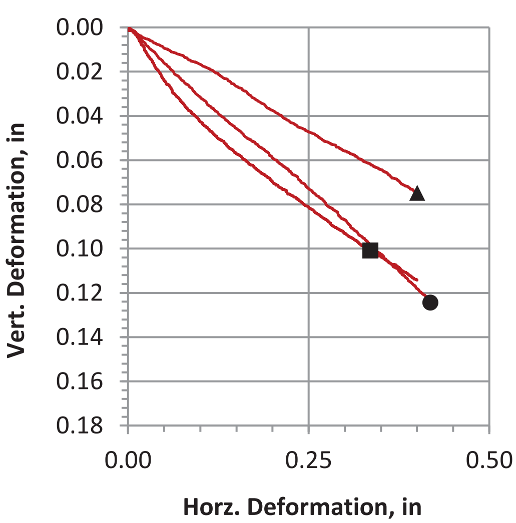
Direct Shear
ASTM D 3080







		■	▲	●
Symbol		■	▲	●
Test No.		1	2	3
Sample No.		SS-4	SS-4	SS-4
Depth, ft		8.5' -10.0'	8.5' -10.0'	8.5' -10.0'
Shape		Circular	Circular	Circular
Initial	Diameter, in	2.5	2.5	2.5
	Area, in^2	4.91	4.91	4.91
	Height, in	1.020	1.000	1.000
	Water Content, %	11.7	13.1	12.9
	Dry Density, pcf	110.7	110.7	110.8
	Saturation, %	60.7	67.5	67.0
	Void Ratio	0.522	0.522	0.521
Consol. Height, in		0.998	0.962	0.957
Consol. Void Ratio		0.410	0.403	0.412
Final	Water Content, %	18.9	14.8	16.1
	Dry Density, pcf	119.5	132.3	138.5
	Saturation, %	100.0	100.0	100.0
	Void Ratio	0.410	0.274	0.217
Normal Strees, tsf		0.5	1.0	2.0
Max. Shear Stress, tsf		0.4	0.8	1.3
Time to Failure, min		356	28	29
Disp. Rate, in/min		0.002	0.002	0.002
Estimated Specific Gravity		2.7	2.7	2.7
Liquid Limit		N/A	N/A	N/A
Plastic Limit		N/A	N/A	N/A
Plasticity Index		N/A	N/A	N/A

Project Name:	Madison Fields Solar
Location:	London, Ohio
Project No:	020-0986
Boring No:	Geo-23
Sample Type:	SS-4

Description: Silty clay, with sand and gravel, firm to stiff, mottled reddish brown and gray, moist

Remarks: N/A

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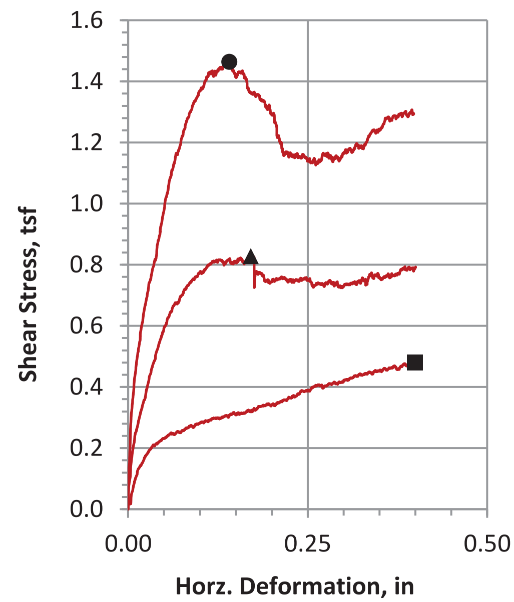
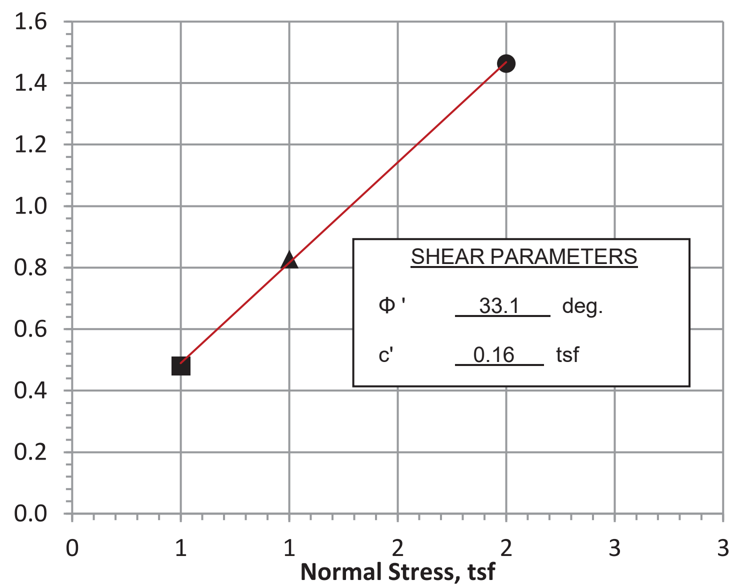
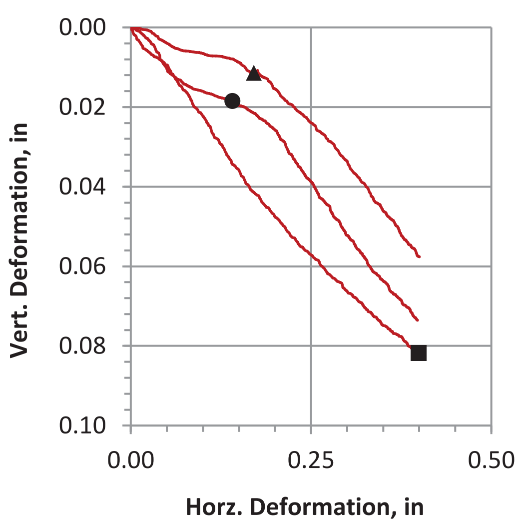
Direct Shear

ASTM D 3080







		1	2	3
Symbol		■	▲	●
Test No.		1	2	3
Sample No.		SS-4	SS-4	SS-4
Depth, ft		8.5' -10.0'	8.5' -10.0'	8.5' -10.0'
Shape		Circular	Circular	Circular
Initial	Diameter, in	2.5	2.5	2.5
	Area, in^2	4.91	4.91	4.91
	Height, in	1.012	0.919	0.960
	Water Content, %	10.6	10.8	10.7
	Dry Density, pcf	102.2	111.1	106.4
	Saturation, %	44.0	56.2	49.5
	Void Ratio	0.648	0.517	0.583
Consol. Height, in		0.985	0.865	0.889
Consol. Void Ratio		0.542	0.373	0.401
Final	Water Content, %	16.9	14.4	16.5
	Dry Density, pcf	106.4	131.8	111.3
	Saturation, %	78.1	100.0	87.0
	Void Ratio	0.583	0.278	0.513
Normal Strees, tsf		0.5	1.0	2.0
Max. Shear Stress, tsf		0.48	0.83	1.46
Time to Failure, min		29	13	11
Disp. Rate, in/min		0.002	0.002	0.002
Estimated Specific Gravity		2.7	2.7	2.7
Liquid Limit		N/A	N/A	N/A
Plastic Limit		N/A	N/A	N/A
Plasticity Index		N/A	N/A	N/A

Project Name:	Madison Fields Solar
Location:	London, Ohio
Project No:	020-0986
Boring No:	Geo-67
Sample Type:	SS-4

Description: Silty sand, with gravel, medium dense, dark gray brown, moist

Remarks: N/A

Moisture Density Curve ASTM: D698, Method B

Project: **Madison Fields Solar** Date: **5/1/20**

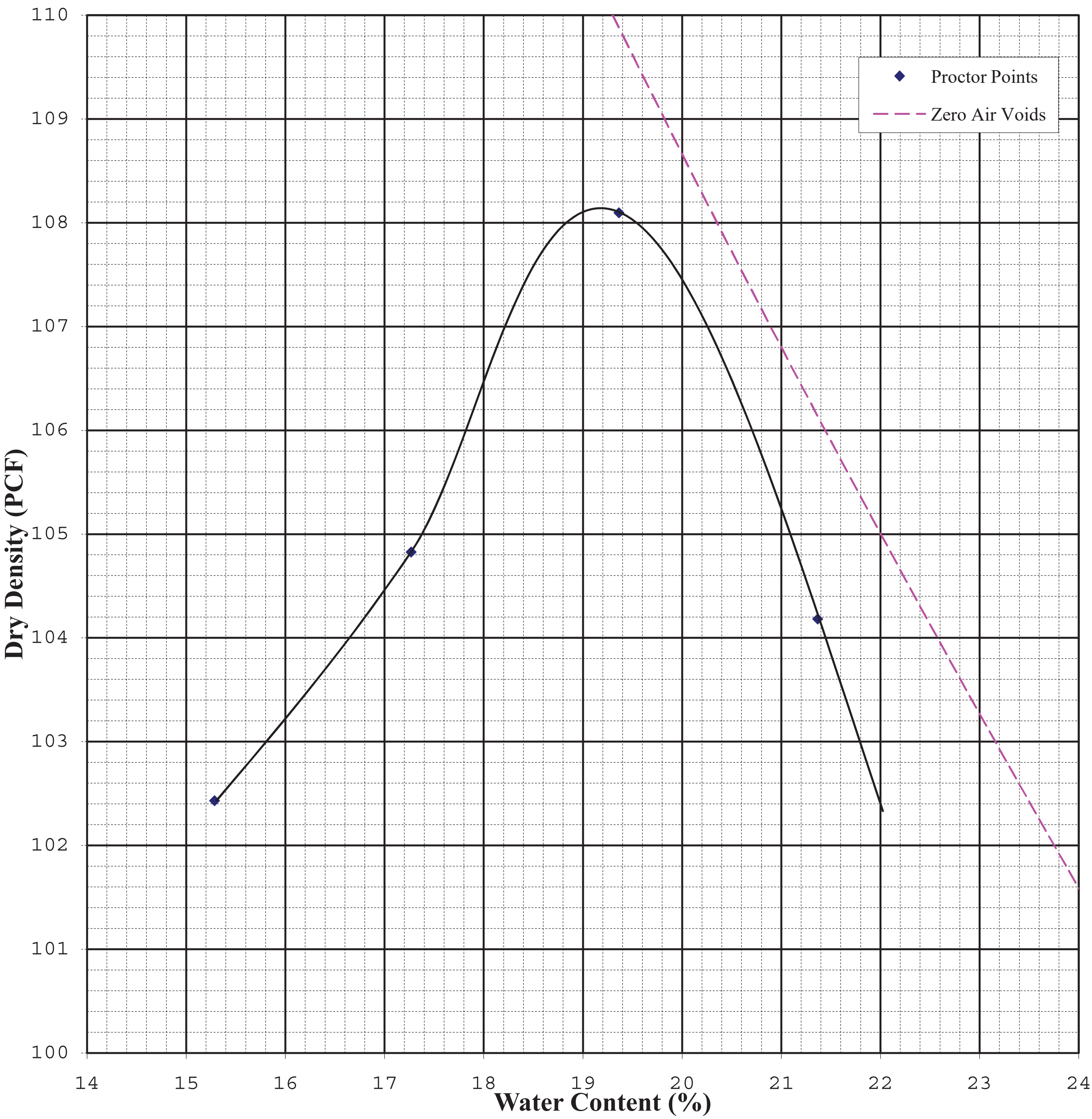
Client: **Olsson Associates** Job No. **12511**

Boring No. **ALT-3** Sample: Depth(ft): **1-5** Location:

Soil Type: **Lean Clay with sand and a trace of gravel (CL)**

As Received W.C. (%): **26.8** LL: PL: PI: Specific Gravity: **2.67** *Assumed

Maximum Dry Density (pcf): **108.1** Opt. Water Content (%): **19.2**



9530 James Ave South

SOIL ENGINEERING TESTING, INC.

Bloomington, MN 55431

SET-R18a

Moisture Density Curve ASTM: D698, Method B

Project: **Madison Fields Solar** Date: **5/7/20**

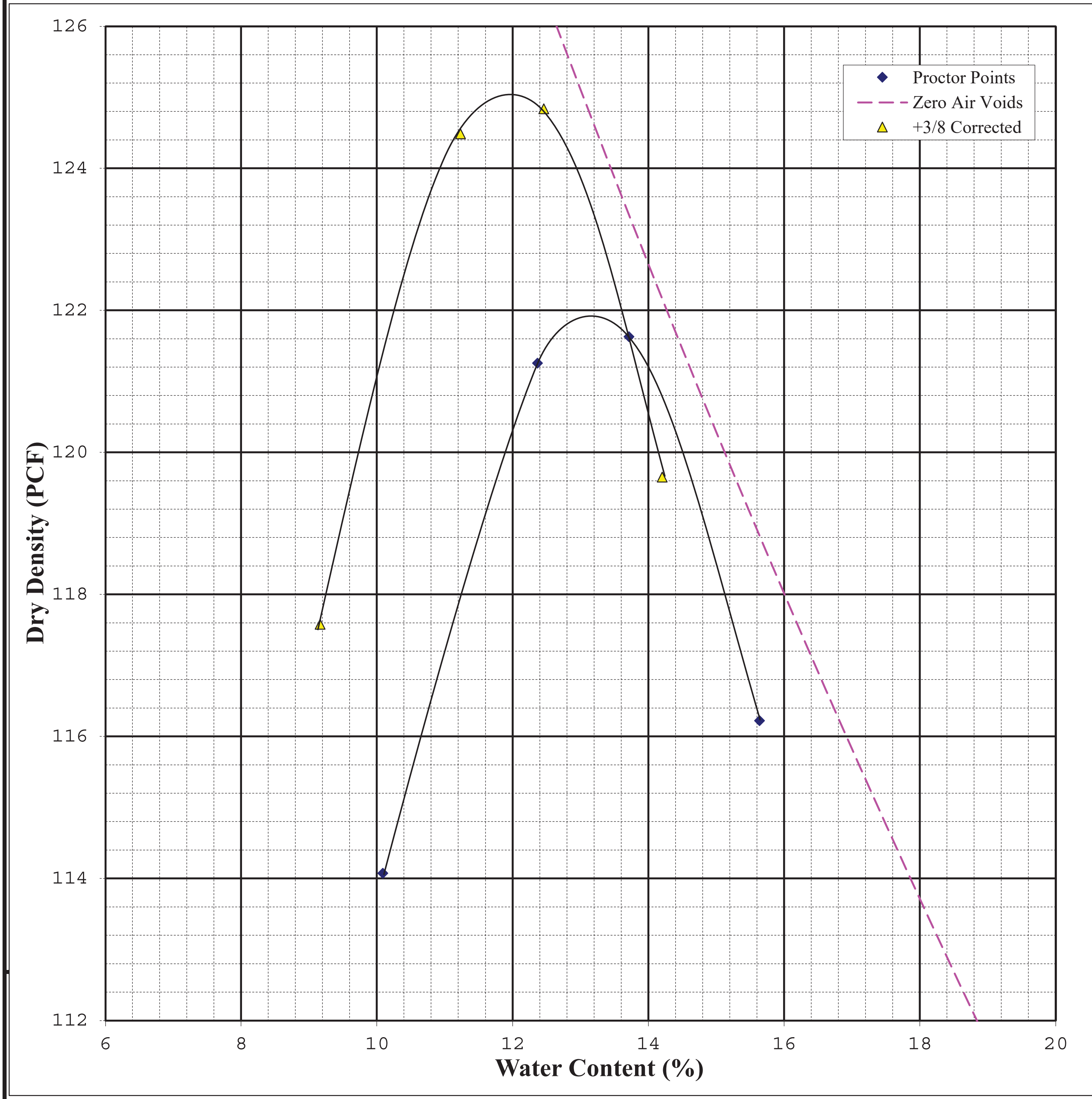
Client: **Olsson Associates** Job No. **12511**

Boring No. **Alt-6** Sample: Depth(ft): **1-6** Location:

Soil Type: **Clayey Sand with a little gravel (SC)**

As Received W.C. (%): **12.9** LL: PL: PI: Specific Gravity: **2.71** *Assumed

	◆	△		◆	△
Maximum Dry Density (pcf):	121.9	125.0	Opt. Water Content (%):	13.1	11.9



Moisture Density Curve ASTM: D698, Method B

Project: **Madison Fields Solar**　　Date: **4/29/20**

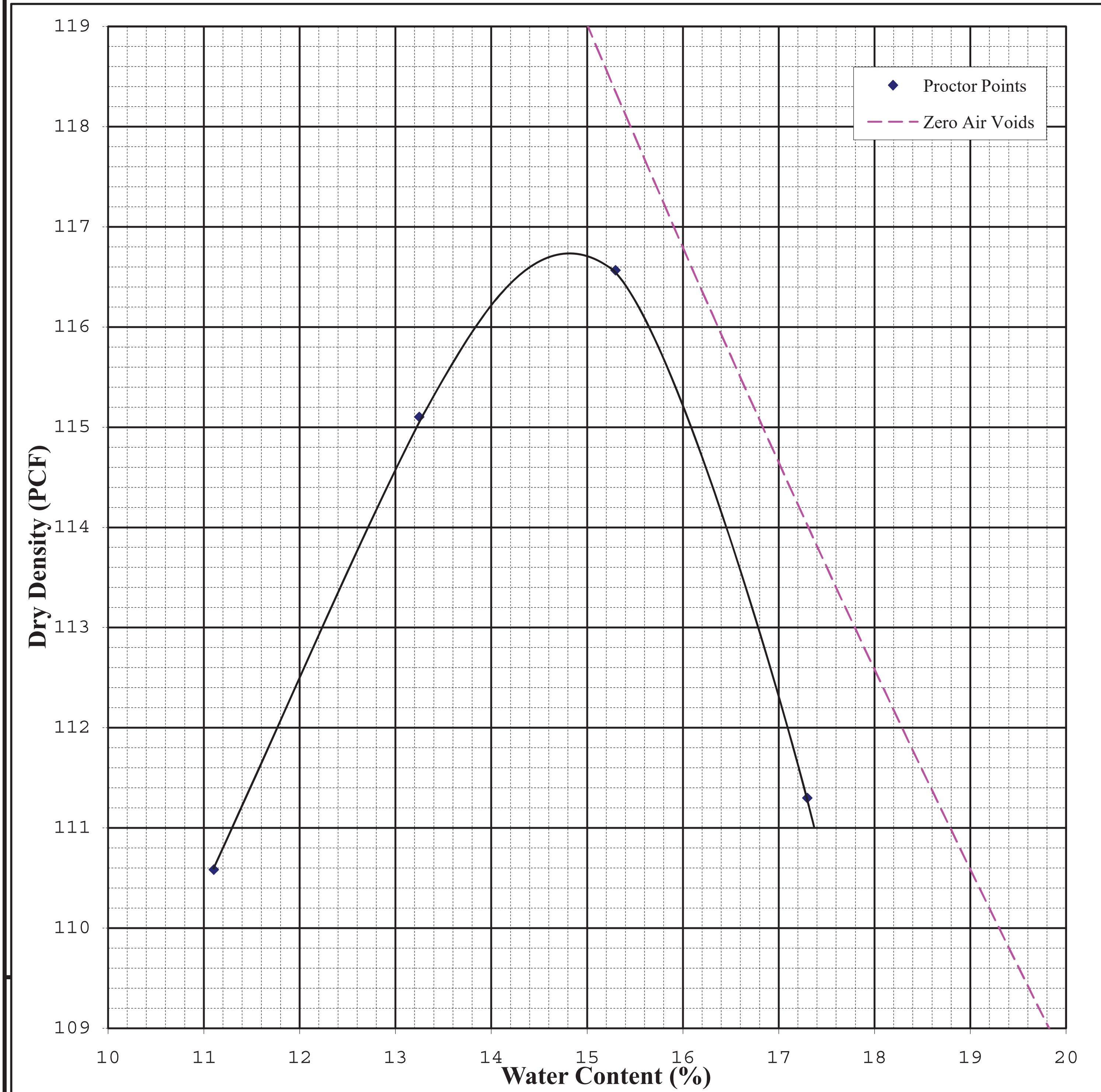
Client: **Olsson Associates**　　Job No. **12511**

Boring No. **B-13**　　Sample:　　Depth(ft):　　Location:

Soil Type: **Sandy Lean Clay (CL)**

As Received W.C. (%): **19.1**　　LL:　　PL:　　PI:　　Specific Gravity: **2.67**　　*Assumed

Maximum Dry Density (pcf): **116.7**　　Opt. Water Content (%): **14.8**



9530 James Ave South　　SOIL ENGINEERING TESTING, INC.　　Bloomington, MN 55431

SET-R18a

Moisture Density Curve ASTM: D698, Method B

Project: **Madison Fields Solar** Date: **4/30/20**

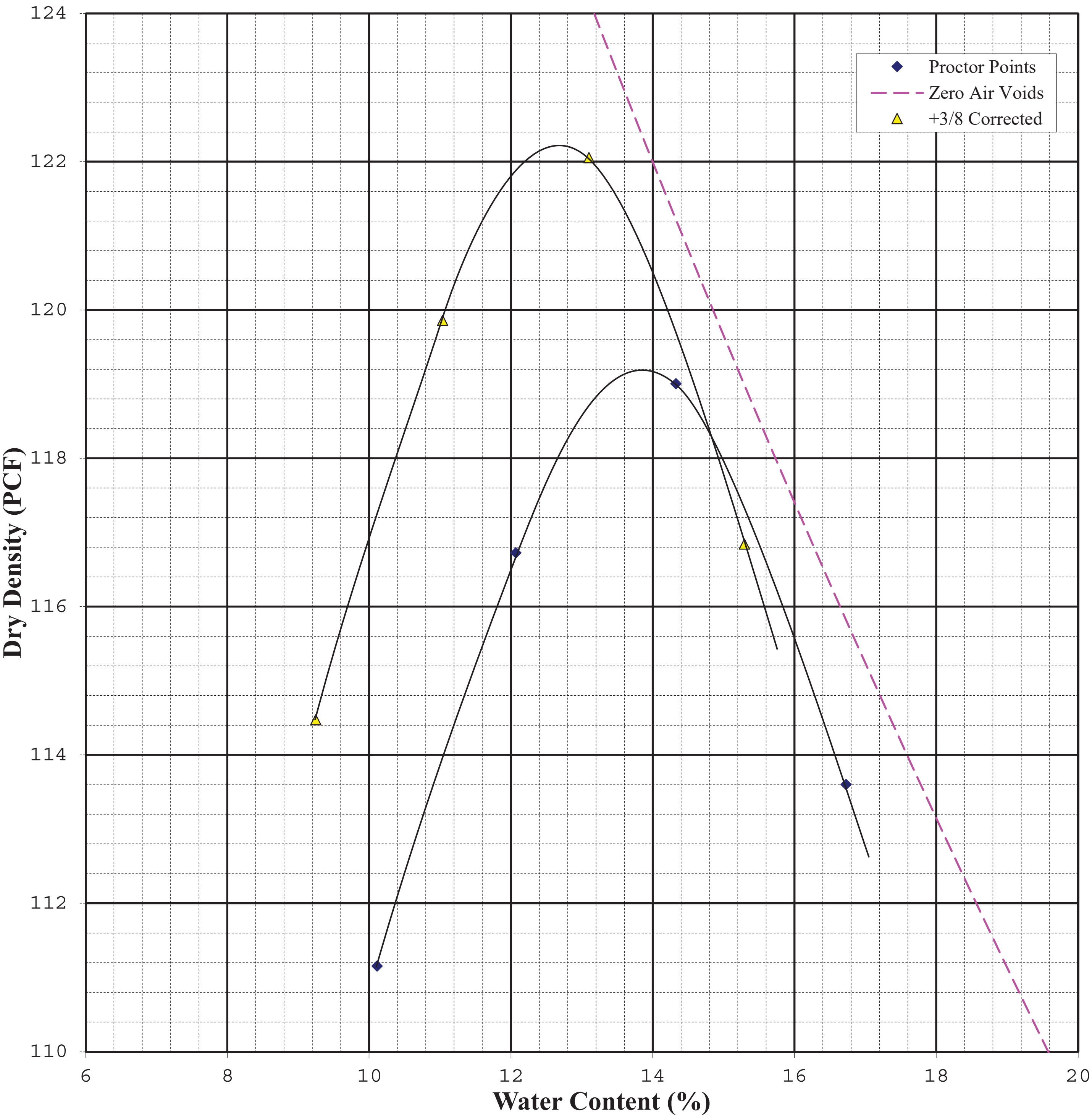
Client: **Olsson Associates** Job No. **12511**

Boring No. **B-35** Sample: Depth(ft): **1-5** Location:

Soil Type: **Sandy Lean Clay with a little gravel (CL)**

As Received W.C. (%): **13.7** LL: PL: PI: Specific Gravity: **2.69** *Assumed

	◆	△		◆	△
Maximum Dry Density (pcf):	119.2	122.2	Opt. Water Content (%):	13.9	12.7



Moisture Density Curve ASTM: D698, Method B

Project: **Madison Fields Solar** Date: **4/30/20**

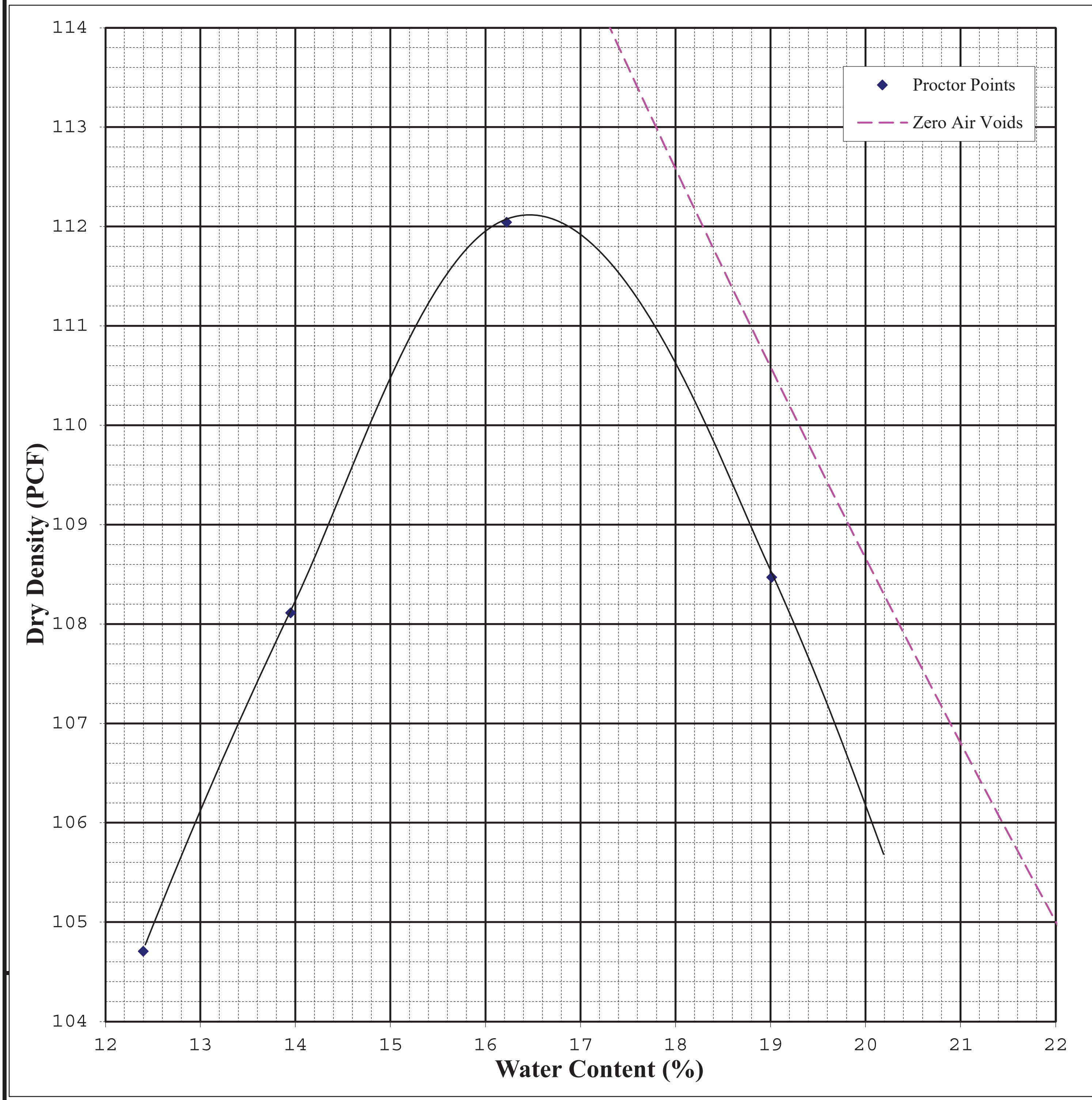
Client: **Olsson Associates** Job No. **12511**

Boring No. **B-45** Sample: Depth(ft): **1-5** Location:

Soil Type: **Sandy Lean Clay (CL)**

As Received W.C. (%): **27.4** LL: PL: PI: Specific Gravity: **2.67** *Assumed

Maximum Dry Density (pcf): **112.1** Opt. Water Content (%): **16.4**



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Bloomington, MN 55431

SET-R18a

Moisture Density Curve ASTM: D698, Method B

Project: **Madison Fields Solar** Date: 5/1/20

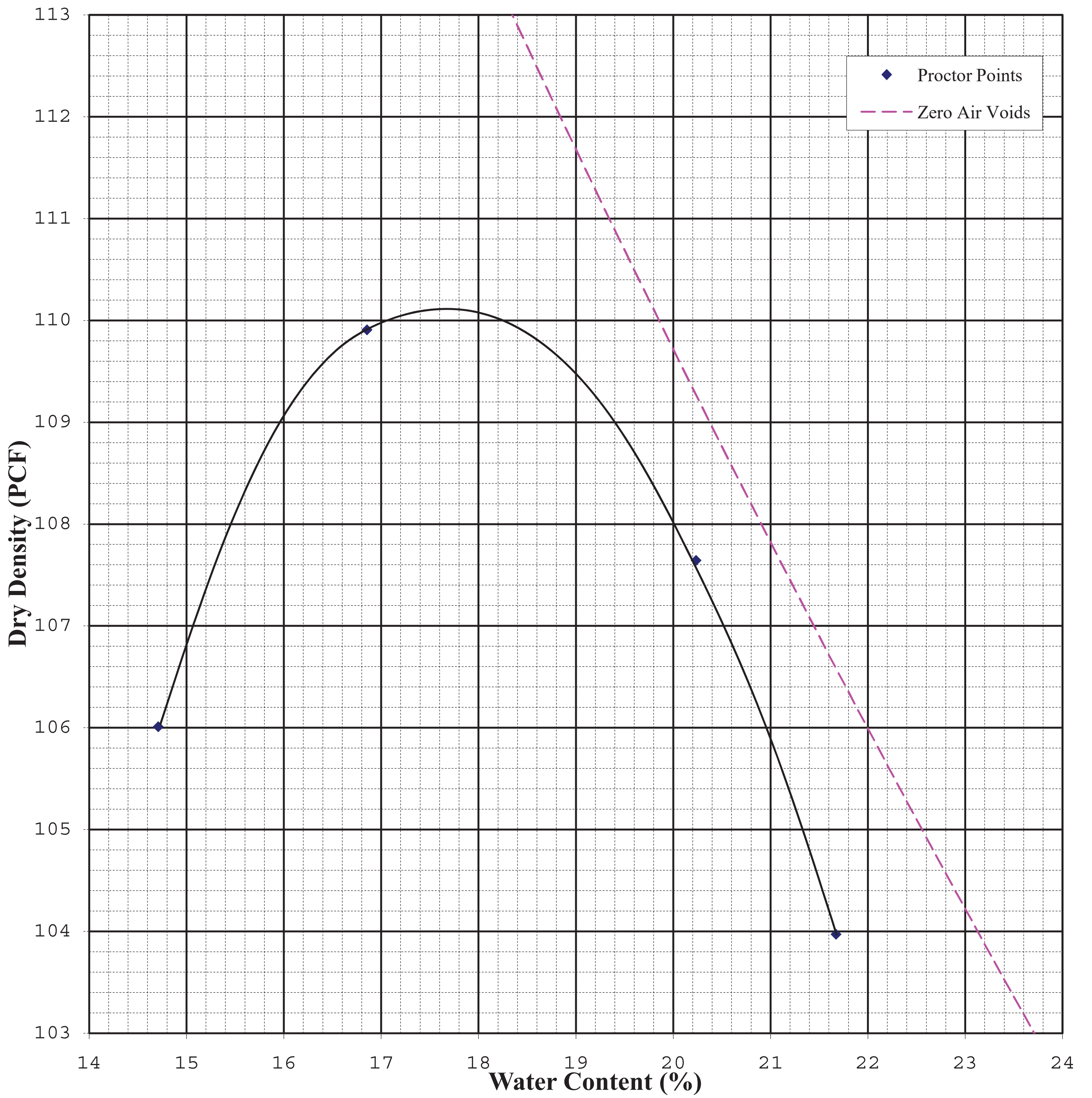
Client: **Olsson Associates** Job No. 12511

Boring No. **B-52** Sample: Depth(ft): Location:

Soil Type: **Sandy Lean Clay with a trace of gravel (CL)**

As Received W.C. (%): **22.3** LL: PL: PI: Specific Gravity: **2.71** *Assumed

Maximum Dry Density (pcf): 110.1 Opt. Water Content (%): 17.7



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Bloomington, MN 55431

SET-R18a

Moisture Density Curve ASTM: D698, Method B

Project: **Madison Fields Solar** Date: **5/7/20**

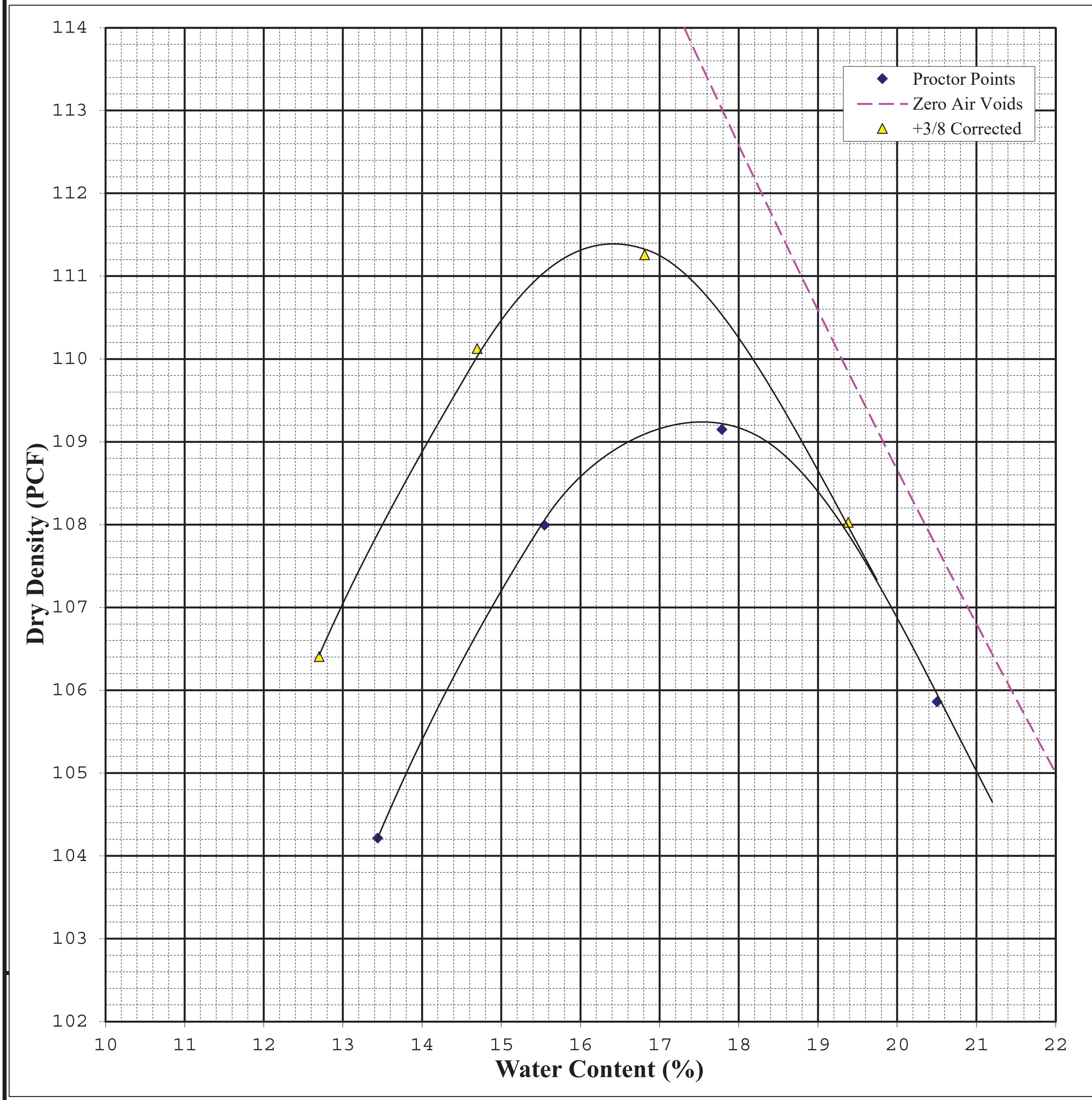
Client: **Olsson Associates** Job No. **12511**

Boring No. **B-58** Sample: Depth(ft): **1-6** Location:

Soil Type: **Lean Clay with sand and a little gravel (CL)**

As Received W.C. (%): **20.1** LL: PL: PI: Specific Gravity: **2.67** *Assumed

	◆	△		◆	△
Maximum Dry Density (pcf):	109.2	111.4	Opt. Water Content (%):	17.5	16.4



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Bloomington, MN 55431

Moisture Density Curve ASTM: D698, Method B

Project: **Madison Fields Solar** Date: **5/7/20**

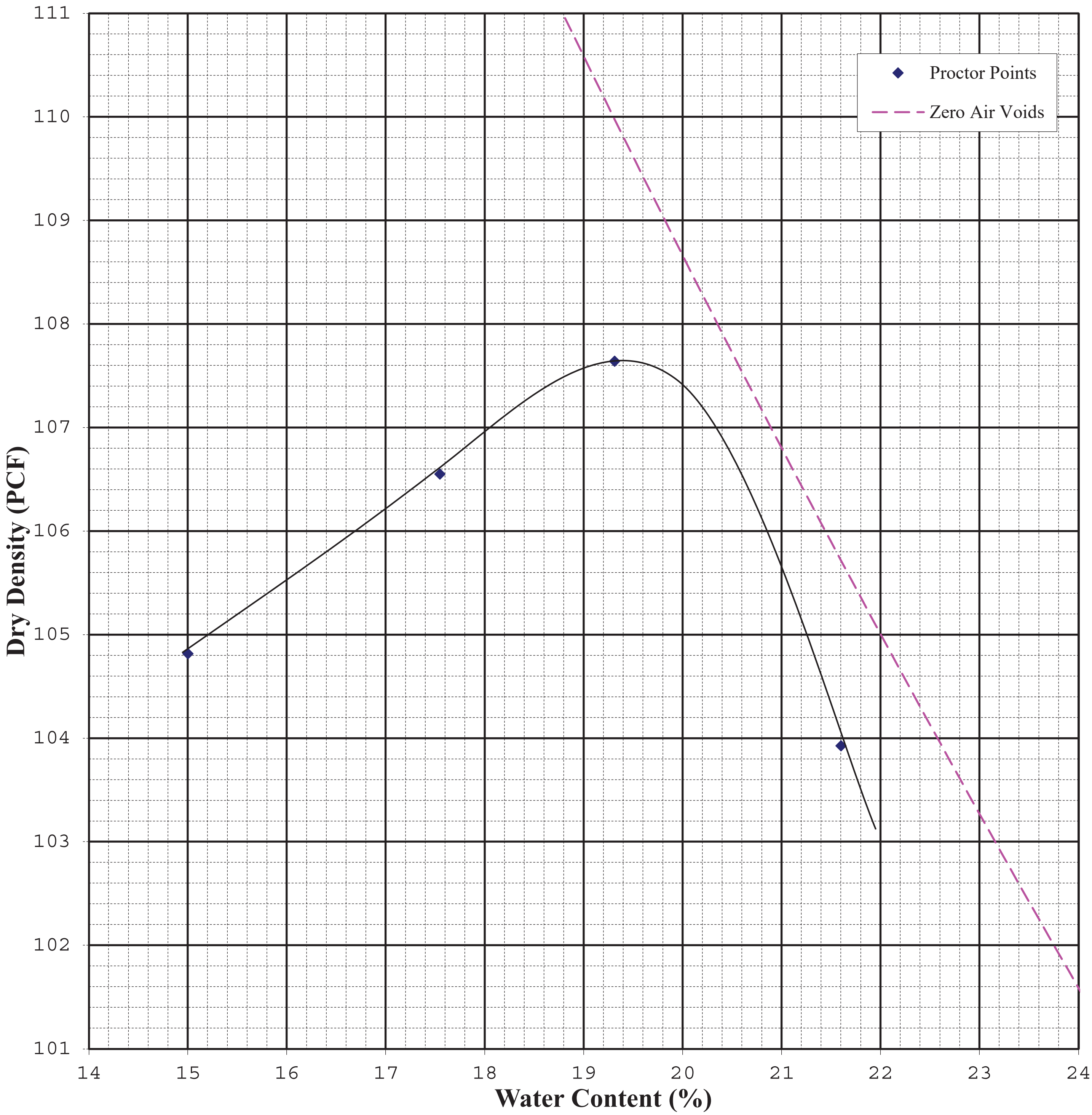
Client: **Olsson Associates** Job No. **12511**

Boring No. **B-60** Sample: Depth(ft): **1-6** Location:

Soil Type: **Lean Clay with sand (CL)**

As Received W.C. (%): **17.9** LL: PL: PI: Specific Gravity: **2.67** *Assumed

Maximum Dry Density (pcf): **107.6** Opt. Water Content (%): **19.4**



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Bloomington, MN 55431

SET-R18a

Moisture Density Curve ASTM: D698, Method B

Project: **Madison Fields Solar** Date: **5/8/20**

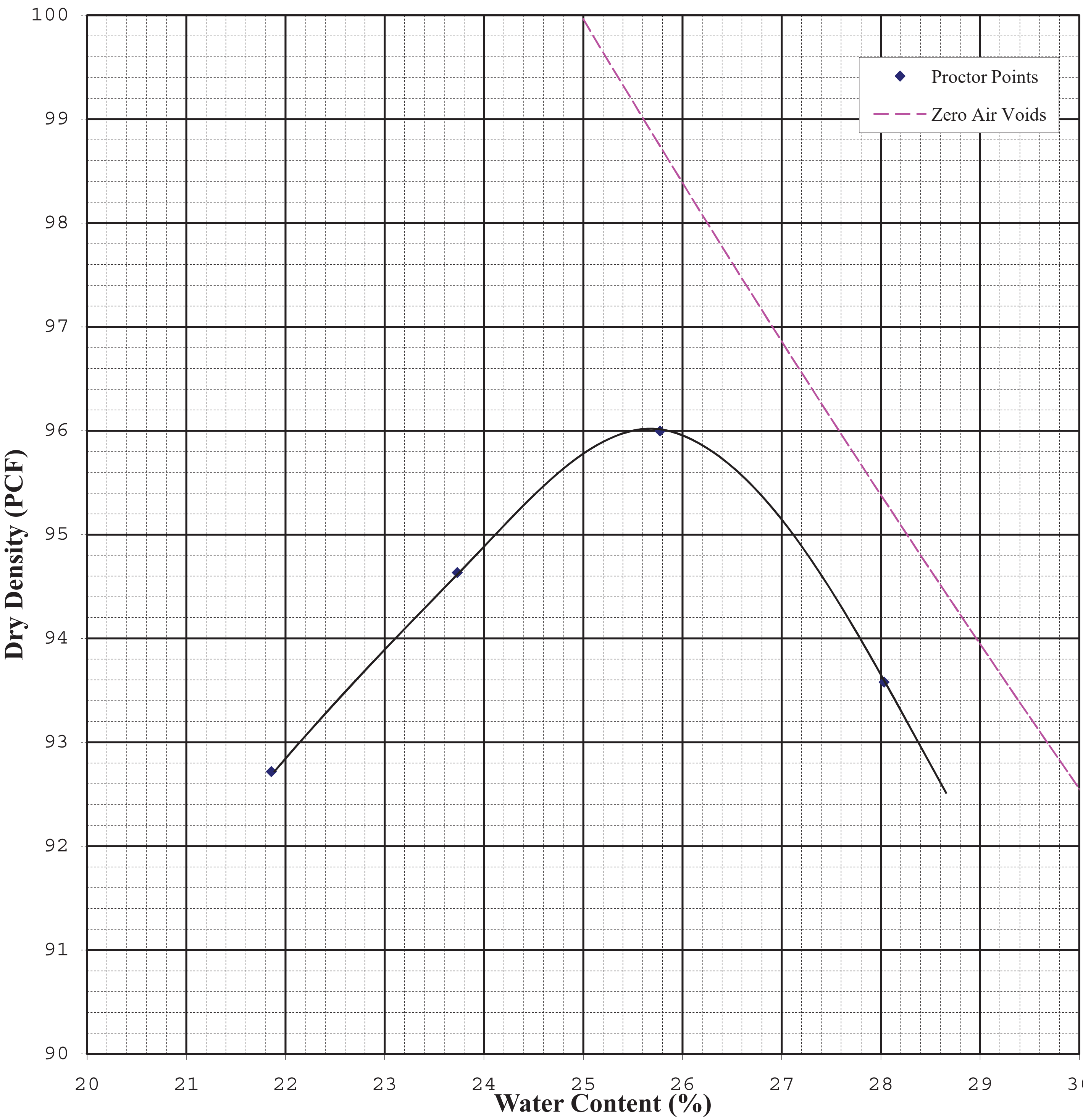
Client: **Olsson Associates** Job No. **12511**

Boring No. **Geo-73** Sample: Depth(ft): **1-3** Location:

Soil Type: **Fat Clay (CH)**

As Received W.C. (%): **30.1** LL: PL: PI: Specific Gravity: **2.67** *Assumed

Maximum Dry Density (pcf): **96.0** Opt. Water Content (%): **25.7**



Moisture Density Curve ASTM: D698, Method B

Project: **Madison Fields Solar** Date: **5/8/20**

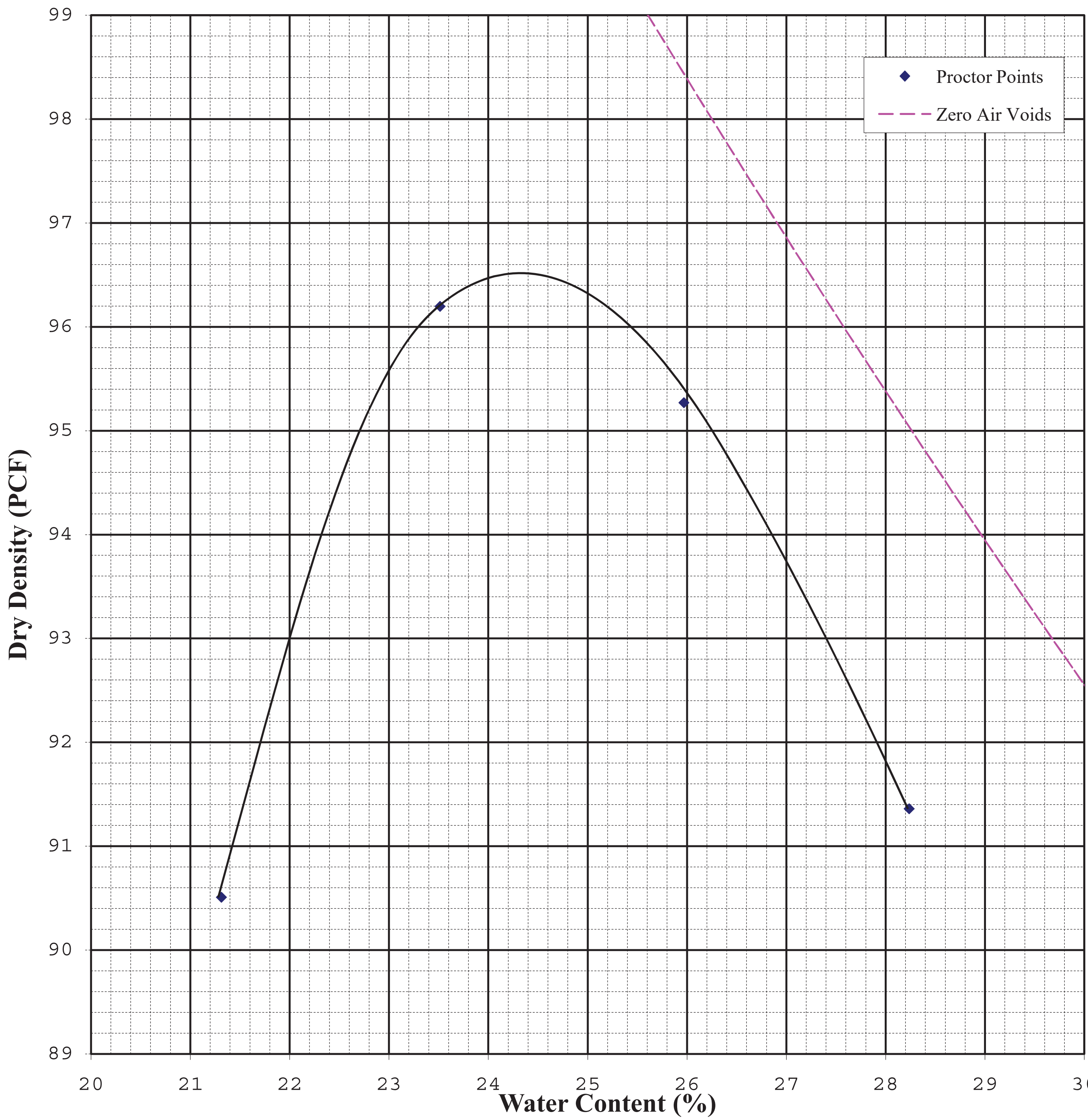
Client: **Olsson Associates** Job No. **12511**

Boring No. **Geo-74** Sample: Depth(ft): **2-4** Location:

Soil Type: **Fat Clay (CH)**

As Received W.C. (%): **26.8** LL: PL: PI: Specific Gravity: **2.67** *Assumed

Maximum Dry Density (pcf): **96.5** Opt. Water Content (%): **24.3**



9530 James Ave South SOIL ENGINEERING TESTING, INC. Bloomington, MN 55431

SET-R18a

California Bearing Ratio ASTM:D1883

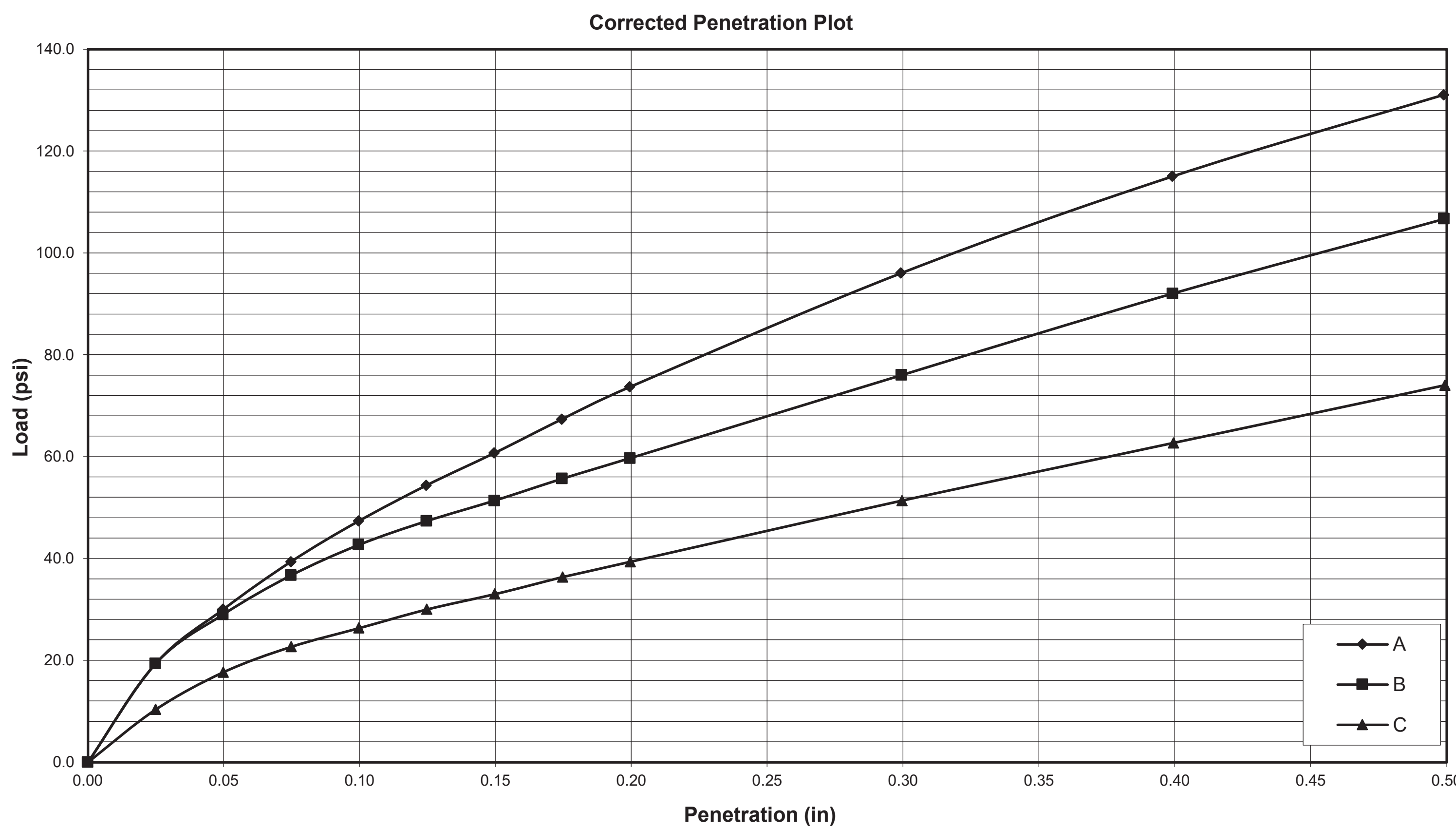
Project:	Madison Fields Solar	Job:	**12511**
Client:	Olsson Associates	Date:	5/11/20

Boring #:	B-13	B-35	B-45	Procedural Method:
Sample:				Specimens compacted to approximately 95% of maximum standard proctor density at optimum moisture content. Specimens soaked for a period of 4 days before CBR test was performed.
Depth (ft):		1-5	1-5	
Type:	Bulk	Bulk	Bulk	
Classification:	Sandy Lean Clay (CL)	Sandy Lean Clay with a little gravel (CL)	Sandy Lean Clay (CL)	

Laboratory Moisture-Density Values				Index Properties	
Method:	ASTM:D698 Method B			LL:	Gs:
Maximum Dry Density (PCF):	116.7	122.2	112.1	PL:	Organic Content:
Optimum Water Content:	14.8%	12.7%	16.4%	PI:	pH:

Initial Molding Conditions			
Specimen	A	B	C
Compaction Hammer:	5 lb	5 lb	5 lb
Number of Layers:	3	3	3
Blows per Layer:	NA	NA	NA
Initial Moisture Content:	14.8%	12.7%	16.4%
Initial Dry Density (PCF)	111.1	116.3	106.6
Relative Compaction	95.2%	95.1%	95.1%
Soaking Phase			
Days Soaked	4	4	4
Surcharge (psf)	50	50	50
Total Swell (%)	0.4%	0.4%	3.0%
Penetration Phase			
Surcharge (psf)	50	50	50
Corrected CBR Values			
at 0.1 inch (%)	**4.7%**	**4.3%**	**2.6%**
at 0.2 inch (%)	4.9%	4.0%	2.6%
Moisture Content After Penetration			
Top 1" of Specimen:	15.5%	14.8%	21.0%
Average of specimen:	15.3%	14.3%	19.5%

Stress vs. Penetration Graph



California Bearing Ratio ASTM:D1883

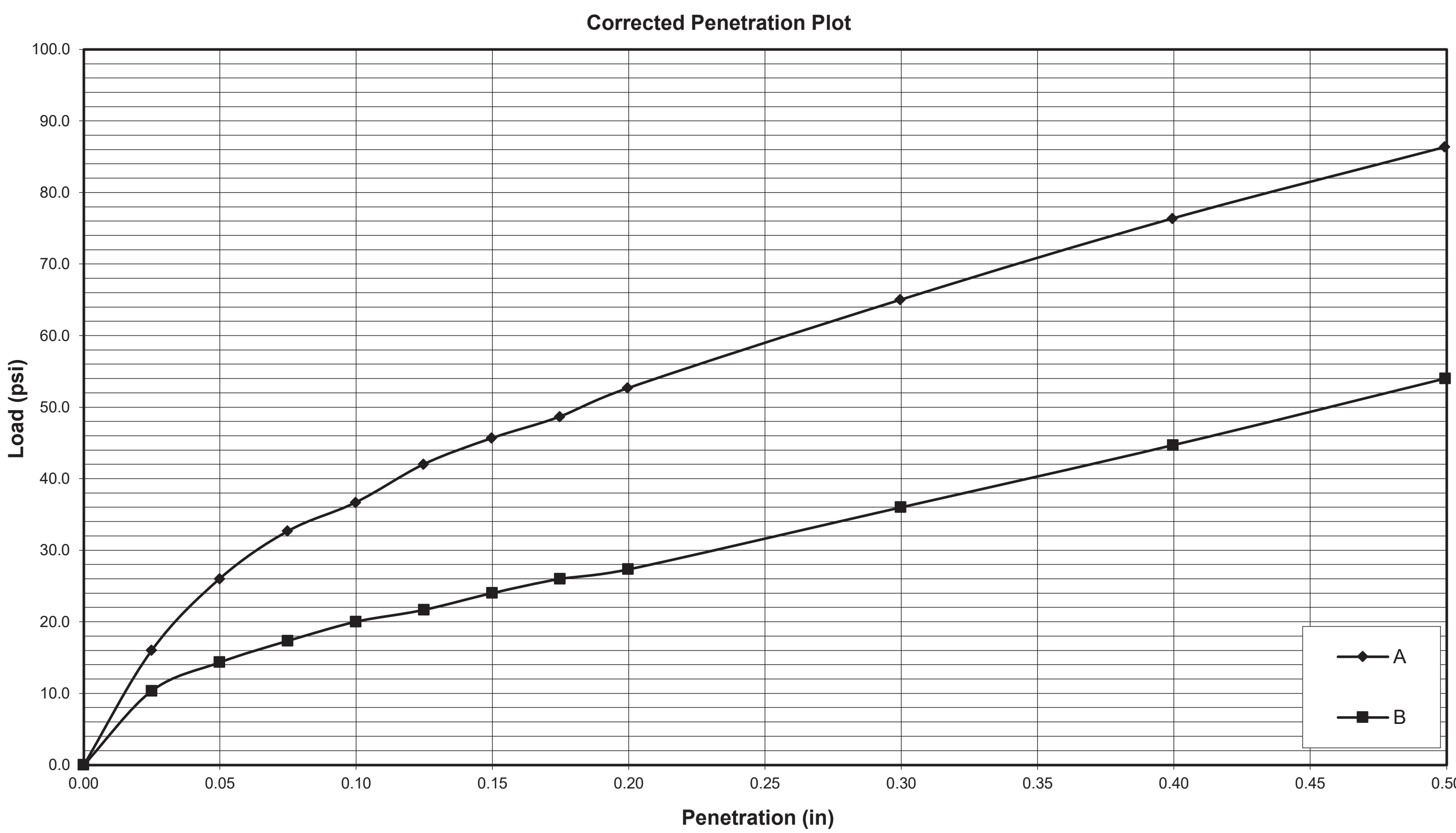
Project:	Madison Fields Solar	Job:	**12511**
Client:	Olsson Associates	Date:	5/11/20

Boring #:	B-52	ALT-3		Procedural Method:
Sample:				Specimens compacted to approximately 95% of maximum standard proctor density at optimum moisture content. Specimens soaked for a period of 4 days before CBR test was performed.
Depth (ft):		1-5		
Type:	Bulk	Bulk	Bulk	
Classification:	Sandy Lean Clay with a trace of gravel (CL)	Lean Clay with sand and a trace of gravel (CL)		

Laboratory Moisture-Density Values				Index Properties	
Method:	ASTM:D698 Method B			LL:	Gs:
Maximum Dry Density (PCF):	110.1	108.1		PL:	Organic Content:
Optimum Water Content:	17.7%	19.2%		PI:	pH:

Initial Molding Conditions			
Specimen	A	B	
Compaction Hammer:	5 lb	5 lb	
Number of Layers:	3	3	
Blows per Layer:	NA	NA	
Initial Moisture Content:	17.7%	19.2%	
Initial Dry Density (PCF)	104.8	102.9	
Relative Compaction	95.2%	95.2%	
Soaking Phase			
Days Soaked	4	4	
Surcharge (psf)	50	50	
Total Swell (%)	0.9%	4.0%	
Penetration Phase			
Surcharge (psf)	50	50	
Corrected CBR Values			
at 0.1 inch (%)	**3.7%**	**2.0%**	
at 0.2 inch (%)	3.5%	1.8%	
Moisture Content After Penetration			
Top 1" of Specimen:	20.3%	23.8%	
Average of specimen:	19.3%	21.3%	

Stress vs. Penetration Graph



California Bearing Ratio ASTM:D1883

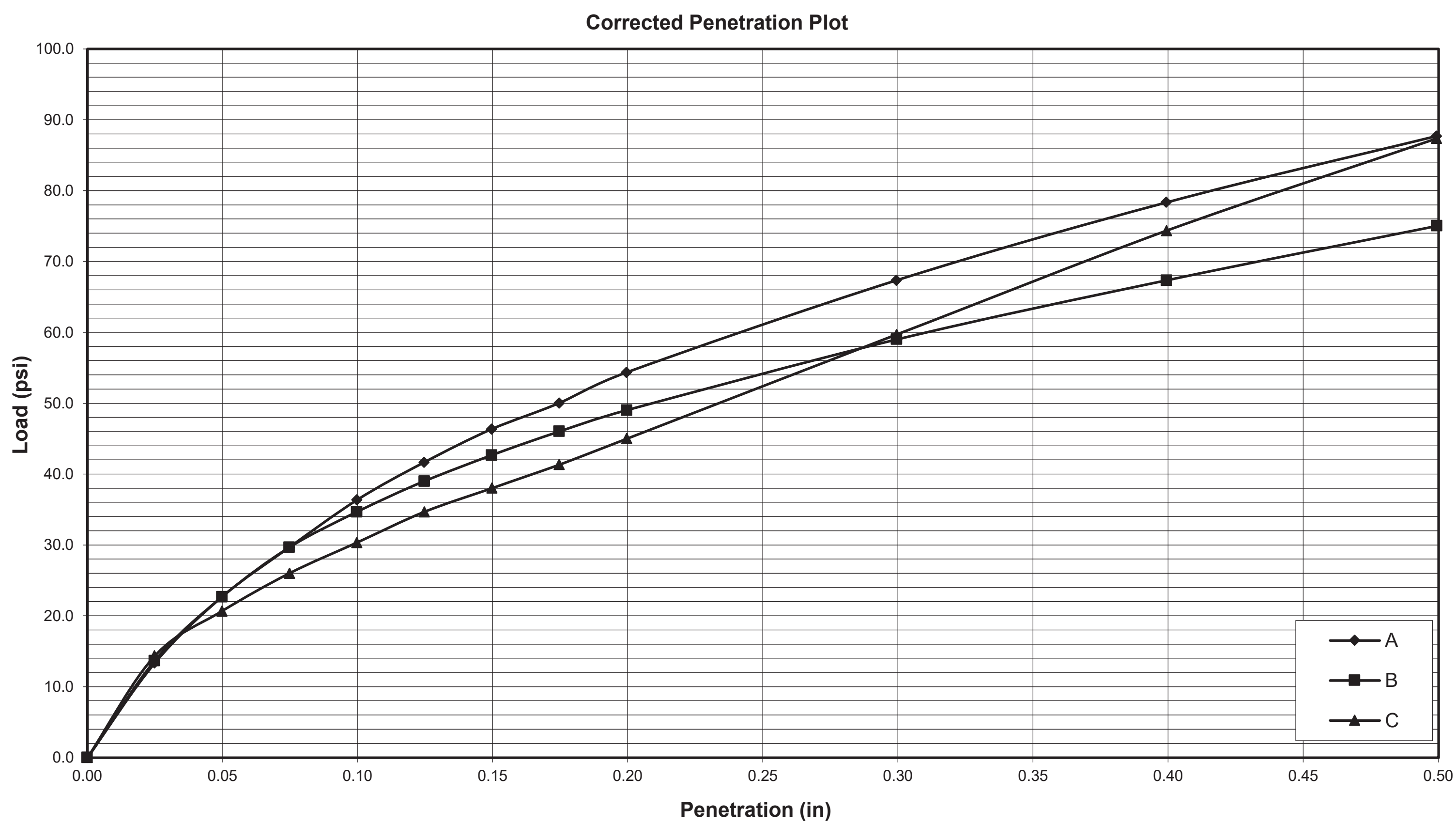
Project:	Madison Fields Solar	Job:	**12511**
Client:	Olsson Associates	Date:	5/13/20

Boring #:	B-58	B-60	ALT-6	Procedural Method:
Sample:				Specimens compacted to approximately 95% of maximum standard proctor density at optimum moisture content. Specimens soaked for a period of 4 days before CBR test was performed.
Depth (ft):	1-6	1-6	1-6	
Type:	Bulk	Bulk	Bulk	
Classification:	Lean Clay with sand and a little gravel (CL)	Lean Clay with sand (CL)	Clayey Sand with a little gravel (SC)	

Laboratory Moisture-Density Values				Index Properties	
Method:	ASTM:D698 Method B			LL:	Gs:
Maximum Dry Density (PCF):	111.4	107.6	125.0	PL:	Organic Content:
Optimum Water Content:	16.4%	19.4%	11.9%	PI:	pH:

Initial Molding Conditions			
Specimen	A	B	C
Compaction Hammer:	5 lb	5 lb	5 lb
Number of Layers:	3	3	3
Blows per Layer:	NA	NA	NA
Initial Moisture Content:	16.4%	19.4%	11.9%
Initial Dry Density (PCF)	106.0	102.4	119.0
Relative Compaction	95.2%	95.1%	95.2%
Soaking Phase			
Days Soaked	4	4	4
Surcharge (psf)	50	50	50
Total Swell (%)	1.8%	1.3%	1.1%
Penetration Phase			
Surcharge (psf)	50	50	50
Corrected CBR Values			
at 0.1 inch (%)	**3.6%**	**3.5%**	**3.0%**
at 0.2 inch (%)	3.6%	3.3%	3.0%
Moisture Content After Penetration			
Top 1" of Specimen:	20.2%	21.2%	13.4%
Average of specimen:	19.5%	20.4%	13.4%

Stress vs. Penetration Graph



9530 James Ave South

SOIL ENGINEERING TESTING, INC.

Bloomington, MN 55431

May 14, 2020

Olsson Associates

M. Flanagan

1525 Raleigh St, Suite 400

Denver CO 80204

Project Name - Madison Fields **Project Number - A20-0986**

Attached are your analytical results for Madison Fields received by Origins Laboratory, Inc. May 07, 2020. This project is associated with Origins project number Y005088-01.

The analytical results in the following report were analyzed under the guidelines of EPA Methods. These methods are identified as follows; "SW" are defined in SW-846, "EPA" are defined in 40CFR part 136 and "SM" are defined in the most current revision of Standard Methods For the Examination of Water and Wastewater.

The analytical results apply specifically to the samples and analyses specified per the attached Chain of Custody. As such, this report shall not be reproduced except in full, without the written approval of Origin's laboratory.

Unless otherwise noted, the analytical results for all soil samples are reported on a wet weight basis. All analytical analyses were performed under NELAP guidelines unless noted by a data qualifier.

Any holding time exceedances, deviations from the method specifications or deviations from Origins Laboratory's Standard Operating Procedures are outlined in the case narrative.

Thank you for selecting Origins for your analytical needs. Please contact us with any questions concerning this report, or if we can help with anything at all.

Origins Laboratory, Inc.
303.433.1322
o-squad@oelabinc.com

THE NELAC INSTITUTE

Olsson Associates
1525 Raleigh St, Suite 400
Denver CO 80204

M. Flanagan
Project Number: A20-0986
Project: Madison Fields

CROSS REFERENCE REPORT

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
GEO-02, 1-2.5ft	Y005088-01	Soil	April 16, 2020 0:00	05/07/2020 15:15
GEO-06,1-2.5ft	Y005088-02	Soil	April 18, 2020 0:00	05/07/2020 15:15
GEO-09,3.5-5ft	Y005088-03	Soil	April 22, 2020 0:00	05/07/2020 15:15
GEO-15,1-2.5ft	Y005088-04	Soil	April 16, 2020 0:00	05/07/2020 15:15
GEO-17, 1-2.5ft	Y005088-05	Soil	April 15, 2020 0:00	05/07/2020 15:15
GEO-22, 1-2.5ft	Y005088-06	Soil	April 15, 2020 0:00	05/07/2020 15:15
GEO-30, 1-2.5ft	Y005088-07	Soil	April 21, 2020 0:00	05/07/2020 15:15
GEO-32, 1-2.5ft	Y005088-08	Soil	April 18, 2020 0:00	05/07/2020 15:15
GEO-34, 3.5-5ft	Y005088-09	Soil	April 22, 2020 0:00	05/07/2020 15:15
GEO-35, 6-7.5ft	Y005088-10	Soil	April 22, 2020 0:00	05/07/2020 15:15
GEO-40, 1-2.5ft	Y005088-11	Soil	April 27, 2020 0:00	05/07/2020 15:15
GEO-45, 1-2.5ft	Y005088-12	Soil	April 21, 2020 0:00	05/07/2020 15:15
GEO-47, 6-7.5ft	Y005088-13	Soil	April 21, 2020 0:00	05/07/2020 15:15
GEO-55, 3.5-5ft	Y005088-14	Soil	April 20, 2020 0:00	05/07/2020 15:15

Origins Laboratory, Inc.

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Jordan A. Merrill For Jen Pellegrini, Project Manager

Olsson Associates

1525 Raleigh St, Suite 400

Denver CO 80204

M. Flanagan

Project Number: A20-0986

Project: Madison Fields

CROSS REFERENCE REPORT

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
GEO-58, 1-2.5ft	Y005088-15	Soil	April 28, 2020 0:00	05/07/2020 15:15
GEO-64, 1-2.5ft	Y005088-16	Soil	April 24, 2020 0:00	05/07/2020 15:15
GEO-68, 1-2.5ft	Y005088-17	Soil	April 20, 2020 0:00	05/07/2020 15:15
GEO-73, 1-2.5ft	Y005088-18	Soil	April 29, 2020 0:00	05/07/2020 15:15
GEO-74, 1-2.5ft	Y005088-19	Soil	April 29, 2020 0:00	05/07/2020 15:15
GEO-77, 3.5-5ft	Y005088-20	Soil	April 24, 2020 0:00	05/07/2020 15:15
GEO-80, 3.5-5ft	Y005088-21	Soil	April 27, 2020 0:00	05/07/2020 15:15

Origins Laboratory, Inc.

Jordan A. Merrill For Jen Pellegrini, Project Manager

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Olsson Associates
1525 Raleigh St, Suite 400
Denver CO 80204

M. Flanagan
Project Number: A20-0986
Project: Madison Fields

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Y005088

page 1 of 3

Client: Olsson
Address: 3990 Fox Street
Telephone Number: 303-918-2502
Email Address: mflanagan@olsson.com

Project Manager: Michael Flanagan
Project Name: Madison Fields
Project Number: A20-0986
Samples Collected By: mflanagan@olsson.com

Sample ID Description	Date Sampled	Time Sampled	# of Containers	Preservative: Unpreserved	Preservative: HCl	Preservative: HNO_3	Preservative: Other	Matrix: Groundwater	Matrix: Soil	Matrix: Air Summa Canister #	Matrix: Other	Analysis	Sample Instructions	
GEO-02, 1-2.5 ft	4/16/2020	--	1	X					X			Sulfates and Chlorides	Use EPA Method 300.0	1
GEO-06, 1-2.5 ft	4/18/2020	--	1	X					X			Sulfates and Chlorides	Use EPA Method 300.0	2
GEO-09, 3.5-5 ft	4/22/2020	--	1	X					X			Sulfates and Chlorides	Use EPA Method 300.0	3
GEO-15, 1-2.5 ft	4/16/2020	--	1	X					X			Sulfates and Chlorides	Use EPA Method 300.0	4
GEO-17, 1-2.5 ft	4/15/2020	--	1	X					X			Sulfates and Chlorides	Use EPA Method 300.0	5
GEO-22, 1-2.5 ft	4/15/2020	--	1	X					X			Sulfates and Chlorides	Use EPA Method 300.0	6
GEO-30, 1-2.5 ft	4/21/2020	--	1	X					X			Sulfates and Chlorides	Use EPA Method 300.0	7
GEO-32, 1-2.5 ft	4/18/2020	--	1	X					X			Sulfates and Chlorides	Use EPA Method 300.0	8
GEO-34, 3.5-5 ft	4/22/2020	--	1	X					X			Sulfates and Chlorides	Use EPA Method 300.0	9
GEO-35, 6-7.5 ft	4/22/2020	--	1	X					X			Sulfates and Chlorides	Use EPA Method 300.0	10

Relinquished By:	Date:	Time:	Received By:	Date:	Time:	Turnaround Time:
Matt Almond	5/7/20	1515		5/7/20	1515	Same Day ☐ 24 Hr ☐
Relinquished By:	Date:	Time:	Received By:	Date:	Time:	48 Hr ☐ 72 Hr ☐ Standard ☒

2.3

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Origins Laboratory, Inc.

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Jordan A. Merrill For Jen Pellegrini, Project Manager

ORIGINS LABORATORY, INC

Olsson Associates
1525 Raleigh St, Suite 400
Denver CO 80204

M. Flanagan
Project Number: A20-0986
Project: Madison Fields

ORIGINS LABORATORY, INC

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page 2 of 3

Y005088

Client: Olsson
Address: 3990 Fox Street
Telephone Number: 303-918-2502
Email Address: mflanagan@olsson.com

Project Manager: Michael Flanagan
Project Name: Madison Fields
Project Number: A20-0986
Samples Collected By: mflanagan@olsson.com

Sample ID Description	Date Sampled	Time Sampled	# of Containers	Preservative: Unpreserved	Preservative: HCl	Preservative: HNO_3	Preservative: Other	Matrix: Groundwater	Matrix: Soil	Matrix: Air Summa Canister #	Matrix: Other	Analysis	Sample Instructions	
GEO-40, 1-2.5 ft	4/27/2020	--	1	X					X			Sulfates and Chlorides	Use EPA Method 300.0	1
GEO-45, 1-2.5 ft	4/21/2020	--	1	X					X			Sulfates and Chlorides	Use EPA Method 300.0	2
GEO-47, 6-7.5 ft	4/21/2020	--	1	X					X			Sulfates and Chlorides	Use EPA Method 300.0	3
GEO-55, 3.5-5 ft	4/20/2020	--	1	X					X			Sulfates and Chlorides	Use EPA Method 300.0	4
GEO-58, 1-2.5 ft	4/28/2020	--	1	X					X			Sulfates and Chlorides	Use EPA Method 300.0	5
GEO-64, 1-2.5 ft	4/24/2020	--	1	X					X			Sulfates and Chlorides	Use EPA Method 300.0	6
GEO-68, 1-2.5 ft	4/20/2020	--	1	X					X			Sulfates and Chlorides	Use EPA Method 300.0	7
GEO-73, 1-2.5 ft	4/29/2020	--	1	X					X			Sulfates and Chlorides	Use EPA Method 300.0	8
GEO-74, 1-2.5 ft	4/29/2020	--	1	X					X			Sulfates and Chlorides	Use EPA Method 300.0	9
GEO-77, 3.5-5 ft	4/24/2020	--	1	X					X			Sulfates and Chlorides	Use EPA Method 300.0	10

Relinquished By:	Date:	Time:	Received By:	Date:	Time:	Turnaround Time:
	5/7/20	1515		5/7/20	1515	Same Day ☐ 24 Hr ☐
Relinquished By:	Date:	Time:	Received By:	Date:	Time:	48 Hr ☐ 72 Hr ☐ Standard ☒

1725 Elk Place | Denver, CO 80211 | Phone: 303.433.1322 | Fax: 303.265.9645

Origins Laboratory, Inc.

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Jordan A. Merrill For Jen Pellegrini, Project Manager

ORIGINS LABORATORY, INC

Olsson Associates
1525 Raleigh St, Suite 400
Denver CO 80204

M. Flanagan
Project Number: A20-0986
Project: Madison Fields

ORIGINS LABORATORY, INC

Y0050588

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page 3 of 3

Client: Olsson
Address: 3990 Fox Street
Telephone Number: 303-918-2502
Email Address: mflanagan@olsson.com

Project Manager: Michael Flanagan
Project Name: Madison Fields
Project Number: A20-0986
Samples Collected By: mflanagan@olsson.com

Sample ID Description	Date Sampled	Time Sampled	# of Containers	Preservative: Unpreserved	Preservative: HCl	Preservative: HNO_3	Preservative: Other	Matrix: Groundwater	Matrix: Soil	Matrix: Air Summa Canister #	Matrix: Other	Analysis	Sample Instructions	
GEO-80, 3.5-5 ft	4/27/2020	--	1	X					X			Sulfates and Chlorides	Use EPA Method 300.0	1
														2
														3
														4
														5
														6
														7
														8
														9
														10

Relinquished By:	Date:	Time:	Received By:	Date:	Time:
Matt Almand	5/7/20	1515	[signature]	5/7/20	1515
Relinquished By:	Date:	Time:	Received By:	Date:	Time:

Turnaround Time: Same Day ☐ 24 Hr ☐ 48 Hr ☐ 72 Hr ☐ Standard ☒

21.3

Date Results Needed: 5/1?/2020

1725 Elk Place | Denver, CO 80211 | Phone: 303.433.1322 | Fax: 303.265.9645

Origins Laboratory, Inc.

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Jordan A. Merrill For Jen Pellegrini, Project Manager

ORIGINS LABORATORY, INC

Olsson Associates
1525 Raleigh St, Suite 400
Denver CO 80204

M. Flanagan
Project Number: A20-0986
Project: Madison Fields

Origins Laboratory

F-012207-01-R1
Effective Date: 01/09/12

Sample Receipt Checklist

Origins Work Order: Y005068

Client: Olsson

Client Project ID: Madison Fields

Checklist Completed by: JG

Shipped Via: HD
(UPS, FedEx, Hand Delivered, Pick-up, etc.)

Date/time completed: 5/7/20

Airbill #: N/A

Matrix(s) Received: (Check all that apply): X Soil/Solid ____ Water ____ Other: ________ (Describe)

Cooler Number/Temperature: 1 / 21.3 °C ___/___ °C ___/___ °C ___/___ °C

Thermometer ID: T003

Requirement Description	Yes	No	N/A	Comments (if any)
If samples require cooling, was the temperature between 0°C to ≤ 6°C(1)?		✓		
Is there ice present (document if blue ice is used)		✓		
Are custody seals present on cooler? (if so, document in comments if they are signed and dated, broken or intact)		✓		
Are custody seals present on each sample container? (if so, document in comments if they are signed and dated, broken or intact)		✓		
Were all samples received intact(1)?	✓			
Was adequate sample volume provided(1)?	✓			
Are short holding time analytes or samples with HTs due within 48 hours present(1)?		✓		
Is a chain-of-custody (COC) present and filled out completely(1)?		✓		No sample times
Does the COC agree with the number and type of sample bottles received(1)?	✓			
Do the sample IDs on the bottle labels match the COC(1)?	✓			
Is the COC properly relinquished by the client with date and time recorded(1)?	✓			
For volatiles in water – is there headspace (> ¼ inch bubble) present? **If yes, contact client and note in narrative.**			✓	
Are samples preserved that require preservation and was it checked (1)? *(note ID of confirmation instrument used in comments) / (preservation is not confirmed for subcontracted analyses in order to insure sample integrity)/(pH <2 for samples preserved with HNO3, HCL, H2SO4) / (pH >10 for samples preserved with NaAsO2+NaOH, ZnAc+NaOH)*			✓	

Additional Comments (if any):

(1) If NO, then contact the client before proceeding with analysis and note date/time and person contacted as well as the corrective action to in the additional comments (above) and the case narrative.

JM
Reviewed by (Project Manager)

5-8-20
Date/Time Reviewed

Origins Laboratory, Inc.

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Jordan A. Merrill For Jen Pellegrini, Project Manager

Olsson Associates
1525 Raleigh St, Suite 400
Denver CO 80204

M. Flanagan
Project Number: A20-0986
Project: Madison Fields

GEO-02. 1-2.5ft
4/16/2020 12:00:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes

GEL Laboratories, LLC
Y005088-01 (Soil)

Anions by EPA 300.0

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes
Chloride	**3.82**	2.46	mg/kg dry	1	1996469	JLD1	05/12/2020	05/12/2020	
Sulfate	**5.32**	4.91	"	"	"	JLD1	"	"	

Origins Laboratory, Inc.

Jordan A. Merrill For Jen Pellegrini, Project Manager

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Olsson Associates
1525 Raleigh St, Suite 400
Denver CO 80204

M. Flanagan
Project Number: A20-0986
Project: Madison Fields

GEO-06.1-2.5ft
4/18/2020 12:00:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes

GEL Laboratories, LLC
Y005088-02 (Soil)

Anions by EPA 300.0

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes
Chloride	**3.39**	2.66	mg/kg dry	1	1996469	JLD1	05/12/2020	05/12/2020	
Sulfate	**11.9**	5.33	"	"	"	JLD1	"	"	

ORIGINS LABORATORY, INC

Olsson Associates
1525 Raleigh St, Suite 400
Denver CO 80204

M. Flanagan
Project Number: A20-0986
Project: Madison Fields

GEO-09.3.5-5ft
4/22/2020 12:00:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes

GEL Laboratories, LLC
Y005088-03 (Soil)

Anions by EPA 300.0

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes
Chloride	**4.31**	2.31	mg/kg dry	1	1996469	JLD1	05/12/2020	05/12/2020	
Sulfate	**5.84**	4.61	"	"	"	JLD1	"	"	

Origins Laboratory, Inc.

JMerrill

Jordan A. Merrill For Jen Pellegrini, Project Manager

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Olsson Associates

1525 Raleigh St, Suite 400

Denver CO 80204

M. Flanagan

Project Number: A20-0986

Project: Madison Fields

GEO-15.1-2.5ft

4/16/2020 12:00:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes

GEL Laboratories, LLC

Y005088-04 (Soil)

Anions by EPA 300.0

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes
Chloride	**3.22**	2.68	mg/kg dry	1	1996469	JLD1	05/12/2020	05/12/2020	
Sulfate	**7.70**	5.36	"	"	"	JLD1	"	"	

Origins Laboratory, Inc.

Jordan A. Merrill For Jen Pellegrini, Project Manager

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Olsson Associates
1525 Raleigh St, Suite 400
Denver CO 80204

M. Flanagan
Project Number: A20-0986
Project: Madison Fields

GEO-17. 1-2.5ft
4/15/2020 12:00:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes

GEL Laboratories, LLC
Y005088-05 (Soil)

Anions by EPA 300.0

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes
Chloride	**3.47**	2.32	mg/kg dry	1	1996469	JLD1	05/12/2020	05/12/2020	
Sulfate	**5.29**	4.65	"	"	"	JLD1	"	"	

Origins Laboratory, Inc.

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Jordan A. Merrill For Jen Pellegrini, Project Manager

Olsson Associates
1525 Raleigh St, Suite 400
Denver CO 80204

M. Flanagan
Project Number: A20-0986
Project: Madison Fields

GEO-22. 1-2.5ft
4/15/2020 12:00:00AM

GEL Laboratories, LLC
Y005088-06 (Soil)

Anions by EPA 300.0

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes
Chloride	**4.70**	2.24	mg/kg dry	1	1996469	JLD1	05/12/2020	05/12/2020	
Sulfate	**9.20**	4.49	"	"	"	JLD1	"	"	

Origins Laboratory, Inc.

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Jordan A. Merrill For Jen Pellegrini, Project Manager

Olsson Associates
1525 Raleigh St, Suite 400
Denver CO 80204

M. Flanagan
Project Number: A20-0986
Project: Madison Fields

GEO-30. 1-2.5ft
4/21/2020 12:00:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes

GEL Laboratories, LLC
Y005088-07 (Soil)

Anions by EPA 300.0

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes
Chloride	**2.67**	2.38	mg/kg dry	1	1996469	JLD1	05/12/2020	05/12/2020	
Sulfate	**8.08**	4.76	"	"	"	JLD1	"	"	

Origins Laboratory, Inc.

Jordan A. Merrill For Jen Pellegrini, Project Manager

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ORIGINS LABORATORY, INC

Olsson Associates
1525 Raleigh St, Suite 400
Denver CO 80204

M. Flanagan
Project Number: A20-0986
Project: Madison Fields

GEO-32. 1-2.5ft
4/18/2020 12:00:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes

GEL Laboratories, LLC
Y005088-08 (Soil)

Anions by EPA 300.0

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes
Chloride	**4.54**	2.75	mg/kg dry	1	1996469	JLD1	05/12/2020	05/12/2020	
Sulfate	**14.3**	5.50	"	"	"	JLD1	"	"	

Origins Laboratory, Inc.

Jordan A. Merrill For Jen Pellegrini, Project Manager

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Olsson Associates
1525 Raleigh St, Suite 400
Denver CO 80204

M. Flanagan
Project Number: A20-0986
Project: Madison Fields

GEO-34. 3.5-5ft
4/22/2020 12:00:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes

GEL Laboratories, LLC
Y005088-09 (Soil)

Anions by EPA 300.0

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes
Chloride	**3.43**	2.25	mg/kg dry	1	1996469	JLD1	05/12/2020	05/12/2020	
Sulfate	**4.16**	4.51	"	"	"	JLD1	"	"	J

Origins Laboratory, Inc.

Jordan A. Merrill For Jen Pellegrini, Project Manager

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ORIGINS LABORATORY, INC

Olsson Associates	M. Flanagan
1525 Raleigh St, Suite 400	Project Number: A20-0986
Denver CO 80204	Project: Madison Fields

GEO-35. 6-7.5ft
4/22/2020 12:00:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes
GEL Laboratories, LLC									
Y005088-10 (Soil)									
Anions by EPA 300.0									
Chloride	**4.04**	2.22	mg/kg dry	1	1996469	JLD1	05/12/2020	05/12/2020	
Sulfate	**8.79**	4.44	"	"	"	JLD1	"	"	

Origins Laboratory, Inc.

Jordan A. Merrill For Jen Pellegrini, Project Manager

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Olsson Associates
1525 Raleigh St, Suite 400
Denver CO 80204

M. Flanagan
Project Number: A20-0986
Project: Madison Fields

GEO-40. 1-2.5ft
4/27/2020 12:00:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes

GEL Laboratories, LLC
Y005088-11 (Soil)

Anions by EPA 300.0

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes
Chloride	**7.09**	2.45	mg/kg dry	1	1996695	JLD1	05/12/2020	05/13/2020	
Sulfate	**4.16**	4.90	"	"	"	JLD1	"	"	J

Origins Laboratory, Inc.

Jordan A. Merrill For Jen Pellegrini, Project Manager

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ORIGINS LABORATORY, INC

Olsson Associates
1525 Raleigh St, Suite 400
Denver CO 80204

M. Flanagan
Project Number: A20-0986
Project: Madison Fields

GEO-45. 1-2.5ft
4/21/2020 12:00:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes

GEL Laboratories, LLC
Y005088-12 (Soil)

Anions by EPA 300.0

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes
Chloride	**3.89**	2.48	mg/kg dry	1	1996695	JLD1	05/12/2020	05/13/2020	
Sulfate	**6.56**	4.96	"	"	"	JLD1	"	"	

Origins Laboratory, Inc.

Jordan A. Merrill For Jen Pellegrini, Project Manager

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Olsson Associates
1525 Raleigh St, Suite 400
Denver CO 80204

M. Flanagan
Project Number: A20-0986
Project: Madison Fields

GEO-47. 6-7.5ft
4/21/2020 12:00:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes

GEL Laboratories, LLC
Y005088-13 (Soil)

Anions by EPA 300.0

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes
Chloride	**7.20**	2.28	mg/kg dry	1	1996695	JLD1	05/12/2020	05/13/2020	
Sulfate	**17.5**	4.57	"	"	"	JLD1	"	"	

Origins Laboratory, Inc.

Jordan A. Merrill For Jen Pellegrini, Project Manager

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Olsson Associates
1525 Raleigh St, Suite 400
Denver CO 80204

M. Flanagan
Project Number: A20-0986
Project: Madison Fields

GEO-55. 3.5-5ft
4/20/2020 12:00:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes

GEL Laboratories, LLC
Y005088-14 (Soil)

Anions by EPA 300.0

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes
Chloride	**3.73**	2.41	mg/kg dry	1	1996695	JLD1	05/12/2020	05/13/2020	
Sulfate	**3.55**	4.83	"	"	"	JLD1	"	"	J

Origins Laboratory, Inc.

Jordan A. Merrill For Jen Pellegrini, Project Manager

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ORIGINS LABORATORY, INC

Olsson Associates
1525 Raleigh St, Suite 400
Denver CO 80204

M. Flanagan
Project Number: A20-0986
Project: Madison Fields

GEO-58. 1-2.5ft
4/28/2020 12:00:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes

GEL Laboratories, LLC
Y005088-15 (Soil)

Anions by EPA 300.0

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes
Chloride	**4.32**	2.65	mg/kg dry	1	1996695	JLD1	05/12/2020	05/13/2020	
Sulfate	**5.12**	5.30	"	"	"	JLD1	"	"	J

Origins Laboratory, Inc.

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Jordan A. Merrill For Jen Pellegrini, Project Manager

Olsson Associates
1525 Raleigh St, Suite 400
Denver CO 80204

M. Flanagan
Project Number: A20-0986
Project: Madison Fields

GEO-64. 1-2.5ft
4/24/2020 12:00:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes

GEL Laboratories, LLC
Y005088-16 (Soil)

Anions by EPA 300.0

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes
Chloride	**6.98**	2.61	mg/kg dry	1	1996695	JLD1	05/12/2020	05/13/2020	
Sulfate	**10.9**	5.21	"	"	"	JLD1	"	"	

Origins Laboratory, Inc.

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Jordan A. Merrill For Jen Pellegrini, Project Manager

Olsson Associates
1525 Raleigh St, Suite 400
Denver CO 80204

M. Flanagan
Project Number: A20-0986
Project: Madison Fields

GEO-68. 1-2.5ft
4/20/2020 12:00:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes

GEL Laboratories, LLC
Y005088-17 (Soil)

Anions by EPA 300.0

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes
Chloride	**2.85**	2.59	mg/kg dry	1	1996695	JLD1	05/12/2020	05/13/2020	
Sulfate	**7.59**	5.18	"	"	"	JLD1	"	"	

Origins Laboratory, Inc.

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Jordan A. Merrill For Jen Pellegrini, Project Manager

Olsson Associates
1525 Raleigh St, Suite 400
Denver CO 80204

M. Flanagan
Project Number: A20-0986
Project: Madison Fields

GEO-73. 1-2.5ft
4/29/2020 12:00:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes

GEL Laboratories, LLC
Y005088-18 (Soil)

Anions by EPA 300.0

Chloride	**4.84**	2.60	mg/kg dry	1	1996695	JLD1	05/12/2020	05/13/2020	
Sulfate	**9.64**	5.20	"	"	"	JLD1	"	"	

Origins Laboratory, Inc.

Jordan A. Merrill For Jen Pellegrini, Project Manager

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ORIGINS LABORATORY, INC

Olsson Associates
1525 Raleigh St, Suite 400
Denver CO 80204

M. Flanagan
Project Number: A20-0986
Project: Madison Fields

GEO-74. 1-2.5ft
4/29/2020 12:00:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes

GEL Laboratories, LLC
Y005088-19 (Soil)

Anions by EPA 300.0

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes
Chloride	**2.03**	2.49	mg/kg dry	1	1996695	JLD1	05/12/2020	05/13/2020	J
Sulfate	**18.7**	4.98	"	"	"	JLD1	"	"	

Origins Laboratory, Inc.

JMerrill

Jordan A. Merrill For Jen Pellegrini, Project Manager

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ORIGINS LABORATORY, INC

Olsson Associates
1525 Raleigh St, Suite 400
Denver CO 80204

M. Flanagan
Project Number: A20-0986
Project: Madison Fields

GEO-77. 3.5-5ft
4/24/2020 12:00:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes

GEL Laboratories, LLC
Y005088-20 (Soil)

Anions by EPA 300.0

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes
Chloride	**2.39**	2.44	mg/kg dry	1	1996695	JLD1	05/12/2020	05/13/2020	J
Sulfate	**12.4**	4.88	"	"	"	JLD1	"	"	

Origins Laboratory, Inc.

Jordan A. Merrill For Jen Pellegrini, Project Manager

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Olsson Associates
1525 Raleigh St, Suite 400
Denver CO 80204

M. Flanagan
Project Number: A20-0986
Project: Madison Fields

GEO-80. 3.5-5ft
4/27/2020 12:00:00AM

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes

GEL Laboratories, LLC
Y005088-21 (Soil)

Anions by EPA 300.0

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Analyst	Prepared	Analyzed	Notes
Chloride	**2.73**	2.20	mg/kg dry	1	1996695	JLD1	05/12/2020	05/13/2020	
Sulfate	**4.97**	4.39	"	"	"	JLD1	"	"	

Origins Laboratory, Inc.

Jordan A. Merrill For Jen Pellegrini, Project Manager

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ORIGINS LABORATORY, INC

Olsson Associates	M. Flanagan
1525 Raleigh St, Suite 400	Project Number: A20-0986
Denver CO 80204	Project: Madison Fields

Anions by EPA 300.0 - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1996695 - EPA 300.0 PREP										
BLANK (1204560264-BLK)					Prepared: 05/12/2020 Analyzed: 05/13/2020					
Chloride	ND	1.99	mg/kg				-			U
Sulfate	ND	3.98	"				-			U
LCS (1204560265-BKS)					Prepared: 05/12/2020 Analyzed: 05/13/2020					
Sulfate	101	4.03	mg/kg	101		100	90-110			
Chloride	49.5	2.02	"	50.4		98.3	90-110			
DUP (1204560267 D)		**Source: Y005088-11**			Prepared: 05/12/2020 Analyzed: 05/13/2020					
Sulfate	3.97	5.06	mg/kg dry		4.16		0-101	4.47	101	J
Chloride	3.17	2.53	"		7.09		0-90	76.5	90	
MS (1204560269 S)		**Source: Y005088-11**			Prepared: 05/12/2020 Analyzed: 05/13/2020					
Chloride	63.4	2.48	mg/kg dry	62.1	7.09	90.6	90-110			
Sulfate	128	4.97	"	124	4.16	99.7	90-110			

Origins Laboratory, Inc.

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Jordan A. Merrill For Jen Pellegrini, Project Manager

Olsson Associates
1525 Raleigh St, Suite 400
Denver CO 80204

M. Flanagan
Project Number: A20-0986
Project: Madison Fields

Anions by EPA 300.0 - Quality Control
GEL Laboratories, LLC

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Batch 1996469 - EPA 300.0 PREP										
BLANK (1204559729-BLK)					Prepared: 05/12/2020 Analyzed: 05/12/2020					
Sulfate	ND	3.99	mg/kg				-			U
Chloride	ND	2.00	"				-			U
LCS (1204559730-BKS)					Prepared: 05/12/2020 Analyzed: 05/12/2020					
Sulfate	99.8	3.97	mg/kg	99.3		101	90-110			
Chloride	49.2	1.99	"	49.6		99.1	90-110			
DUP (1204559731 D)		**Source: Y005088-01**			Prepared: 05/12/2020 Analyzed: 05/12/2020					
Sulfate	4.47	4.97	mg/kg dry		5.32		0-101	17.5	101	J
Chloride	4.02	2.49	"		3.82		0-90	5.11	90	
MS (1204559733 S)		**Source: Y005088-01**			Prepared: 05/12/2020 Analyzed: 05/12/2020					
Sulfate	127	4.91	mg/kg dry	123	5.32	99	90-110			
Chloride	63.9	2.46	"	61.4	3.82	97.9	90-110			

Origins Laboratory, Inc.

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Jordan A. Merrill For Jen Pellegrini, Project Manager

Olsson Associates
1525 Raleigh St, Suite 400
Denver CO 80204

M. Flanagan
Project Number: A20-0986
Project: Madison Fields

Notes and Definitions

U	Result not detected above the detection limit
J	Greater than the detection limit but less than the reporting limit
ND	Analyte NOT DETECTED at or above the reporting limit
RPD	Relative Percent Difference

All soil results are reported at a wet weight basis.

Origins Laboratory, Inc.

Jmerrill

Jordan A. Merrill For Jen Pellegrini, Project Manager

The results in this report apply to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

APPENDIX F

ELECTRICAL RESISTIVITY REPORT

May 20, 2020

Madison Fields Solar Project, LLC
Attn: Mr. Jonathan Dimitriou
422 Admiral Blvd
Kansas City, Missouri 64106

Re: Electrical Resistivity Testing Results
Madison Fields Solar Project
Madison County, Ohio
Olsson Project No. 020-0986

Dear Mr. Dimitriou:

Olsson, Inc. (Olsson), under contract and authorization with Madison Fields Solar Project, LLC (Madison Fields) performed soil electrical resistivity measurements at the Madison Fields Solar Project in May of 2020. This letter presents the methods and results.

Methods

A total of twenty-one (21) electrical resistivity tests were performed by Olsson at the project site. Of those, nineteen (19) were performed at proposed solar array locations, and one was performed at each of the two proposed substation locations (GEO-73 and GEO-74). Test locations were provided to Olsson by Madison Fields prior to beginning the investigation. Test locations were staked in the field by Olsson prior to the investigation. All tests were centered as close to the proposed test location as possible while trying to avoid ground disturbed by geotechnical borings and test piles. The test locations, coordinates of each test location, and other pertinent information are provided in Table 1.

Olsson conducted the work in accordance with ASTM method G57 "Standard Test Method for Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method" (equivalent to IEEE Std. 81).

At the test locations, a single resistivity array orientation was utilized, and resistivity measurements were obtained. Each measurement for the solar array locations corresponded to one of the following electrode ("a") spacings: 0.5, 1, 1.5, 2, 3, 5, 7, 10, 15, 20, 30, 45, 70, 100, 150 and 200 feet. At the substation locations, an additional "a" spacing of 300 feet was performed. After one set of readings were taken, the array orientation was then rotated approximately 90 degrees with measurements taken at the same "a" spacings.

The equipment used to collect the data consisted of a resistivity meter, four metal electrodes and connecting wire. The meter used for the investigation was a SuperSting R1+ manufactured by Advanced Geosciences, Inc. The resistivity meter reads resistance (Ω) directly, but records the electric potential (V) and inductance (I). The meter outputs the apparent resistivity (ρa) for a given "a" spacing

Table 1: Testing Conditions and Coordinates

Structure Type	Geotechnical ID	Geographic Coordinates [NAD83]	
		Latitude (degrees)	Longitude (degrees)
Solar Array	GEO-02	40.10292	-83.48532
Solar Array	GEO-06	40.09417	-83.49264
Solar Array	GEO-09	40.08507	-83.49308
Solar Array	GEO-15	40.09857	-83.48755
Solar Array	GEO-17	40.09896	-83.48102
Solar Array	GEO-22	40.09624	-83.47375
Solar Array	GEO-30	40.07617	-83.48048
Solar Array	GEO-32	40.09377	-83.48601
Solar Array	GEO-34	40.08932	-83.48343
Solar Array	GEO-35	40.08467	-83.48097
Solar Array	GEO-40	40.08194	-83.46848
Solar Array	GEO-45	40.07301	-83.47360
Solar Array	GEO-47	40.06915	-83.47064
Solar Array	GEO-55	40.09189	-83.47786
Solar Array	GEO-58	40.08700	-83.47158
Solar Array	GEO-64	40.08191	-83.47489
Solar Array	GEO-68	40.08932	-83.48933
Substation	GEO-73	40.09070	-83.47043
Substation	GEO-74	40.07990	-83.48725
Solar Array	GEO-77	40.07685	-83.49095
Solar Array	GEO-80	40.07677	-83.46533

Co-linear arrays of four electrodes were placed in the ground for each measurement. Electrical current was input to the ground through the two outer electrodes of the array. The voltage drop produced by the resulting electrical field was measured across the two inner electrodes. The "a" spacing was increased with each measurement, expanding the array about a common center. Increasing the electrode separation increases the depth of investigation, and indicates vertical variation in resistivity.

In order to check the accuracy of the single resistivity array, a perpendicular array was set up at each test location for all electrode spacings.

Apparent resistivity (ρ_a) was calculated for each measurement and corresponding electrode spacing (a) using the resistance measurement (Ω) and the geometric factor (K) as follows:

$$\rho_a = K(V/I)$$

where:

$$K = 2\pi a$$

The field results and calculated values are presented in the attachments.

Results and Discussion

Apparent resistivity measurements for the proposed solar array locations ranged from 1,724 to 40,874 ohm-centimeters (Ω-cm), with an average of 6,462 Ω-cm. Measurements at the proposed substation locations ranged from 2,622 to 45,964 Ω-cm with an average of 9,388 Ω-cm. Detailed results for the tested locations are attached to this letter report and summarized in Table 2.

Soil resistivity variations are likely associated with differences in soil type, layer thicknesses, and degree of water saturation in the near surface soils. Higher moisture contents and higher clay contents generally reduce the electrical resistivity of a soil. Generally, the apparent resistivity results were lower at smaller electrode spacings and higher at larger electrode spacings.

Apparent resistivity test results below 2,000 Ω-cm indicate that the soil could be considered corrosive to metal foundations placed in direct contact with the soil. Test results indicated that most apparent resistivities resulted in values higher than this 2,000 Ω-cm value, but testing had not yet been fully completed at the time of this letter. The foundation designer should select appropriate protection for the foundations.

Table 2: Apparent Resistivity versus Electrode Spacing for Solar Array and Substation Locations

Electrode Spacing [feet]	Apparent Resistivity [Ω-cm]		
	Range	Mean	Standard Deviation
0.5	1783 - 6818	3,436	910
1	1724 - 6239	3,431	828
1.5	1992 - 4822	3,315	601
2	2058 - 4974	3,389	611
3	2226 - 5054	3,565	711
5	2733 - 5846	4,046	805
7	3286 - 6443	4,520	902
10	3395 - 6803	5,102	891
15	3706 - 7090	5,805	900
20	4100 - 7977	6,461	949
30	4990 - 10058	7,084	1,147
45	5678 - 14533	7,864	2,165
70	5837 - 20181	9,034	3,795
100	5968 - 26237	10,424	5,514
150	6319 - 34229	12,934	7,423
200	7126 - 40874	15,782	8,933
300	15106 - 45964	26,758	14,439

Closing
Thank you for the opportunity to provide this service. Please call me at 303-237-2072 with questions or requests for additional information.

Sincerely,

Michael Flanagan, E.I.

Attachments:

Figure 1: Electrical Resistivity Testing Locations
Electrical Resistivity Test Results

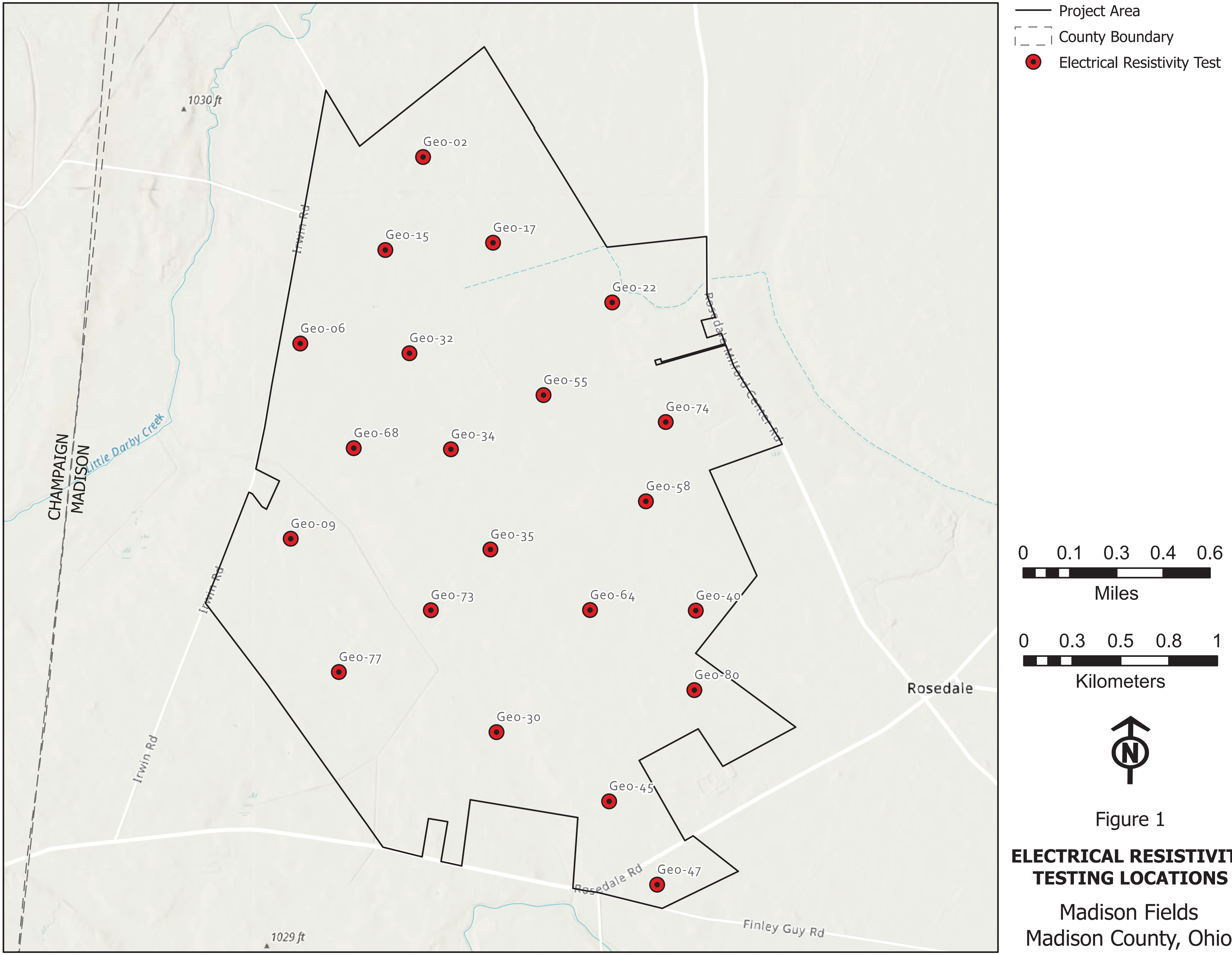

Figure 1

ELECTRICAL RESISTIVITY TESTING LOCATIONS

Madison Fields
Madison County, Ohio

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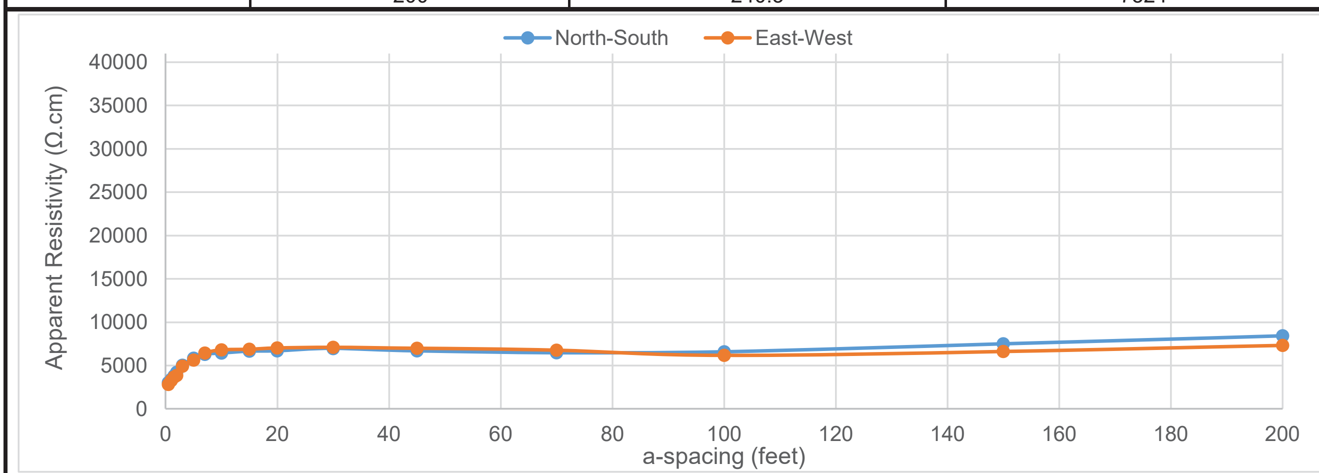
Field Electrical Resistivity Results

Project name:	Madison Fields	Test date:	5/4/2020
Project number:	020-0986	Test Location:	GEO-02
Project location:	Madison County, Ohio	Outside temperature:	57 F
Equipment model:	Supersting	Surface ground condition:	Moist
Test Method:	Wenner 4-electrode	Technician:	B. Tabor

Array direction	a-spacing (feet)	Apparent Resistivity (Ω.ft)	Apparent Resistivity (Ω.cm)
North-South	0.5	99.84	3043
	1	112.3	3423
	1.5	125.0	3810
	2	138.9	4234
	3	165.8	5054
	5	191.8	5846
	7	207.0	6309
	10	211.5	6447
	15	218.6	6663
	20	220.4	6718
	30	228.9	6977
	45	219.8	6700
	70	212.8	6486
	100	216.7	6605
	150	245.9	7495
	200	276.4	8425
East-West	0.5	92.86	2830
	1	107.8	3286
	1.5	121.1	3691
	2	126.2	3847
	3	161.2	4913
	5	184.8	5633
	7	211.4	6443
	10	223.2	6803
	15	225.3	6867
	20	230.4	7023
	30	232.7	7093
	45	229.5	6995
	70	222.0	6767
	100	202.5	6172
	150	217.0	6614
	200	240.3	7324



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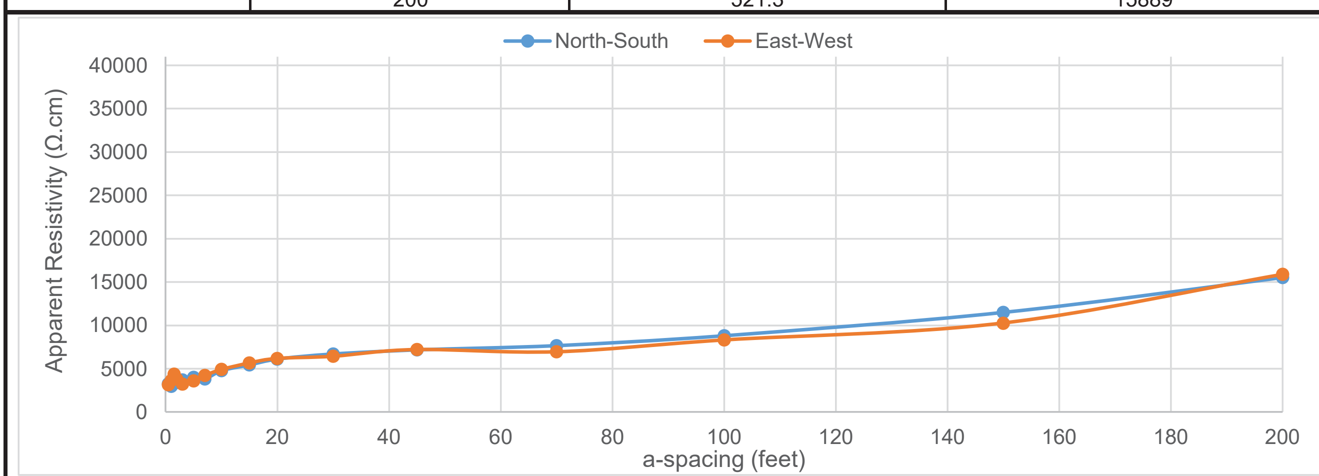
Field Electrical Resistivity Results

Project name:	Madison Fields	Test date:	5/6/2020
Project number:	020-0986	Test Location:	GEO-06
Project location:	Madison County, Ohio	Outside temperature:	56 F
Equipment model:	Supersting	Surface ground condition:	Moist
Test Method:	Wenner 4-electrode	Technician:	B. Tabor

Array direction	a-spacing (feet)	Apparent Resistivity (Ω.ft)	Apparent Resistivity (Ω.cm)
North-South	0.5	106.9	3258
	1	97.40	2969
	1.5	108.1	3295
	2	118.7	3618
	3	122.2	3725
	5	131.6	4011
	7	125.1	3813
	10	156.6	4773
	15	178.3	5435
	20	200.4	6108
	30	219.7	6696
	45	235.1	7166
	70	251.9	7678
	100	289.4	8821
	150	376.7	11482
	200	509.2	15520
East-West	0.5	103.6	3158
	1	119.6	3645
	1.5	143.9	4386
	2	125.4	3822
	3	106.4	3243
	5	118.7	3618
	7	139.1	4240
	10	161.3	4916
	15	186.0	5669
	20	202.9	6184
	30	211.3	6440
	45	236.8	7218
	70	227.9	6946
	100	273.2	8327
	150	336.7	10263
	200	521.3	15889



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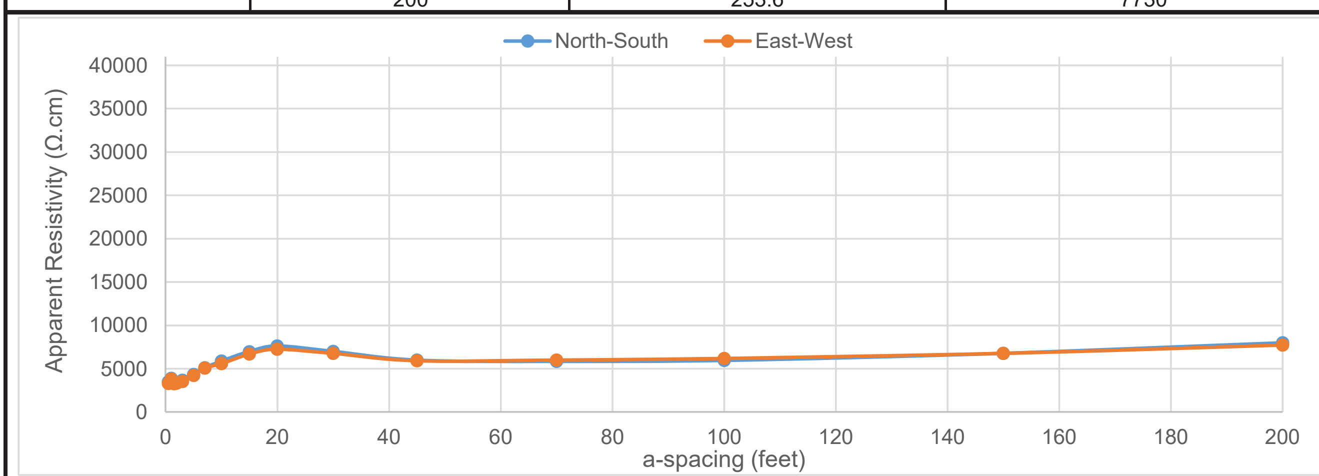
Field Electrical Resistivity Results

Project name:	Madison Fields	Test date:	5/6/2020
Project number:	020-0986	Test Location:	GEO-09
Project location:	Madison County, Ohio	Outside temperature:	49 F
Equipment model:	Supersting	Surface ground condition:	Moist
Test Method:	Wenner 4-electrode	Technician:	B. Tabor

Array direction	a-spacing (feet)	Apparent Resistivity (Ω.ft)	Apparent Resistivity (Ω.cm)
North-South	0.5	114.0	3475
	1	127.4	3883
	1.5	116.2	3542
	2	112.1	3417
	3	120.8	3682
	5	142.6	4346
	7	167.9	5118
	10	192.6	5870
	15	228.9	6977
	20	249.8	7614
	30	230.0	7010
	45	196.4	5986
	70	191.5	5837
	100	195.8	5968
	150	222.7	6788
	200	262.8	8010
East-West	0.5	108.3	3301
	1	125.0	3810
	1.5	107.4	3274
	2	109.6	3341
	3	115.1	3508
	5	139.2	4243
	7	166.3	5069
	10	183.5	5593
	15	219.6	6693
	20	237.8	7248
	30	221.8	6760
	45	194.0	5913
	70	196.7	5995
	100	203.1	6190
	150	222.3	6776
	200	253.6	7730



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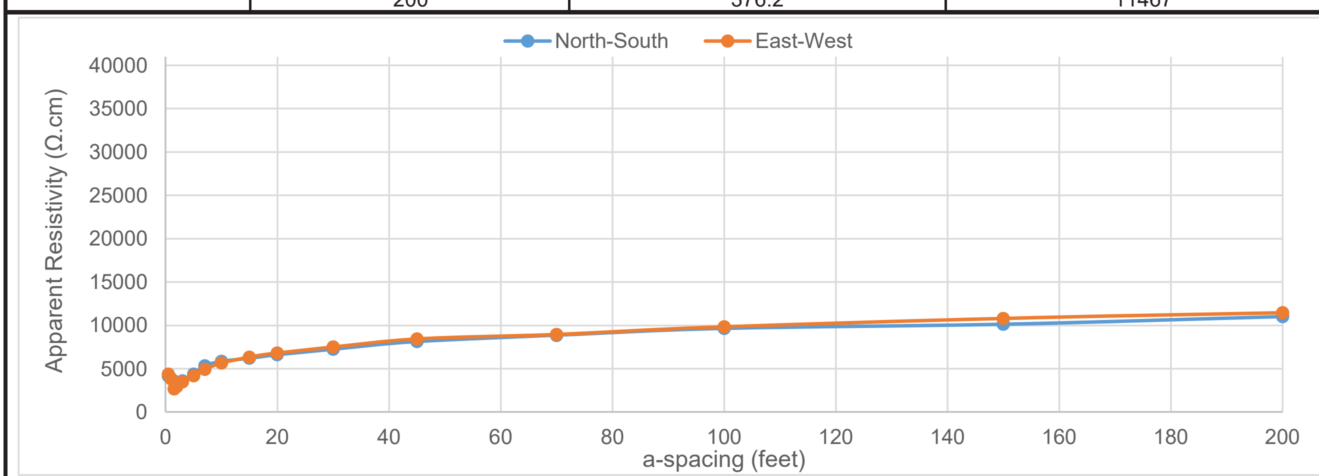
Field Electrical Resistivity Results

Project name:	Madison Fields	Test date:	5/4/2020
Project number:	020-0986	Test Location:	GEO-15
Project location:	Madison County, Ohio	Outside temperature:	63 F
Equipment model:	Supersting	Surface ground condition:	Moist
Test Method:	Wenner 4-electrode	Technician:	B. Tabor

Array direction	a-spacing (feet)	Apparent Resistivity (Ω.ft)	Apparent Resistivity (Ω.cm)
North-South	0.5	136.7	4167
	1	126.2	3847
	1.5	117.3	3575
	2	101.8	3103
	3	118.7	3618
	5	143.1	4362
	7	175.4	5346
	10	192.4	5864
	15	203.9	6215
	20	217.1	6617
	30	237.8	7248
	45	267.0	8138
	70	290.7	8861
	100	317.1	9665
	150	332.6	10138
	200	361.4	11015
East-West	0.5	143.7	4380
	1	125.9	3837
	1.5	87.5	2667
	2	95.8	2920
	3	115.0	3505
	5	137.6	4194
	7	161.8	4932
	10	185.6	5657
	15	208.1	6343
	20	223.7	6818
	30	245.9	7495
	45	276.8	8437
	70	294.0	8961
	100	322.6	9833
	150	354.7	10811
	200	376.2	11467



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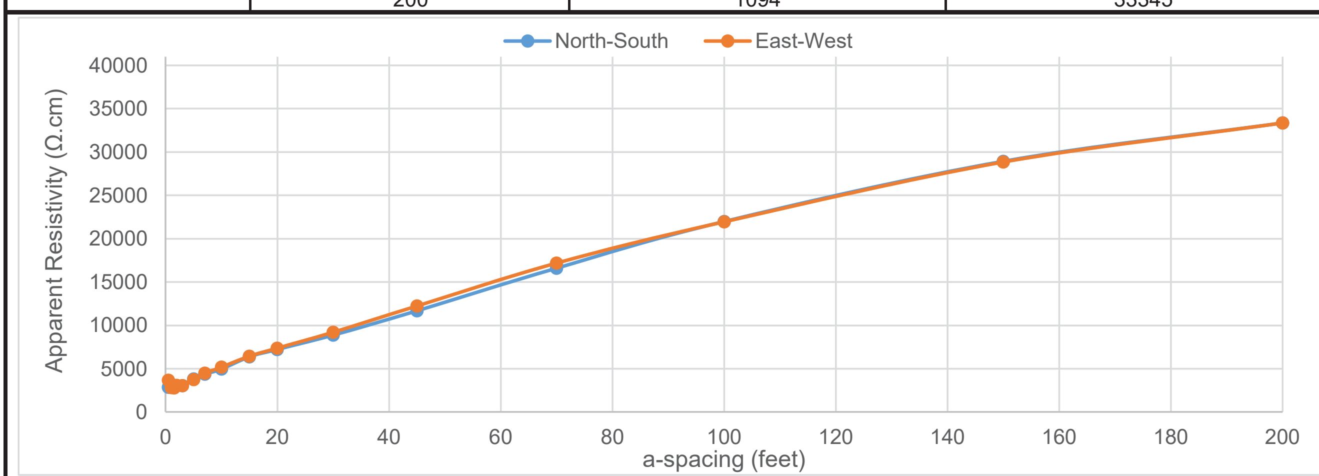
Field Electrical Resistivity Results

Project name:	Madison Fields	Test date:	5/12/2020
Project number:	020-0986	Test Location:	GEO-17
Project location:	Madison County, Ohio	Outside temperature:	54 F
Equipment model:	Supersting	Surface ground condition:	Moist
Test Method:	Wenner 4-electrode	Technician:	B. Tabor

Array direction	a-spacing (feet)	Apparent Resistivity (Ω.ft)	Apparent Resistivity (Ω.cm)
North-South	0.5	94.11	2868
	1	98.56	3004
	1.5	101.5	3094
	2	99.92	3046
	3	100.2	3054
	5	125.3	3819
	7	143.8	4383
	10	162.9	4965
	15	209.5	6386
	20	237.3	7233
	30	291.3	8879
	45	383.4	11686
	70	544.7	16602
	100	721.2	21982
	150	949.3	28935
	200	1094	33345
East-West	0.5	120.3	3667
	1	93.02	2835
	1.5	91.56	2791
	2	100.8	3072
	3	99.36	3028
	5	122.4	3731
	7	147.0	4481
	10	170.1	5185
	15	211.2	6437
	20	241.9	7373
	30	302.0	9205
	45	401.8	12247
	70	563.7	17182
	100	720.4	21958
	150	946.4	28846
	200	1094	33345



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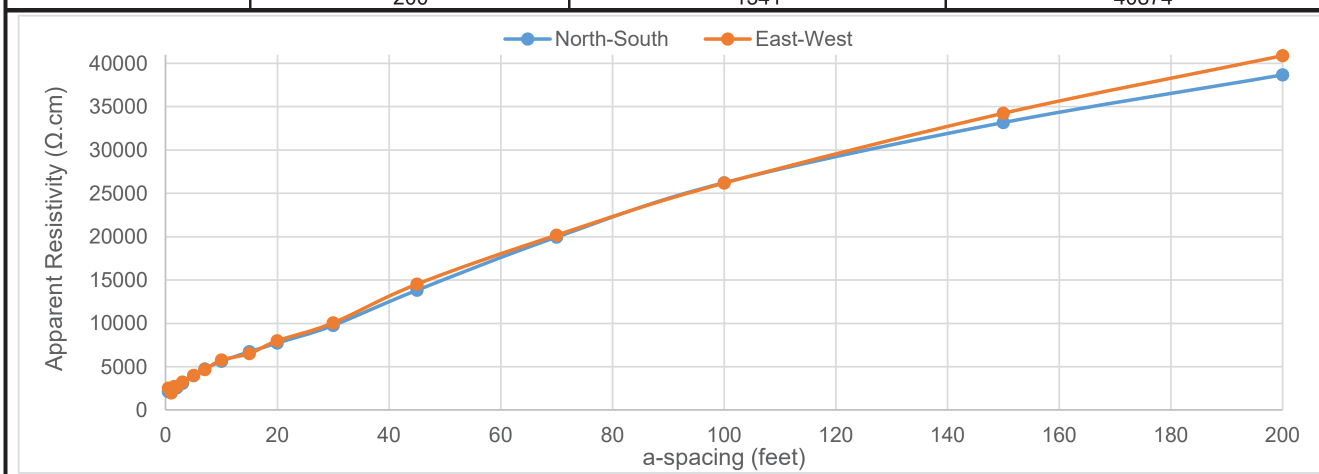
Field Electrical Resistivity Results

Project name:	Madison Fields	Test date:	5/17/2020
Project number:	020-0986	Test Location:	GEO-22
Project location:	Madison County, Ohio	Outside temperature:	79 F
Equipment model:	Supersting	Surface ground condition:	Moist
Test Method:	Wenner 4-electrode	Technician:	B. Tabor

Array direction	a-spacing (feet)	Apparent Resistivity (Ω.ft)	Apparent Resistivity (Ω.cm)
North-South	0.5	69.57	2120
	1	79.20	2414
	1.5	81.91	2497
	2	84.62	2579
	3	101.5	3094
	5	129.9	3959
	7	155.2	4730
	10	184.4	5621
	15	220.6	6724
	20	253.7	7733
	30	320.3	9763
	45	453.8	13832
	70	654.3	19943
	100	860.8	26237
	150	1088	33162
	200	1269	38679
East-West	0.5	83.17	2535
	1	65.27	1989
	1.5	88.90	2710
	2	89.18	2718
	3	105.4	3213
	5	131.7	4014
	7	153.6	4682
	10	189.1	5764
	15	213.9	6520
	20	261.7	7977
	30	330.0	10058
	45	476.8	14533
	70	662.1	20181
	100	859.4	26195
	150	1123	34229
	200	1341	40874



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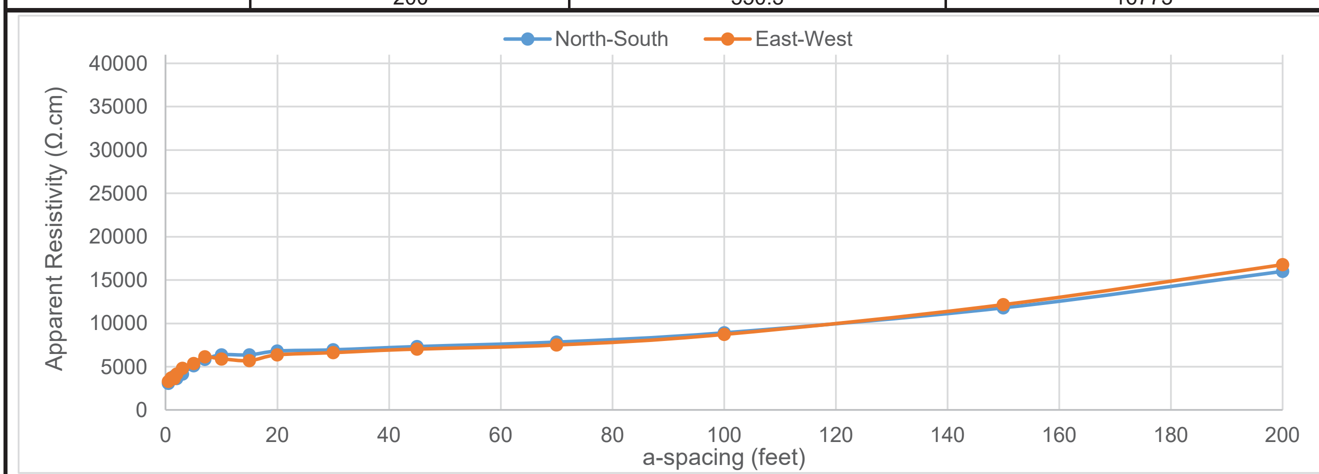
Field Electrical Resistivity Results

Project name:	Madison Fields	Test date:	5/7/2020
Project number:	020-0986	Test Location:	GEO-30
Project location:	Madison County, Ohio	Outside temperature:	66 F
Equipment model:	Supersting	Surface ground condition:	Moist
Test Method:	Wenner 4-electrode	Technician:	B. Tabor

Array direction	a-spacing (feet)	Apparent Resistivity (Ω.ft)	Apparent Resistivity (Ω.cm)
North-South	0.5	101.6	3097
	1	117.4	3578
	1.5	128.2	3908
	2	119.7	3648
	3	136.2	4151
	5	168.3	5130
	7	191.6	5840
	10	209.2	6376
	15	208.7	6361
	20	223.4	6809
	30	227.9	6946
	45	240.0	7315
	70	257.2	7839
	100	292.4	8912
	150	387.4	11808
	200	524.7	15993
East-West	0.5	108.2	3298
	1	121.5	3703
	1.5	118.9	3624
	2	136.4	4157
	3	157.9	4813
	5	176.4	5377
	7	201.7	6148
	10	193.8	5907
	15	187.4	5712
	20	208.6	6358
	30	217.6	6632
	45	231.2	7047
	70	245.9	7495
	100	286.4	8729
	150	398.8	12155
	200	550.3	16773



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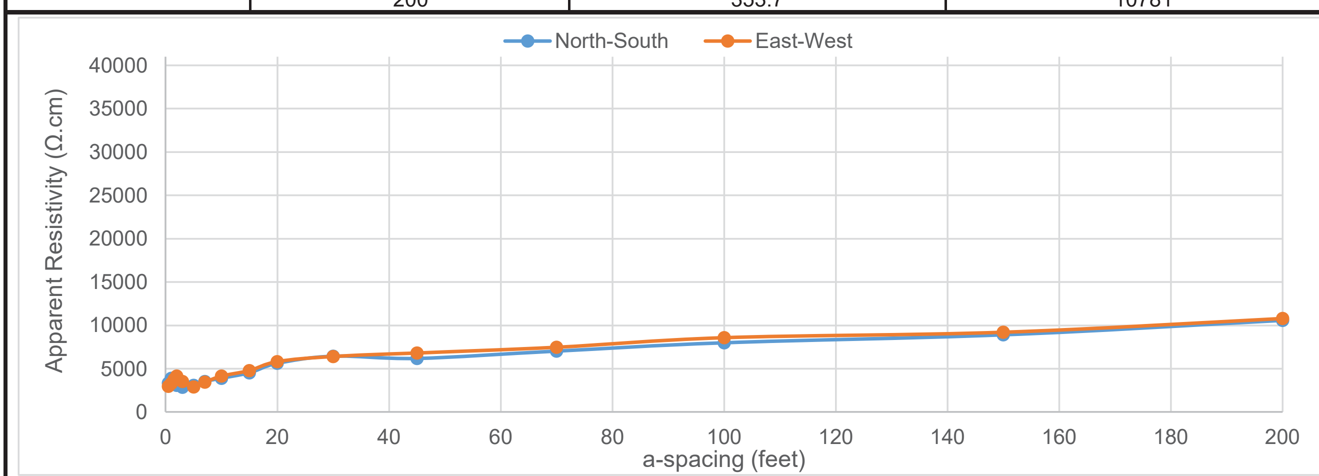
Field Electrical Resistivity Results

Project name:	Madison Fields	Test date:	5/6/2020
Project number:	020-0986	Test Location:	GEO-32
Project location:	Madison County, Ohio	Outside temperature:	58 F
Equipment model:	Supersting	Surface ground condition:	Moist
Test Method:	Wenner 4-electrode	Technician:	B. Tabor

Array direction	a-spacing (feet)	Apparent Resistivity (Ω.ft)	Apparent Resistivity (Ω.cm)
North-South	0.5	109.2	3328
	1	128.4	3914
	1.5	113.6	3463
	2	101.4	3091
	3	93.62	2854
	5	101.1	3082
	7	116.2	3542
	10	128.3	3911
	15	148.7	4532
	20	184.3	5617
	30	211.6	6450
	45	203.4	6200
	70	231.0	7041
	100	262.5	8001
	150	292.3	8909
	200	347.1	10580
East-West	0.5	97.41	2969
	1	108.7	3313
	1.5	123.6	3767
	2	136.1	4148
	3	115.7	3527
	5	94.8	2890
	7	112.8	3438
	10	136.0	4145
	15	157.3	4795
	20	191.0	5822
	30	210.5	6416
	45	223.8	6821
	70	245.1	7471
	100	281.9	8592
	150	302.4	9217
	200	353.7	10781



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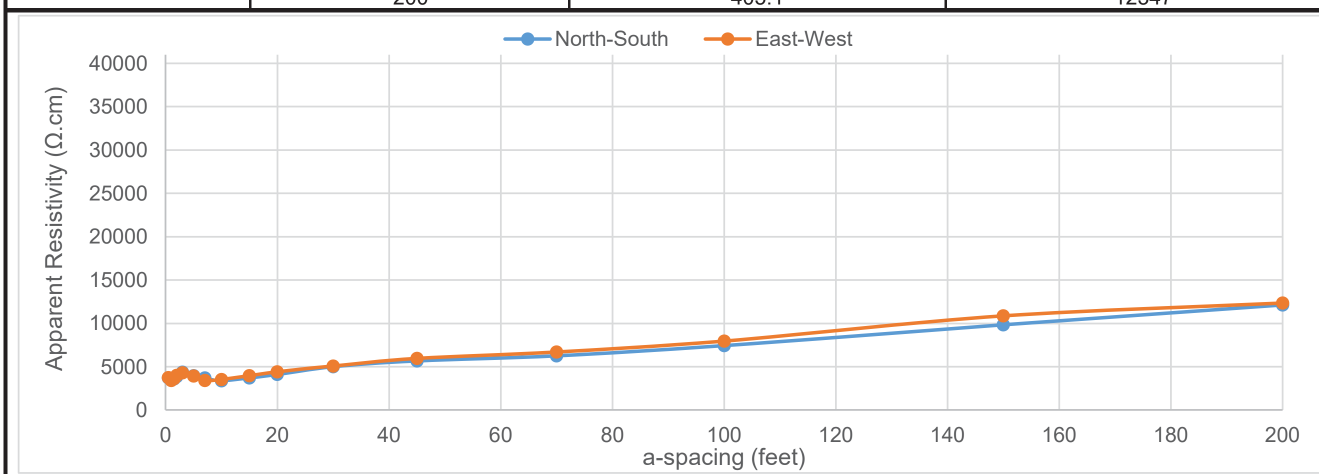
Field Electrical Resistivity Results

Project name:	Madison Fields	Test date:	5/6/2020
Project number:	020-0986	Test Location:	GEO-34
Project location:	Madison County, Ohio	Outside temperature:	60 F
Equipment model:	Supersting	Surface ground condition:	Moist
Test Method:	Wenner 4-electrode	Technician:	B. Tabor

Array direction	a-spacing (feet)	Apparent Resistivity (Ω.ft)	Apparent Resistivity (Ω.cm)
North-South	0.5	121.6	3706
	1	113.5	3459
	1.5	118.2	3603
	2	126.0	3840
	3	143.7	4380
	5	130.1	3965
	7	121.3	3697
	10	111.4	3395
	15	121.6	3706
	20	134.5	4100
	30	163.7	4990
	45	186.3	5678
	70	205.1	6251
	100	243.9	7434
	150	322.3	9824
	200	398.1	12134
East-West	0.5	123.1	3752
	1	112.1	3417
	1.5	119.7	3648
	2	131.1	3996
	3	140.7	4289
	5	128.6	3920
	7	112.3	3423
	10	115.8	3530
	15	130.0	3962
	20	145.1	4423
	30	167.1	5093
	45	195.4	5956
	70	220.0	6706
	100	261.5	7971
	150	356.3	10860
	200	405.1	12347



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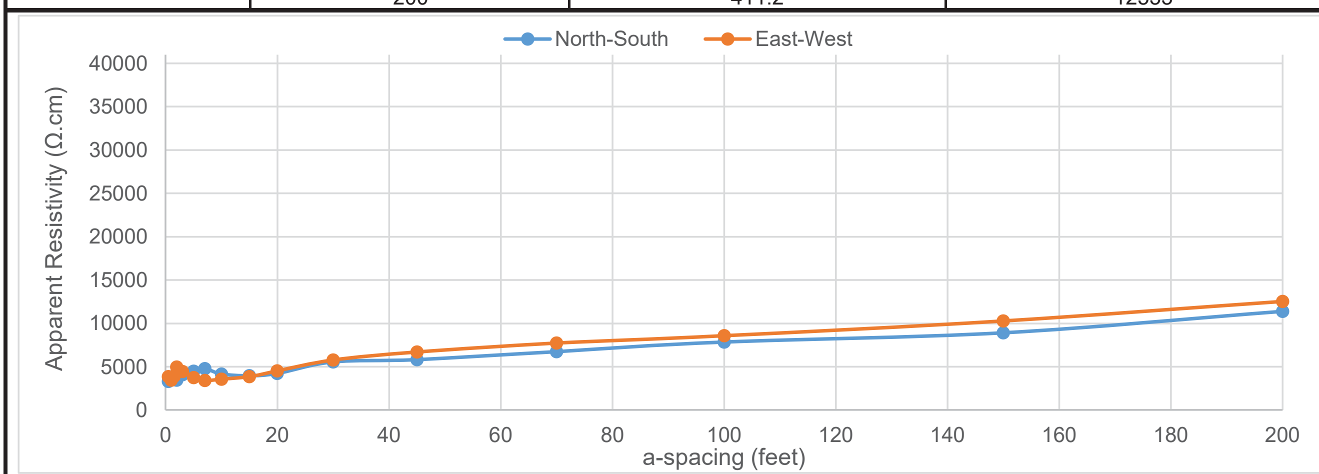
Field Electrical Resistivity Results

Project name:	Madison Fields	Test date:	5/9/2020
Project number:	020-0986	Test Location:	GEO-35
Project location:	Madison County, Ohio	Outside temperature:	47 F
Equipment model:	Supersting	Surface ground condition:	Moist
Test Method:	Wenner 4-electrode	Technician:	B. Tabor

Array direction	a-spacing (feet)	Apparent Resistivity (Ω.ft)	Apparent Resistivity (Ω.cm)
North-South	0.5	108.7	3313
	1	114.6	3493
	1.5	128.7	3923
	2	112.8	3438
	3	134.3	4093
	5	147.2	4487
	7	156.9	4782
	10	136.7	4167
	15	129.7	3953
	20	138.6	4225
	30	182.4	5560
	45	191.2	5828
	70	221.6	6754
	100	257.8	7858
	150	292.8	8925
	200	373.8	11393
East-West	0.5	126.1	3844
	1	113.8	3469
	1.5	127.4	3883
	2	163.2	4974
	3	145.9	4447
	5	123.4	3761
	7	112.3	3423
	10	117.2	3572
	15	126.3	3850
	20	148.2	4517
	30	189.9	5788
	45	219.6	6693
	70	253.2	7718
	100	281.3	8574
	150	337.2	10278
	200	411.2	12533



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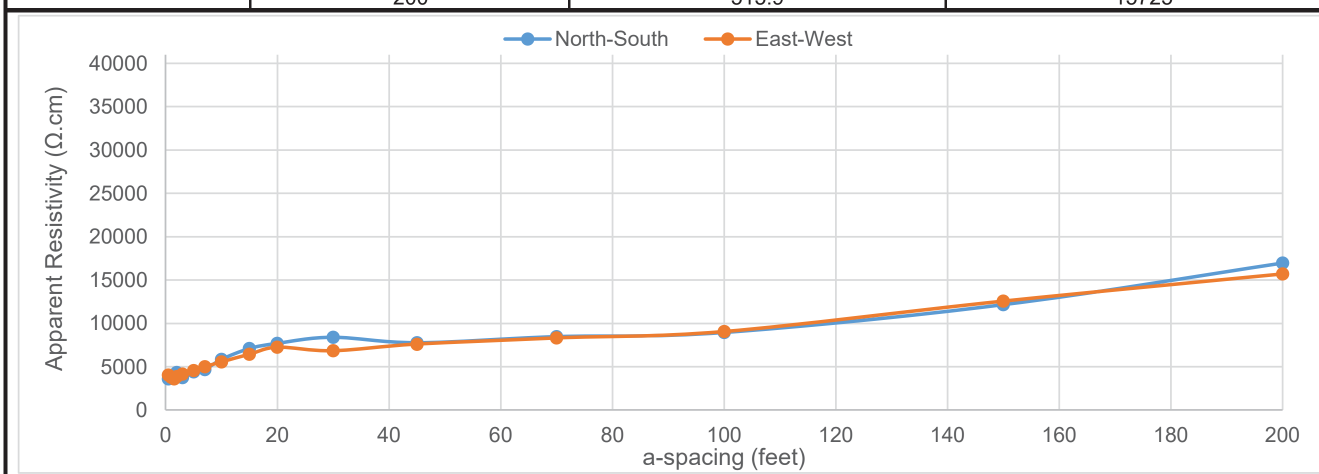
Field Electrical Resistivity Results

Project name:	Madison Fields	Test date:	5/7/2020
Project number:	020-0986	Test Location:	GEO-40
Project location:	Madison County, Ohio	Outside temperature:	64 F
Equipment model:	Supersting	Surface ground condition:	Moist
Test Method:	Wenner 4-electrode	Technician:	B. Tabor

Array direction	a-spacing (feet)	Apparent Resistivity (Ω.ft)	Apparent Resistivity (Ω.cm)
North-South	0.5	118.7	3618
	1	126.9	3868
	1.5	134.3	4093
	2	141.8	4322
	3	122.7	3740
	5	144.2	4395
	7	152.7	4654
	10	191.6	5840
	15	232.6	7090
	20	252.3	7690
	30	275.5	8397
	45	254.9	7769
	70	277.9	8470
	100	293.6	8949
	150	398.6	12149
	200	556.4	16959
East-West	0.5	132.9	4051
	1	123.7	3770
	1.5	117.6	3584
	2	126.8	3865
	3	136.2	4151
	5	149.7	4563
	7	163.9	4996
	10	182.4	5560
	15	211.0	6431
	20	237.7	7245
	30	224.6	6846
	45	249.5	7605
	70	273.2	8327
	100	297.4	9065
	150	412.6	12576
	200	515.9	15725



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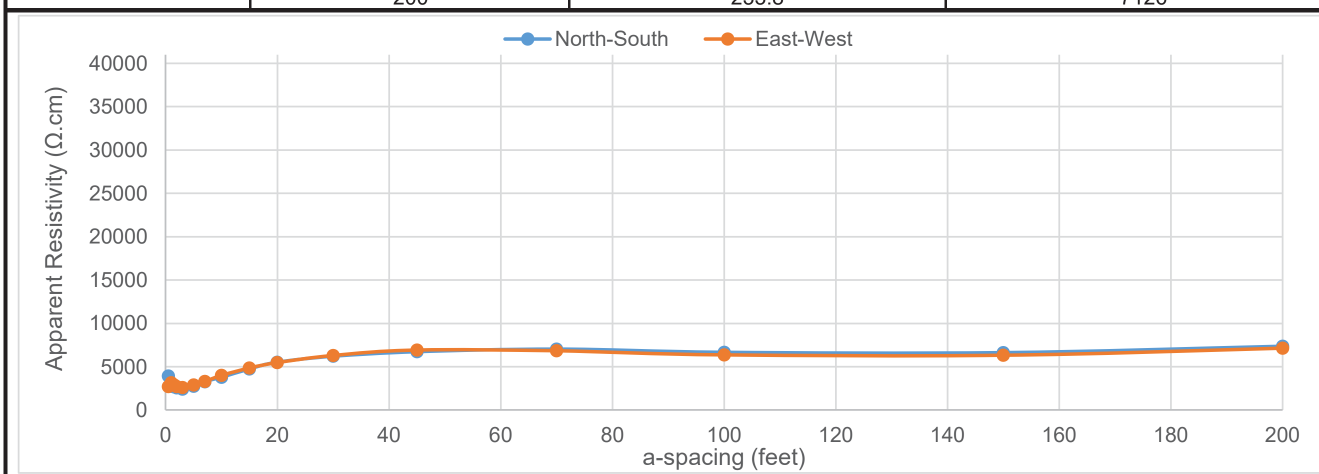
Field Electrical Resistivity Results

Project name:	Madison Fields	Test date:	5/7/2020
Project number:	020-0986	Test Location:	GEO-45
Project location:	Madison County, Ohio	Outside temperature:	63 F
Equipment model:	Supersting	Surface ground condition:	Moist
Test Method:	Wenner 4-electrode	Technician:	B. Tabor

Array direction	a-spacing (feet)	Apparent Resistivity (Ω.ft)	Apparent Resistivity (Ω.cm)
North-South	0.5	128.6	3920
	1	90.63	2762
	1.5	87.53	2668
	2	84.63	2580
	3	79.45	2422
	5	89.67	2733
	7	107.8	3286
	10	124.3	3789
	15	155.8	4749
	20	181.5	5532
	30	203.9	6215
	45	221.1	6739
	70	230.7	7032
	100	218.6	6663
	150	217.5	6629
	200	241.8	7370
East-West	0.5	88.89	2709
	1	103.6	3158
	1.5	95.69	2917
	2	88.93	2711
	3	85.14	2595
	5	95.36	2907
	7	108.4	3304
	10	131.0	3993
	15	159.4	4859
	20	179.5	5471
	30	206.7	6300
	45	227.4	6931
	70	224.6	6846
	100	209.0	6370
	150	207.3	6319
	200	233.8	7126



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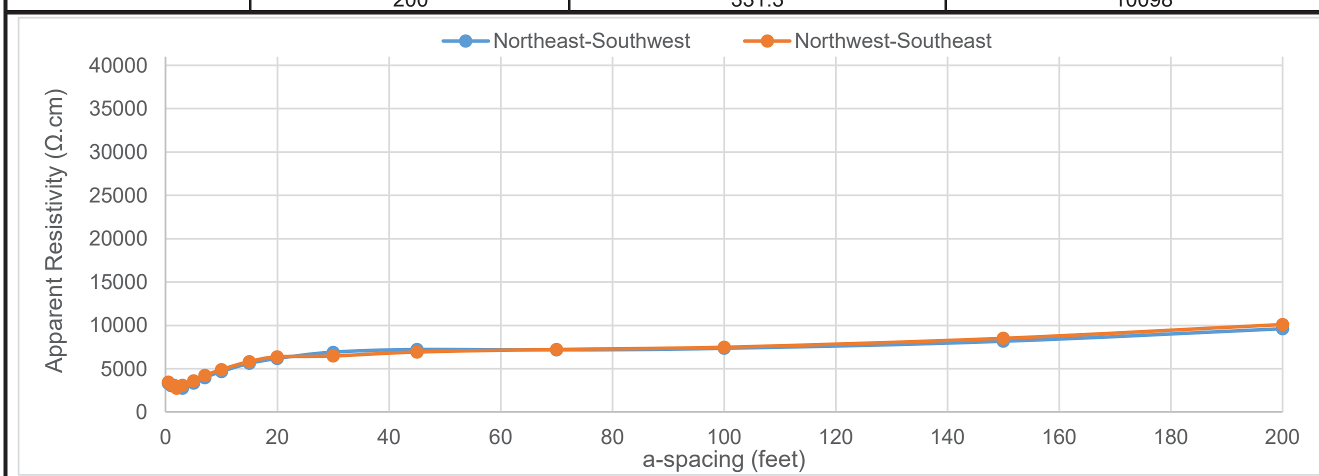
Field Electrical Resistivity Results

Project name:	Madison Fields	Test date:	5/7/2020
Project number:	020-0986	Test Location:	GEO-47
Project location:	Madison County, Ohio	Outside temperature:	60 F
Equipment model:	Supersting	Surface ground condition:	Moist
Test Method:	Wenner 4-electrode	Technician:	B. Tabor

Array direction	a-spacing (feet)	Apparent Resistivity (Ω.ft)	Apparent Resistivity (Ω.cm)
Northeast-Southwest	0.5	108.2	3298
	1	100.5	3063
	1.5	100.8	3072
	2	96.88	2953
	3	90.69	2764
	5	109.1	3325
	7	130.7	3984
	10	153.7	4685
	15	184.2	5614
	20	202.7	6178
	30	226.5	6904
	45	236.7	7215
	70	235.0	7163
	100	241.1	7349
	150	267.8	8163
	200	315.5	9616
Northwest-Southeast	0.5	113.0	3444
	1	104.1	3173
	1.5	98.32	2997
	2	90.71	2765
	3	101.4	3091
	5	118.6	3615
	7	139.2	4243
	10	161.0	4907
	15	191.3	5831
	20	208.7	6361
	30	212.1	6465
	45	227.4	6931
	70	237.1	7227
	100	245.6	7486
	150	279.1	8507
	200	331.3	10098



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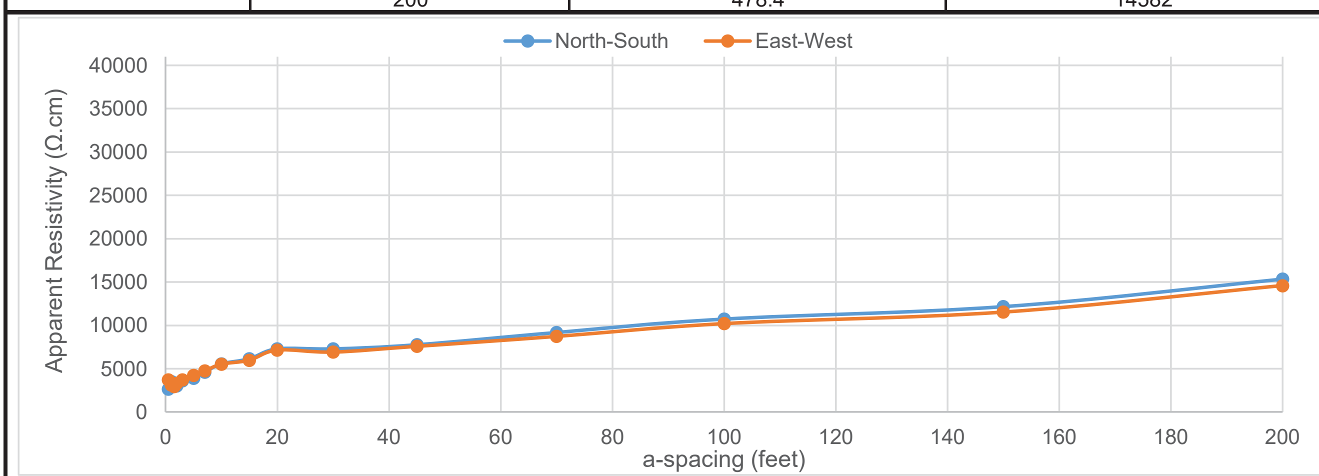
Field Electrical Resistivity Results

Project name:	Madison Fields	Test date:	5/17/2020
Project number:	020-0986	Test Location:	GEO-55
Project location:	Madison County, Ohio	Outside temperature:	76 F
Equipment model:	Supersting	Surface ground condition:	Moist
Test Method:	Wenner 4-electrode	Technician:	B. Tabor

Array direction	a-spacing (feet)	Apparent Resistivity (Ω.ft)	Apparent Resistivity (Ω.cm)
North-South	0.5	86.34	2632
	1	115.6	3523
	1.5	111.4	3395
	2	98.46	3001
	3	118.2	3603
	5	127.5	3886
	7	151.0	4602
	10	182.6	5566
	15	201.5	6142
	20	239.2	7291
	30	238.8	7279
	45	254.6	7760
	70	301.4	9187
	100	352.1	10732
	150	398.7	12152
	200	503.2	15338
East-West	0.5	121.7	3709
	1	102.4	3121
	1.5	96.12	2930
	2	108.1	3295
	3	121.2	3694
	5	138.7	4228
	7	155.3	4734
	10	181.4	5529
	15	196.2	5980
	20	234.8	7157
	30	226.7	6910
	45	248.9	7586
	70	286.2	8723
	100	334.7	10202
	150	378.2	11528
	200	478.4	14582



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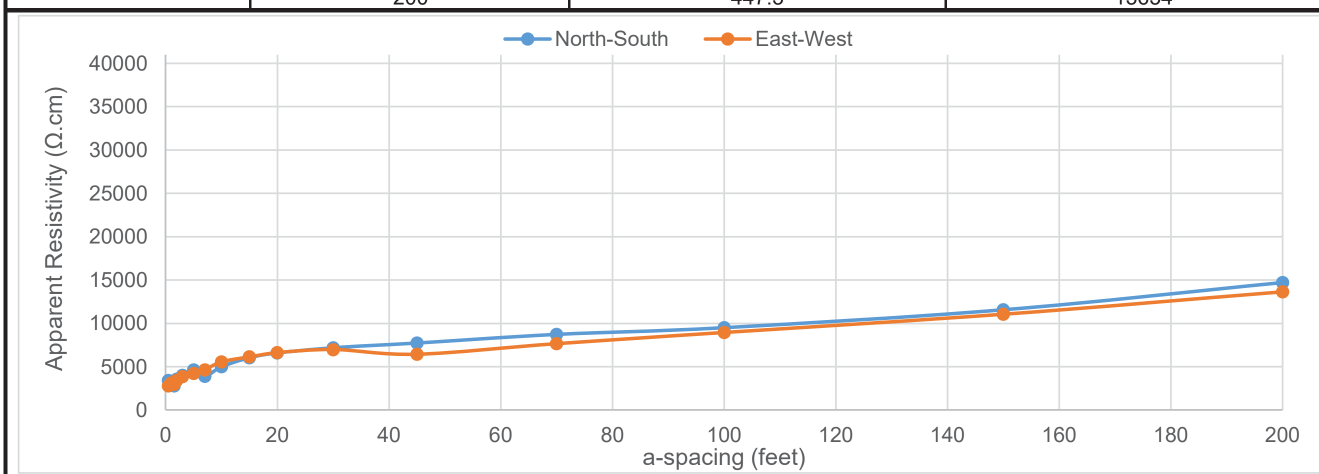
Field Electrical Resistivity Results

Project name:	Madison Fields	Test date:	5/9/2020
Project number:	020-0986	Test Location:	GEO-58
Project location:	Madison County, Ohio	Outside temperature:	48 F
Equipment model:	Supersting	Surface ground condition:	Moist
Test Method:	Wenner 4-electrode	Technician:	B. Tabor

Array direction	a-spacing (feet)	Apparent Resistivity (Ω.ft)	Apparent Resistivity (Ω.cm)
North-South	0.5	112.5	3429
	1	99.74	3040
	1.5	90.93	2772
	2	117.4	3578
	3	131.6	4011
	5	152.4	4645
	7	127.6	3889
	10	163.7	4990
	15	198.2	6041
	20	215.9	6581
	30	236.1	7196
	45	253.7	7733
	70	286.3	8726
	100	311.6	9498
	150	379.4	11564
	200	483.2	14728
East-West	0.5	91.28	2782
	1	102.5	3124
	1.5	97.36	2968
	2	111.5	3399
	3	126.4	3853
	5	138.2	4212
	7	151.9	4630
	10	182.8	5572
	15	201.3	6136
	20	217.4	6626
	30	228.9	6977
	45	211.6	6450
	70	251.2	7657
	100	293.7	8952
	150	362.9	11061
	200	447.3	13634



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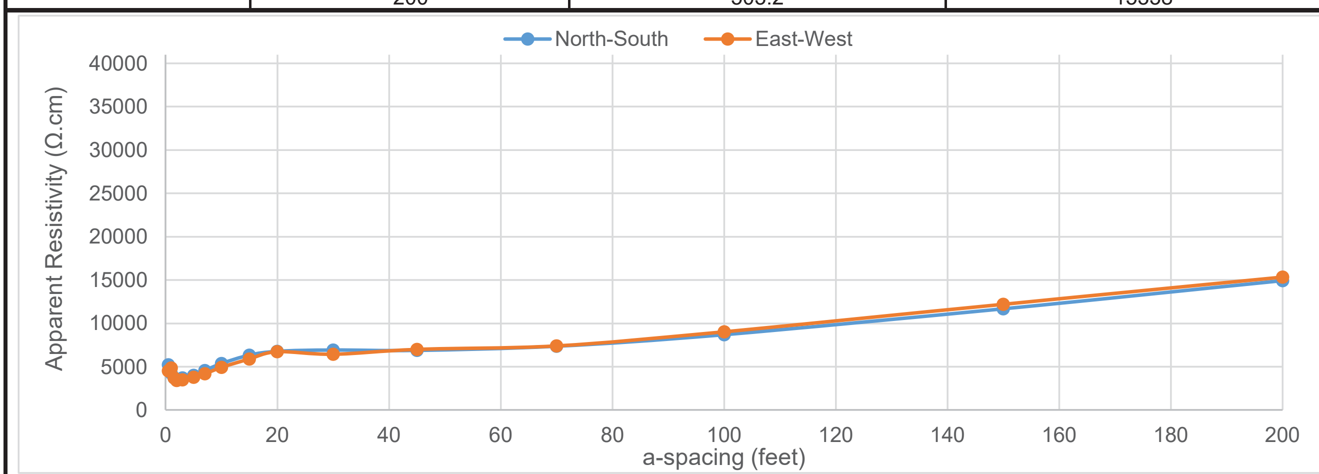
Field Electrical Resistivity Results

Project name:	Madison Fields	Test date:	5/9/2020
Project number:	020-0986	Test Location:	GEO-64
Project location:	Madison County, Ohio	Outside temperature:	44 F
Equipment model:	Supersting	Surface ground condition:	Moist
Test Method:	Wenner 4-electrode	Technician:	B. Tabor

Array direction	a-spacing (feet)	Apparent Resistivity (Ω.ft)	Apparent Resistivity (Ω.cm)
North-South	0.5	171.7	5233
	1	139.1	4240
	1.5	122.2	3725
	2	113.3	3453
	3	121.9	3716
	5	131.1	3996
	7	149.8	4566
	10	176.3	5374
	15	208.2	6346
	20	222.3	6776
	30	227.6	6937
	45	226.1	6892
	70	241.3	7355
	100	285.5	8702
	150	383.5	11689
	200	489.9	14932
East-West	0.5	147.8	4505
	1	159.6	4865
	1.5	121.8	3712
	2	112.0	3414
	3	114.8	3499
	5	124.3	3789
	7	137.4	4188
	10	161.9	4935
	15	193.7	5904
	20	220.9	6733
	30	211.2	6437
	45	230.1	7013
	70	242.9	7404
	100	296.4	9034
	150	400.5	12207
	200	503.2	15338



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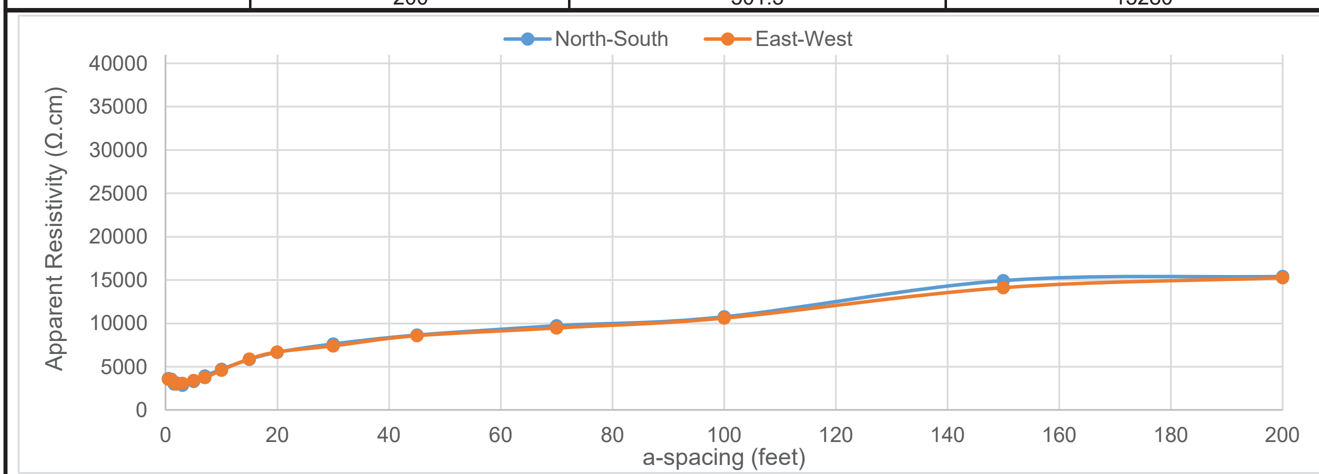
Field Electrical Resistivity Results

Project name:	Madison Fields	Test date:	5/6/2020
Project number:	020-0986	Test Location:	GEO-68
Project location:	Madison County, Ohio	Outside temperature:	54 F
Equipment model:	Supersting	Surface ground condition:	Moist
Test Method:	Wenner 4-electrode	Technician:	B. Tabor

Array direction	a-spacing (feet)	Apparent Resistivity (Ω.ft)	Apparent Resistivity (Ω.cm)
North-South	0.5	119.3	3636
	1	117.5	3581
	1.5	98.24	2994
	2	102.0	3109
	3	93.69	2856
	5	108.5	3307
	7	129.0	3932
	10	154.4	4706
	15	191.7	5843
	20	218.5	6660
	30	250.5	7635
	45	283.7	8647
	70	319.1	9726
	100	352.9	10756
	150	489.8	14929
	200	506.2	15429
East-West	0.5	117.0	3566
	1	114.4	3487
	1.5	104.6	3188
	2	98.37	2998
	3	100.7	3069
	5	112.4	3426
	7	123.2	3755
	10	150.6	4590
	15	193.7	5904
	20	220.1	6709
	30	243.0	7407
	45	281.6	8583
	70	311.1	9482
	100	348.1	10610
	150	463.2	14118
	200	501.3	15280



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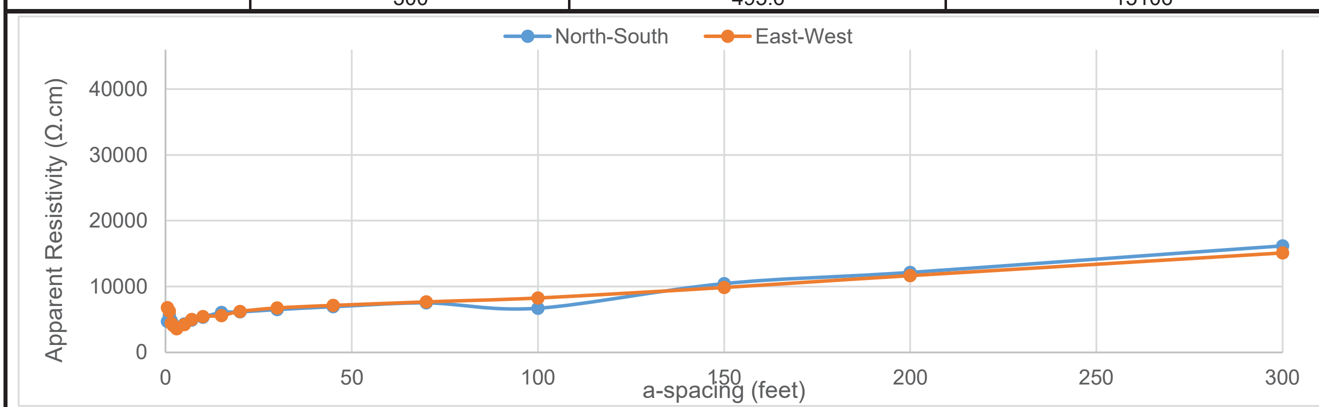
Field Electrical Resistivity Results

Project name:	Madison Fields	Test date:	5/17/2020
Project number:	020-0986	Test Location:	GEO-73
Project location:	Madison County, Ohio	Outside temperature:	63 F
Equipment model:	Supersting	Surface ground condition:	Moist
Test Method:	Wenner 4-electrode	Technician:	B. Tabor

Array direction	a-spacing (feet)	Apparent Resistivity (Ω.ft)	Apparent Resistivity (Ω.cm)
North-South	0.5	154.1	4697
	1	186.9	5697
	1.5	158.2	4822
	2	137.8	4200
	3	124.9	3807
	5	141.3	4307
	7	161.0	4907
	10	174.8	5328
	15	198.5	6050
	20	201.7	6148
	30	213.1	6495
	45	227.4	6931
	70	246.2	7504
	100	220.5	6721
	150	343.0	10455
	200	399.2	12168
	300	531.1	16188
East-West	0.5	223.7	6818
	1	204.7	6239
	1.5	144.5	4404
	2	134.3	4093
	3	117.9	3594
	5	139.0	4237
	7	164.1	5002
	10	178.5	5441
	15	183.3	5587
	20	203.2	6194
	30	221.1	6739
	45	234.2	7138
	70	251.4	7663
	100	271.3	8269
	150	323.2	9851
	200	383.0	11674
	300	495.6	15106



Field Electrical Resistivity Results

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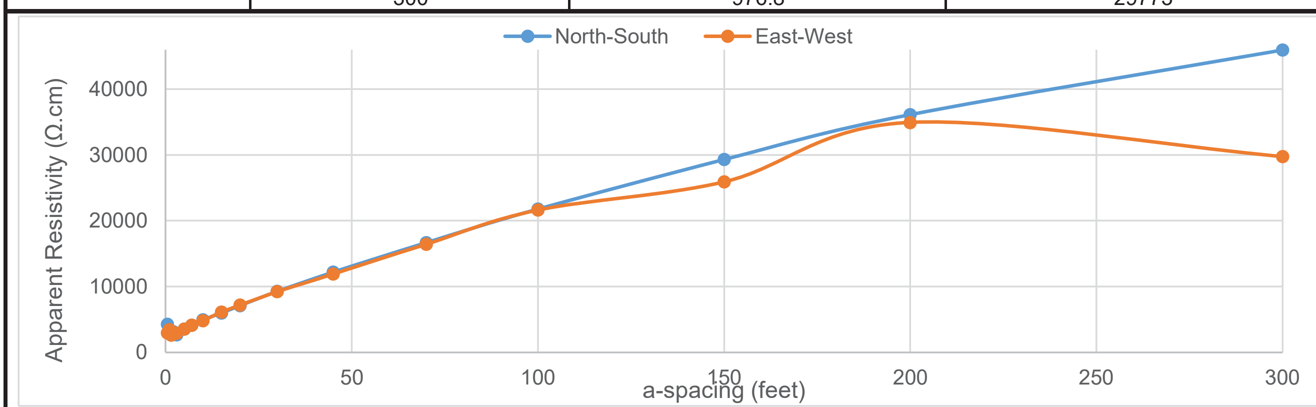
Project name:	Madison Fields	Test date:	5/17/2020
Project number:	020-0986	Test Location:	GEO-74
Project location:	Madison County, Ohio	Outside temperature:	73 F
Equipment model:	Supersting	Surface ground condition:	Moist
Test Method:	Wenner 4-electrode	Technician:	B. Tabor

Array direction	a-spacing (feet)	Apparent Resistivity (Ω.ft)	Apparent Resistivity (Ω.cm)
North-South	0.5	140.5	4282
	1	111.2	3389
	1.5	103.7	3161
	2	103.2	3146
	3	87.62	2671
	5	116.5	3551
	7	135.0	4115
	10	161.8	4932
	15	196.2	5980
	20	232.9	7099
	30	304.0	9266
	45	399.4	12174
	70	546.8	16666
	100	714.1	21766
	150	961.0	29291
	200	1185	36119
	300	1508	45964
East-West	0.5	97.38	2968
	1	112.8	3438
	1.5	86.02	2622
	2	94.65	2885
	3	94.87	2892
	5	115.3	3514
	7	135.0	4115
	10	157.9	4813
	15	200.0	6096
	20	235.7	7184
	30	302.0	9205
	45	390.6	11905
	70	539.5	16444
	100	709.7	21632
	150	850.6	25926
	200	1146	34930
	300	976.8	29773



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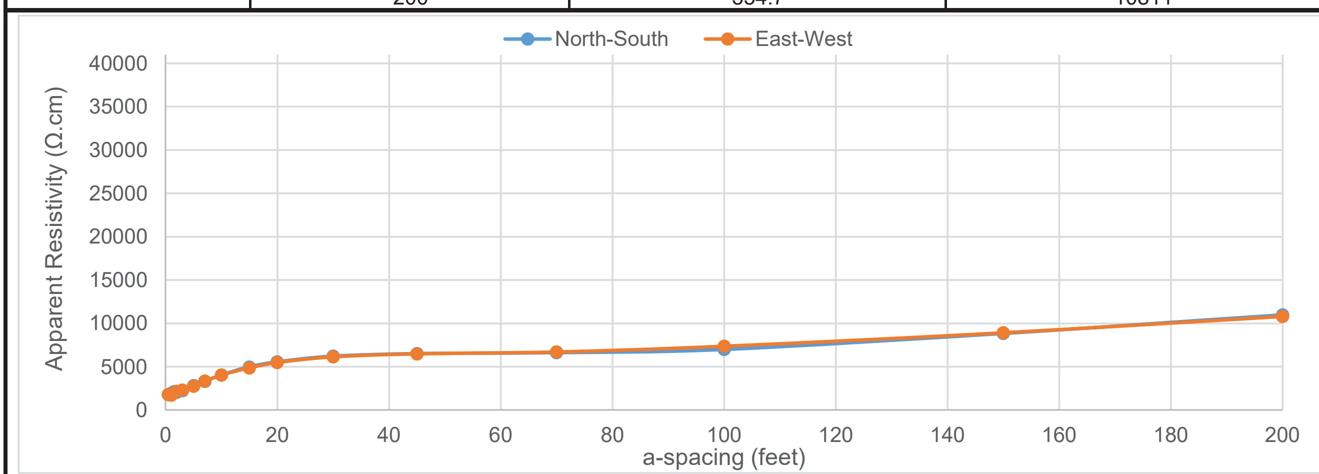
Field Electrical Resistivity Results

Project name:	Madison Fields	Test date:	5/15/2020
Project number:	020-0986	Test Location:	GEO-77
Project location:	Madison County, Ohio	Outside temperature:	66 F
Equipment model:	Supersting	Surface ground condition:	Moist
Test Method:	Wenner 4-electrode	Technician:	B. Tabor

Array direction	a-spacing (feet)	Apparent Resistivity (Ω.ft)	Apparent Resistivity (Ω.cm)
North-South	0.5	58.51	1783
	1	63.12	1924
	1.5	69.46	2117
	2	67.51	2058
	3	73.02	2226
	5	92.35	2815
	7	108.2	3298
	10	132.9	4051
	15	163.5	4983
	20	182.6	5566
	30	203.9	6215
	45	214.0	6523
	70	217.6	6632
	100	229.9	7007
	150	289.7	8830
	200	360.3	10982
East-West	0.5	58.63	1787
	1	56.56	1724
	1.5	65.34	1992
	2	71.30	2173
	3	75.87	2313
	5	90.42	2756
	7	109.4	3335
	10	132.3	4033
	15	159.4	4859
	20	180.2	5492
	30	201.6	6145
	45	213.0	6492
	70	219.3	6684
	100	241.9	7373
	150	292.5	8915
	200	354.7	10811



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Field Electrical Resistivity Results

Project name:	Madison Fields	Test date:	5/17/2020
Project number:	020-0986	Test Location:	GEO-80
Project location:	Madison County, Ohio	Outside temperature:	81 F
Equipment model:	Supersting	Surface ground condition:	Moist
Test Method:	Wenner 4-electrode	Technician:	B. Tabor

Array direction	a-spacing (feet)	Apparent Resistivity (Ω.ft)	Apparent Resistivity (Ω.cm)
North-South	0.5	66.28	2020
	1	94.53	2881
	1.5	98.77	3011
	2	121.8	3712
	3	146.1	4453
	5	182.5	5563
	7	201.8	6151
	10	214.7	6544
	15	221.9	6764
	20	231.4	7053
	30	232.0	7071
	45	243.3	7416
	70	258.3	7873
	100	276.8	8437
	150	311.0	9479
	200	408.5	12451
East-West	0.5	108.3	3301
	1	89.72	2735
	1.5	96.41	2939
	2	119.4	3639
	3	148.9	4538
	5	190.1	5794
	7	207.3	6319
	10	218.2	6651
	15	223.4	6809
	20	232.6	7090
	30	229.7	7001
	45	245.0	7468
	70	260.3	7934
	100	269.2	8205
	150	307.3	9367
	200	440.1	13414