EXCELSIOR ENERGY CENTER

Case No. 19-F-0299

1001.21 Exhibit 21

Geology, Seismology, and Soils

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Exhibit 21: Geology, Seismology, and Soils

This Exhibit will track the requirements of Stipulation 21, dated July 6, 2020, and therefore, the requirements of 16 New York Codes, Rules and Regulations (NYCRR) § 1001.21. This Exhibit contains a comprehensive summary of the geology, seismology, and soil character impacts resulting from proposed construction of the Excelsior Energy Center. This Exhibit includes the identification and mapping of existing geological and surficial soil conditions, an impact analysis, definition of constraints resulting from these geological conditions, and a discussion on potential impact avoidance and mitigation measures.

Conclusions made within this exhibit are based on the findings of a geotechnical investigation performed by Terracon Consultants, Inc. (Terracon) in October 2019. A report detailing these findings was completed in January 2020. A total of 24 borings and 10 test pits were completed at the Project Area during the geotechnical exploration. A summary of the borings completed to date is presented in the following table.

Table 21-1. Summary of Test Borings During Site Survey

Test Boring No.	Depth of Bore (feet)	Date Completed
EB-1	17.0	10/23/2019
EB-2	20.0	10/17/2019
EB-3	20.0	10/17/2019
EB-4	20.0	10/24/2019
EB-5	20.0	10/24/2019
EB-6	20.0	10/21/2019
EB-7	20.0	10/21/2019
EB-8	20.0	10/21/2019
EB-9	20.0	10/24/2019
EB-10	19.5	10/24/2019
EB-11	20.0	10/24/2019
EB-12	20.0	10/22/2019
EB-13	19.5	10/16/2019
EB-14	20.0	10/16/2019
EB-15	20.0	10/25/2019
EB-16	19.0	10/24/2019
EB-17	20.0	10/18/2019

Table 21-1. Summary of Test Borings During Site Survey

Test Boring No.	Depth of Bore (feet)	Date Completed
EB-18	20.0	10/18/2019
EB-19	20.0	10/18/2019
EB-20	18.5	10/18/2019
EB-21	20.0	10/18/2019
EB-22	20.0	10/16/2019
ESS-1	31.0	11/05/2019
ESS-2	34.0	11/06/2019
ETP-1	10.0	10/18/2019
ETP-2	10.5	10/21/2019
ETP-3	10.0	10/18/2019
ETP-4	10.0	10/18/2019
ETP-5	10.5	10/21/2019
ETP-6	12.0	10/18/2019
ETP-7	12.0	10/18/2019
ETP-8	10.5	10/21/2019
ETP-9	12.0	10/18/2019
ETP-10	11.5	10/18/2019

21(a) Existing Slopes Map

Utilizing the United States Geologic Survey (USGS) National Elevation Dataset and Environmental Systems Research Institute (ESRI) ArcGIS software, Figure 21-1 was created and demarcates predetermined existing slope ranges (0 to 3 percent, 3 to 8 percent, 8 to 15 percent, 15 to 25 percent, 25 to 35 percent, and 35 percent and over) on and within a mapped drainage area that have the potential to be influenced by the Project. Slopes within this area range from 0 to 3 percent to greater than 35 percent, with 99.8 percent of the Project Area occurring on slopes less than 15 percent. Table 21-2 below presents the percent coverage that each slope range encompasses within the influenced drainage area.

Table 21-2. Percent Coverage of Slope Ranges within Drainage Area

Slope Range (%)	Percent within Drainage Area (%)
0 – 3	85.0

Table 21-2. Percent Coverage of Slope Ranges within Drainage Area

Slope Range (%)	Percent within Drainage Area (%)
3 – 8	14.0
8 – 15	0.8
15 – 25	0.2
25 – 35	<0.1
> 35	<0.1
Total	**100.0**

21(b) Slope Impact Avoidance

Approximately 6 acres within the Project Area exceed 15-percent grade and these areas were avoided for panel installation. Project Components are sited to avoid steep slopes; therefore, impacts to steep slopes are not expected. Site grading will be performed as indicated on the Grading & Drainage Plans presented in Appendix 11-1. No solar arrays will be installed on slopes exceeding 15 percent. Erosion and sediment control measures are described in greater detail within the Preliminary Stormwater Pollution Prevention Plan (SWPPP) provided as Appendix 23-3 in Exhibit 23 and are also depicted on the Preliminary Design Drawings presented in Appendix 11-1.

21(c) Proposed Site Plan

A proposed preliminary site plan was prepared and is included within the Preliminary Design Drawings presented in Appendix 11-1. The site plan shows existing and proposed contours at 1-foot intervals for the Project Area and on-site interconnections. The site plan also identifies locations of proposed operation and maintenance components, solar panel locations, access roads, electrical collection line routes, energy storage, and interconnections to existing utility infrastructure.

21(d) Preliminary Calculations of Cut and Fill

A preliminary calculation was performed utilizing existing and proposed three-dimensional surfaces generated from 1-foot contour data to estimate the quantity of cut and fill necessary for Project construction. The cut-and-fill volumes stated below are differences calculated between the existing ground conditions, based off contemporary and Project-specific Light Detection and

Ranging (LiDAR) data, and the presumed ground surface character, which will be left as a direct result of Project development. Specifically, earthwork quantity calculations were prepared using AutoCAD Civil 3D software. An existing conditions surface was created based on 1-foot contours generated from a LiDAR survey of the Project Area. From that data set, a proposed conditions surface was created from the Project grading plan. Differences between these two surface designs indicated the amount of material that will be excavated for construction.

These calculations do not take into account the collection line's direct burial via cable plow and/or trenching operations as part of the equation. It is presumed that the collection line's direct burial and/or trenching (where proposed) would return soils to near existing conditions with the use of direct burial or backfilling of the trench after collection line placement, negating any net change in the soil strata (similar to how it was done on operational solar farms across New York State; refer to Section 21(g) below for additional details on collection line installation). A total of 65,745 cubic yards of material will be excavated from the Project Area. A total of 6,400 cubic yards of topsoil will be stripped for access roads and the substation and switchyards areas. The remaining excavated topsoil will be replaced in kind, to the maximum extent practicable. A total of 65,406 cubic yards of fill will be required for the proposed construction. This results in a net earthwork balance of approximately 339 cubic yards of fill material needed for the construction of the proposed solar arrays and associated Project infrastructure. Of this total, approximately 51,000 cubic yards of crushed stone are needed for access road, substation, and switchyard construction. Section 21(e) details the quantity of fill material to be imported into the Project Area for construction of the access roads and structure foundations.

It should be noted that the calculation of cut and fill assumed that depths of greater than 78 inches were to be considered as indicating bedrock per the United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) lower limit of soil survey presented in Keys to Soil Taxonomy (NRCS, 2014). However, in reference to Figure 21-3, actual depth to bedrock is greater than 78 inches in some instances. Excavations are not expected to reach or exceed 78 inches.

It is anticipated that no material will be exported from the Project Area and any excess materials from on-site excavations will be used as fill throughout the Project Area, with the exception of gravel for the access roads, which will consist of imported fill material. It should be noted, however, that the initial design is likely conservative and overstates the amount of cut that will actually be necessary during construction of the Project, as the access roads and substation will in fact be constructed in both cut-and-fill conditions.

Invasive Species Management and Control Plan

To identify the presence of invasive species in spoil material and prevent the spread of invasive species by the transportation of materials to and from the Project Area, an Invasive Species Management and Control Plan (ISMCP) has been developed and is provided in Appendix 22-8. The primary purpose of the ISMCP is to control the spread or introduction of invasive species in the excavated materials and avoid spreading and/or transporting invasive species by vectors (mechanisms of species transfer) directly correlated to the construction and operation of the Project. The ISMCP will be appended to the Project construction contract, requiring the Balance of Plant (BOP) Contractor to implement the control measures outlined within the ISMCP. The principal construction-related control measures contained within the ISMCP are to prevent introduction and spread of all New York-listed invasive species. No fill material will be transported off site from the Project Area. This action will minimize the potential for introduction and/or transport of invasive species to uncolonized regions.

Management actions will be grouped into four main categories including: material inspection, targeted species treatment and removal, sanitation, and restoration. Within each category, specific actions or combinations thereof can be taken, depending on characteristics of a particular species and its density within the target area. Monitoring for invasive species will be conducted throughout the duration of the Project to ensure that the ISMCP is implemented appropriately and that the goals outlined therein are being met. Of note, it should be stated that invasive species identified on site prior to construction are likely to spread even in the absence of further human intervention. Therefore, it is necessary to distinguish between natural movement of invasive species and anthropogenic movement caused by Project-related construction activities. The ISMCP will propose a goal of a zero-net increase in the number of invasive species present, and their distribution in the Project Area is based on actions related specifically to Project construction and operation.

Post-construction monitoring will be conducted for a minimum of 5 years following completion of Project-related activities on site. This is to ensure that ISMCP goals are met, as germination and spread of invasive species can continue long after construction activities have concluded. Failure to meet the goals of the ISMCP will result in revision of the control plan and extension of the post-construction monitoring phase in accordance with the Project's certificate conditions.

21(e) Description and Preliminary Calculation of Fill, Gravel, Asphalt, and Surface Treatment Material

The existing site topography is derived from LiDAR survey data of the Project Area. Proposed topography/final grade was developed based on the design criteria and constraints required for the anticipated delivery of Project Components and construction of the Project facility. As stated previously, a preliminary calculation was performed utilizing existing and proposed three-dimensional surfaces generated from 1-foot contour data to estimate the quantity of cut and fill necessary for Project construction.

The fill material will be used for several purposes including subgrade material for access roads and temporary laydown areas, structural bases for electrical equipment pads, and site grading to achieve necessary construction grades. Based on the calculation of cut and fill, the material excavated from the site will be utilized for fill for the solar array sites. Importing additional graded fill material will be required for the construction of permanent access roads and electrical equipment pads including the inverters, substation, and switchyard. It is anticipated that approximately 66,000 cubic yards of granular fill will be required for construction of the Project Area, and approximately 65,000 cubic yards of the granular fill will come from materials excavated at the site. Approximately 51,000 cubic yards of crushed stone/gravel fill will be imported from off-site for construction of the access roads, substation, and switchyard. Excess material from excavations will be distributed across disturbed areas and blended into existing topography to return each area to its pre-construction condition to the maximum extent practicable, or as described in the site grading plan, provided in Appendix 11-1.

Imported granular fill should contain no particles larger than 3 inches and less than 10 percent, by weight, of material finer than a No. 200 mesh sieve. The imported materials should be free of recycled concrete, asphalt, bricks, glass, and pyritic shale rock. Additional laboratory testing will be required during construction to determine if the on-site soils are suitable for use as structural fill on site. To the maximum extent practicable, on-site soils will be utilized as fill.

Additional fill materials of surface material and concrete (used for footings and foundations) will also constitute as fill for the Project. The quantity of gravel and surface treatment materials was estimated based on the preliminary site plan. The estimated quantity of each imported material is presented in Table 21-3 below.

Table 21-3. Estimated Quantity of Imported Material

Imported Material	Quantity (yd^3)
Gravel	51,000
Granular Fill	1,000
Concrete	5,600
TOTAL	**57,600**

At this time, it is assumed that large off-road dump trucks with an approximate capacity of 22 cubic yards will be the primary truck used to transport materials throughout the Project Area. As such, it is presumed that approximately 2,318 truckloads would be required to transport imported gravel fill material into the Project Area throughout the duration of construction. Additionally, 45 truckloads of granular fill material will be brought into the Project Area utilizing these truck types. Concrete truck designs, which are presumed to be utilized for this Project, will carry approximately 8 cubic yards and weigh 70,000 pounds. With an estimated 5,600 cubic yards of concrete for this Project, approximately 700 truckloads will be necessary to transport the concrete on site. Note that 5,200 cubic yards of concrete will be used for fence posts. This concrete will come from bags of concrete mix, mixed right at the location of each fence post. Only approximately 400 cubic yards of concrete will be transported via wet concrete trucks and will be utilized for the substation and switchyard foundations.

21(f) Description and Preliminary Calculation of Cut Material of Spoil to be Removed

Based on the preliminary cut-and-fill calculations performed in Section 21(e), it is not expected that any on-site material will be removed from the Project Area during construction. It is not expected that excess topsoil will be stripped from the ground surface where fill will be placed. Stripped topsoil will be replaced in kind to the maximum extent practicable. This material will be temporarily stockpiled and controlled through erosion and sediment controls along the construction corridors and incorporated in the site restoration where applicable, as described in further detail on the Grading and Drainage Plans provided in Appendix 11-1.

During restoration of the Project, all excess topsoil materials will be regraded to approximate pre-construction conditions for the site character and drainage areas to be returned to existing conditions to the maximum extent practicable.

As stated in Section 21(e), imported structural fill (e.g., gravel) should contain no particles larger than 3 inches and less than 10 percent, by weight, of material finer than a No. 200 mesh sieve. The imported materials should be free of recycled concrete, asphalt, bricks, glass, and pyritic shale rock. Additional laboratory testing will be required to determine if the on-site soils are suitable for use as structural fill on site.

21(g) Construction Methodology and Excavation Techniques

The proposed start date for the construction of the Project is currently 2022. Project excavation and construction will be performed in several stages and will include the main elements and activities described below.

Location and Extent of Horizontal Directional Drilling Methods

The Applicant is proposing to utilize trenchless excavation techniques, otherwise known as horizontal directional drilling (HDD), on the Project to route 34.5-kilovolt (kV) collection circuits under obstacles including five wetlands and one stream feature. The proposed HDD locations include wetlands W-JJB-27, W-JJB-33, W-JJB-31, W-JDV-04, W-JJB-13; and stream S-JJB-06, S-JJB-12, S-IBP-1, and S-IBP-2 (refer to Appendix 11-1). The HDD drill is usually passed 4 to 6 feet below ground surface (bgs). The HDD method was chosen because it has proven to be a safe and efficient method of crossing roads, railroads, streams, wetlands, and other environmentally sensitive areas with minimal surface impact. The Applicant is currently locating and designing all specific target HDD locations, see the Preliminary Design Drawings in Appendix 11-1 for potential locations and a typical HDD equipment layout diagram. Other areas may also be included, as identified in a Compliance Filing, where topographical or environmental constraints dictate that HDD installation methodology is the best construction practice.

Inadvertent Return Plan for HDD

The HDD process involves the use of water and bentonite (a naturally occurring clay) slurry as a coolant and lubricant for the advancing drill head. The slurry also helps to stabilize the bore and aids in the removal of cuttings during the drilling process. Bentonite is nontoxic; however, if released into waterbodies, has the potential to adversely impact fish, fish eggs, aquatic plants, and benthic invertebrates. Therefore, to protect these natural resources, the Applicant has prepared a detailed Inadvertent Return Plan, which outlines operational procedures and responsibilities for the prevention, containment, and cleanup of inadvertent releases associated with the HDD process. The objective of this Plan, included in Appendix 21-2 of this Application, is to:

1. Minimize the potential for an inadvertent release of drilling fluids associated with HDD activities;
2. Provide for the timely detection of inadvertent returns;
3. Protect environmentally sensitive areas (streams, wetlands) while responding to an inadvertent release;
4. Ensure an organized, timely, and “minimum-impact” response in the event of an inadvertent return and release of drilling fluids; and
5. Ensure that all appropriate notifications are made immediately.

Details within the Inadvertent Return Plan created for the Project indicate:

- Site personnel responsibilities;
- Effective training regimes for handling an inadvertent return;
- Measures to prevent inadvertent releases;
- Equipment and containment materials that will be utilized in the event of an inadvertent return;
- An outline on effective responses to an inadvertent release;
- A list of parties to be notified at the unlikely event of an inadvertent return;
- Details outlining an effective cleanup and restoration strategy;
- Steps on construction restart and avoidance of future inadvertent returns; and
- Effective documentation of the incident.

Although HDD has proven to be a safe and reliable method of crossing surface features with very minimal impact, the potential still exists for inadvertent releases of drilling fluid to the surface, which can have a detrimental impact on the environment. These releases typically occur as a result of seeps that can form when pressure in the drill hole exceeds the capability of the overburden to contain it, or when fluids find a preexisting fault in the overburden. The likelihood of these situations occurring can be minimized by taking into consideration the soil type and bedrock composition. Bore depth should be determined based on these site-specific factors; however, a minimum depth of 25 feet in sound soils should be sufficient to prevent an inadvertent release.

The proposed HDD for the Project has a minimal risk of inadvertent release due to the existing site soils and bedrock features. The chance for inadvertent return increases when unfavorable drilling stratum are experienced such as glacial till, highly fractured rock, non-cohesive alluvial material, or cobbles. The soil stratum at the Project Area, as discussed in further detail in Section 21(i) below is composed of clay, silt, and sand and gravel mixtures with occasional cobble fragments, weathered shale, and shale bedrock. The shale bedrock is medium strong and fractured with gypsum seams. The HDD bore depths will remain primarily in the clay, silt, and sand and gravel mixture stratum layer; therefore, inadvertent return is not expected.

Refer to Appendix 21-2 for the Inadvertent Return Plan for this Project.

Construction Phases

Pre-Construction Survey and Environmental Monitoring

Prior to the commencement of Project-related construction, an overall site survey will be performed to effectively locate and demarcate the exact location of Project Components and routes. This survey will facilitate assembly strategy and construction efficiency. An Environmental Monitor (EM) will be designated during the construction phase of the Project to oversee all construction and restoration activities to ensure compliance with all applicable certificate conditions and other permit requirements. Prior to the start of construction at specific sites, the EM, with support of construction management personnel, will conduct site reviews in locations to be impacted, or potentially impacted, by associated construction activities. A pre-construction site review will direct attention to previously identified sensitive resources to avoid (e.g., wetlands and waterbodies, archaeological, or agricultural resources), as well as the limits of clearing, locations of drainage features (e.g., culverts, ditches), locations of agricultural tile lines, and the layout of erosion and sediment control measures. Work area limits will be defined by flagging, staking, and/or fencing prior to construction.

The pre-construction walk-over will also aid in the identification of any specific landowner preferences and concerns. The placement of erosion and sediment control features will also be located during this site review in order to mitigate potential impacts to sensitive sites and also uphold erosion and sediment control state-wide initiatives. The pre-construction site review will serve as a critical means of identifying any required changes in the construction of the Project in a timely manner to avoid future delays to Project construction.

Site Clearing and Preparation

After the initial site review, Project-related construction will be initiated by clearing brush and woody vegetation within the limit of disturbance (LOD) established for the solar arrays, access roads, electrical collection line routes, and other supporting infrastructure (collection substation, switchyard, laydown yard, etc.). Vegetation cleared within this LOD will be removed, organized, and disposed on site and outside any indicated sensitive sites (see Appendix 11-1). The definitive clearing impacts that will occur as a result of the Project will be based on the final engineering design. For more information on clearing impacts, including their description and quantification, refer to Exhibit 22 of this Application.

Laydown Yard Construction

All laydown yard areas were selected for their ease of accessibility, strategic location in the construction work flow, relatively flat ground surface, occurrence outside sensitive resources (wetlands, waterbodies, cultural areas, etc.), and content of limited shrubby or woody vegetation to reduce impacts to natural vegetation areas. Most sites are situated within agricultural areas or within old fields left fallow.

Laydown yards will be developed by stripping and stockpiling the topsoil (stockpiles will be stabilized per the SWPPP) and grading the subsoil (as necessary). Geotextile fabric and gravel fill will then be put in place to create level working areas for the staging of temporary construction trailers, equipment, and materials. Laydown areas will also be utilized for contractor parking.

Upon completion of the construction phase of the Project, any gravel fill will be removed, and topsoil stockpiles will be utilized to return laydown areas to existing grades and conditions. For any laydown yards staged in active agricultural areas, subsoils will be “ripped” to reduce compaction caused by construction of the Project. Active agricultural lands will be restored in accordance with the New York State Department of Agriculture and Markets Guidelines for Solar Energy Projects – Construction Mitigation for Agricultural Lands (Revision October 18, 2019) to the maximum extent practicable.

Access Road Construction

Access roads will be constructed to provide access from existing roadways for the Project. The new gravel access roads will be constructed to reach the proposed solar array location safely and effectively. Road widths will be approximately 12 feet of gravel for array access roads (with a total vehicle clearance width of at least 20 feet), and 20 feet of gravel for substation/switchyard access roads (with a total vehicle clearance width of at least 24 feet).

Road construction will initially involve the stripping of topsoil and grubbing of stumps, as necessary, after removal of vegetation. All topsoil will be segregated from subsoil and stockpiled (windrowed) along the access road corridor for use in site restoration and soil surface grading. Following removal of topsoil, exposed subsoils will be graded to the specifications outlined in the site design, compacted for constructability, and surfaced with gravel or crushed stone for intended use as an established Project access road. Geotextile fabric or grid may be installed beneath the road surface where needed to provide additional stability support to the access road. Details regarding access road construction are discussed in Exhibit 11 of this Application.

If necessary, dewatering of excavations may occur to keep the excavations free of standing water and permit a safe and constructible environment. Dewatering methods will involve pumping the water to a predetermined well-vegetated discharge point, away from wetlands, waterbodies, and other sensitive resources. Discharge of water will include measures/devices to slow water velocities and trap suspended sediment (sediment bags). All dewatering activities will also be conducted in accordance with the final Project SWPPP and in accordance with the State Pollutant Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from Construction Activities in effect at the time of construction. The use of temporary pump-around techniques or coffer dams will be used during the installation of all access road waterbody crossings. Appropriate sediment and erosion control measures will be installed and maintained according to the final Project SWPPP, which will be finalized during final engineering and prior to construction. In order to facilitate effective draining and surface water management within the access road, culverts and/or water bars will also be utilized where necessary. The access roads will be sloped where appropriate to direct water toward the edge of the road and/or downgradient to minimize the potential for ponding on or adjacent to the access roads.

Solar Array Racking System Construction

The construction of solar array racking systems (the supporting structures on which the solar modules will be mounted) will occur after associated access roads to the predefined array sites have been completed or are substantially in place. Upon access to the predetermined array location, strictly adhering to guidance from the site grading plan, the grading and leveling of the array site location will occur. In keeping with conventional topsoil preservation methods, topsoil will be stripped from the excavation area during the access road construction operation. Topsoil will be stockpiled and stabilized in accordance with SWPPP guidelines for future use in site restoration efforts.

During excavation, subsoil and bedrock will also be segregated and stockpiled for reuse as backfill and for access road development. As stated previously, stockpiled soils will be located outside sensitive resource areas and will be stabilized in accordance with the final Project SWPPP. Though none is proposed, where blasting is deemed necessary, all blasting operations will adhere to applicable New York State statutes and regulations governing the use of explosives. See Section 21(j) below for more information on the Project Blasting Plan.

Depending on site soil characteristics, racking posts will be installed by one of four methods. First, the post may be driven directly into the soil. This is the primary method of post installation proposed. If refusal is encountered while driving the posts directly into the subsurface, there are three alternative methods for installation. A helical post (i.e., pile screw) can be installed directly into the subsurface. In cases of high ledge or bedrock, undersized holes can be pre-drilled into the rock to an appropriate depth prior to driving the post. In situations with very hard rock, an oversized hole may need to be pre-drilled, then grouted after the post is installed.

34.5-kV Electrical Collection Line Construction

The construction of the 34.5-kV collection circuit between solar arrays will involve multiple methods including direct burial, open trench, and overhead construction methods utilizing equipment such as a rock saw, cable plow, rock wheel, and/or trencher. Direct burial methods involve the installation of a bundle of electric and fiber optic cable directly into a narrow trench in the ground without the need for excavation. Where direct burial is not possible due to site-specific constraints, an open trench will be utilized. Open trench operations involve the excavation, segregation, and stockpiling of topsoil and subsoil adjacent to the cutting of an open trench. Cable bundles are laid at the base of the trench and the trench is backfilled with suitable fill material and any additional spoils are spread out to match existing grades.

Trench breakers will be put into place as necessary along trench lines to prevent erosion caused by the lateral movement of runoff of soil strata in the open trench. These breakers will be located within the trench on steep slopes (based on field conditions) above agricultural, cultural, or wetland/waterbody areas to avoid erosion, sediment build up, and the deposition of sediment into any of the predetermined sensitive resources in the Project Area.

Following installation of the 34.5-kV collection line route, areas will utilize strategically positioned topsoil and subsoil piles to return disturbed areas to pre-construction grades. Installation of buried electrical lines would typically require a width of up to 20 feet of vegetation clearing for this Project. However, in areas where buried electrical lines have been routed collinear with proposed access roads, there will be no additional vegetation or soil disturbance beyond what is expected for the predetermined access road construction. All cleared areas along the buried electrical line routes will be restored through seeding and mulching, and areas outside the Facility fence line will be allowed to regenerate naturally. As previously noted, HDD will also be employed in select areas to navigate collection line around and prevent damage to existing roadways and sensitive natural resources. For more information on HDD drilling, refer to the subsection on Inadvertent Return for HDD above and the Inadvertent Return Plan located in Appendix 21-2.

Solar Array and Energy Storage Delivery

The solar array segments, racking, inverters, and energy storage components will be delivered to the designated construction locations through the use of large big-rigs utilizing flatbeds and dry vans (for hardware) and offloaded by crane equipment. No excavation of soil strata or disturbance of bedrock are proposed to occur during this stage of the construction.

Collection Substation and Switchyard Construction

Much like the clearing of laydown areas, substation and switchyard construction will commence with clearing of any woody or shrubby vegetation (if applicable) within the substation footprint. After clearing, the topsoil will be stripped and stockpiled for later use in site restoration. Exposed subsoil will then be graded to specifications outlined in the Project grading plan and foundation areas will be excavated using standard excavation equipment. Construction staging areas for equipment and materials will also be graded and created. Structures will be supported with a combination of shallow and deep foundations. At this stage, the shallow mat/slab foundations will be poured, and deep foundations will be embedded or drilled. After the foundations have set, installation of electrical infrastructure (structural steel skeleton, conduits, cables, bus conductors, insulators, switches, circuit breakers, transformers, control buildings, etc.) will occur.

During substation and switchyard site finalization, gravel fill/crushed stone will be spread throughout the substation and switchyard surface and a perimeter of chain-link fence will be erected for security and safety precautions. Finally, the high voltage link-ups will be connected and tested for charge and integrity through electrical control systems in the control house on site. Restoration of the adjacent areas impacted by construction back to existing conditions in direct vicinity to the substation and switchyard will be completed using stockpiled topsoil, and the appropriate seed and mulch.

Blasting Operations

Based upon the geotechnical investigation conducted at the Project Area, blasting is not anticipated. However, there is a possibility that the sub-soil may consist of weathered rock or solid bedrock. As stated previously, this Project involves excavation of soil for the installation of foundations for the placement of the collection substation and switchyard facilities. The excavation consists of holes of various sizes and depths for the installation of foundations to support proposed Project Components.

If rock or bedrock is encountered during excavation, the construction crews will extract and excavate it using a backhoe or other appropriate equipment. However, if the bedrock cannot be extracted with a backhoe, other means may be used for excavation (e.g., pneumatic jacking and/or hydraulic fracturing). Consequently, no blasting will be required if the above procedures are used for the excavation. However, if the rock cannot be excavated using above equipment, it may be necessary to use a blasting method to remove bedrock/rock-laden foundation sites. In such cases, a blasting plan shall be used. See Section 21(j) below for more details on the Project Blasting Plan.

Subsurface Drain Tile Repair Impact and Repair/Replacement

The Applicant is committed to minimizing impacts to agricultural operations and will work with landowners/farm operators to address unanticipated post-construction impacts. The Applicant will work with affected landowners/farmers regarding potential drainage issues on their properties and will utilize trench breakers in areas of moderate to steep slopes on active agricultural land if deemed prudent (based on field conditions) to ensure that the deposition of impacted or stockpiled soils does not occur over agricultural lands.

Existing drain tiles will be identified and located before construction as much as is reasonably possible based primarily on consultation with the landowner. During and after construction operations, any existing drain tiles within the area of disturbance will be checked for damage, and damaged drain tiles will be replaced or repaired consistent with the NYSDAM's details for "Repair of Severed Tile Line" to the maximum extent practicable. The Applicant will coordinate with the landowner to continue to monitor drain tiles post-construction to ensure that repairs are properly functioning.

Temporary Cut or Fill Storage Areas

In the initial siting and design process, Project Components were strategically placed and designed with the direct strategy of minimizing the amount of areas that require cut-and-fill operations to occur. As stated previously, the construction and placement of Project infrastructure will require minor cut or fill to achieve the final grades within the Project Area. A multitude of scenarios would potentially require areas of cut and/or fill including access roads constructed on a side slope, grading areas of the arrays to slopes of 15 percent or less, grading out work areas that are naturally undulatory or crowned, and access roads traversing an existing grade that exceeds the maximum design slope. It is anticipated that approximately 65,000 cubic yards will be granular fill derived from excavated materials.

Following the solar array manufacturer’s recommendations, array racking will be driven at least 5 to 7 feet below the finished grade. Permanent access roads will be constructed using approximately 12 inches of crushed gravel over native sub-soils, which will be stockpiled for this said use. Where necessary, the native soils will be reinforced with geo-synthetic fabric.

Proper methods for segregating stockpiled and spoil material will be implemented. All excavated soils will be reused in close proximity to where they were unearthed to the maximum extent practicable. This technique will aide in reducing the proliferation of non-native flora to uncolonized areas within Project.

21(h) Delineation of Temporary Cut or Fill Storage Areas

Excavation and grading plans, including design and location of temporary storage of topsoil and subsoil structures, are provided in Appendix 11-1 to this application. Excess fill materials will be stockpiled and stored for use on site. Several storage options may be employed to stockpile topsoil materials as determined appropriate for on-site conditions during the construction phase including but not limited to silt fencing and straw bale barriers. Concrete waste may be stored in a constructed concrete wash area sited away from wetlands, wetland buffers, and environmentally sensitive areas.

21(i) Characteristics and Suitability of Material Excavated for Construction

Terracon, an engineering services company, conducted a geotechnical investigation at the Project Area. A total of 24 test borings were advanced. Based on the findings of the investigation, the subsurface materials that were encountered within the Project Area are suitable for construction of the proposed structures.

During the investigation, 11 boring hole locations and 7 test pit locations were tested for corrosivity potential. Thermal resistivity dry-out curves were performed at seven locations. Infiltration testing was performed at six locations during the geotechnical investigation.

The results of the corrosion test are detailed in Table 21-4 below. Additional information on the corrosion series testing is provided in Section 21(v) of this Exhibit. Results for all testing parameters can be found in Appendix 21-1.

Table 21-4. Results of Laboratory Corrosion Analysis (reproduced from the Geotechnical Engineering Report, Appendix 21-1)

Boring	pH	Sulfates (ppm)	Sulfides (ppm)	Chlorides (ppm)	Red-Ox (mV)	Total Salts (ppm)	Resistivity (ohm-cm)
EB-2	7.98	39	Nil	70	681	533	6,402
EB-5	8.10	138	Nil	85	684	936	2,328
EB-8	8.06	122	Nil	58	685	981	3,783
EB-10	8.17	156	Nil	80	686	966	2,813
EB-14	8.50	87	Nil	50	682	662	4,171
EB-15	8.30	32	Nil	63	683	781	3,201
EB-17	8.26	39	Nil	53	681	702	4,171
EB-18	8.18	31	Nil	58	680	778	2,522
EB-20	8.15	28	Nil	73	681	886	3,201
EB-21	8.22	41	Nil	68	680	833	3,298
ESS-1	8.10	77	Nil	75	682	975	2,522
ETP-2	7.80	21	Nil	30	681	567	6,499
ETP-3	8.07	73	Nil	30	682	618	4,171
ETP-4	7.88	65	Nil	35	685	769	6,790
ETP-5	8.09	25	Nil	35	680	572	6,693
ETP-6	7.98	102	Nil	33	682	634	4,171
ETP-7	7.99	134	Nil	58	685	830	2,910
ETP-10	8.19	30	Nil	38	681	519	5,529

Soil resistivity is the most comprehensive indicator of corrosive soils (Roberge, 2006). Soil resistivity generally decreases when soils have a higher water content or soluble salts, which allows for an increase in corrosive reactions within the soil (Roberge, 2006). Highly corrosive soils range between 1,000 to 3,000 ohm-cm; corrosive soils range between 3,000 to 5,000 ohm-cm; and moderately corrosive soils range between 5,000 to 10,000 ohm-cm (Roberge, 2006). Based on the test results, it appears that a corrosive environment does exist within the Project Area. A corrosion specialist will be retained to make recommendations on the concrete mix design and protection of steel posts and piles against potential corrosion.

Frost depth in the Project Area is 30 inches. The foundations for new site structures will bear below this depth to prevent frost heave.

Organic-laden soil was only encountered at the ground surface during the preliminary investigation. The depth of organic material in the topsoil was no more than approximately 17 inches. This material will be stripped during earthwork so that new structures do not bear on organic-laden soil.

The Geotechnical Engineering Report utilized an analysis tool referred to as GeoModel to characterize the subsurface layers based on subsurface exploration, laboratory data, and the geologic setting of the project. The findings of this data suggest that the GeoModel could be broken into four main model layers including:

- Layer 1: Surficial – The surficial layer consists of black and brown topsoils.
- Layer 2: Native Layer – The native layer consists of several clay, silt, sand, and gravel mixtures and occasional cobble fragments. This layer is a red-brown to gray color.
- Layer 3: Weathered Bedrock – The weathered bedrock layer consists of completely to slightly weathered shale or dolostone. This layer ranges from gray to olive-gray in color.
- Layer 4: Bedrock – The bedrock layer consists of unweathered to slightly weathered gray shale. This layer was encountered in borings ESS-1 and ESS-2. They layer is thinly bedded, medium strong shale that is fractured with occasional gypsum seams.

21(j) Preliminary Plan for Blasting Operations

Blasting and/or rock excavation techniques are not anticipated within the Project Area based on the geotechnical investigation and proposed excavation depths, however a Preliminary Blasting Plan has been prepared in the event that blasting is determined to be required (see Section 21(s) below for information on the depth to bedrock within the Project Area). The Preliminary Blasting Plan is provided in Appendix 21-3.

It is anticipated that the contractor for this Project can excavate with relatively little difficulty using an excavator, rock saw, cable trencher, or plow. Where bedrock is encountered, it is anticipated to be rippable due to its content, and thus will be excavated using large excavators, rock rippers, or chipping hammers. The method or combination of methods required will specifically be tailored to the structural integrity, depth, and robustness of rock/bedrock encountered.

In the event that a unique situation requiring blasting arises, the Preliminary Blasting Plan provided as Appendix 21-3, including procedural timeframes for notifying municipal officials and property owners (or persons residing at the location if different) within a one-half mile radius of the blasting site of these activities, as well as an assessment of potential blasting impacts, and blasting impact mitigation measures plan, will be used. The blasting contractor shall be responsible for generating an overall Contractor Blasting Plan, if required, and also a written site-specific blasting plan if there are differences in selected blasting sites, including the subsoil and bedrock conditions. This specification shall also be used for pre-blast surveys, notifications, use of explosives, security, monitoring, and documentation. It will be included in the Final Blasting Plan filed with the Secretary.

21(k) Assessment of Potential Impacts from Blasting

The bedrock encountered in the geotechnical survey consisted of shale. Stratums were sampled by coring. The recovered bedrock core was typically medium strength and was fractured with occasional gypsum seams. Blasting and/or rock excavation techniques are not anticipated based on the depth to and characteristics of bedrock within the Project area; therefore, no impacts to bedrock are expected.

If blasting is determined to be required, the Preliminary Blasting Plan provided in Appendix 21-3 will be used. Impacts from blasting operations may include but are not limited to ground vibration, air blast overpressure, generation of fly rock, generation of dust, and generation of noxious gases and chemical residue in the subsurface. Methods to prevent adverse impacts include site-specific design of load/charge configurations, the use of a blasting delay, the use of blasting mats, etc. Federal, state, and Occupational Safety and Health Administration (OSHA) regulations dictating the minimum distance for accessing or protecting from blast impacts will be followed.

The Applicant will conduct pre- and post-blast surveys on structures, wells, septic systems, drain tiles, and pipelines within a one-half-mile radius of the blasting area, if requested by the property owner. Any damage determined to be a result of the blasting activities will be repaired. The Applicant will make all reasonable efforts to complete the post-blast survey within 30 days of a request from a property owner.

21(l) Identification and Evaluation of Reasonable Mitigation Measures Regarding Blasting Impacts

The utilization of blasting techniques is not anticipated for this Project; therefore, impacts requiring mitigation are not expected. Should blasting be required, an investigation and evaluation of reasonable mitigation measures will be provided with the Final Blasting Plan to be filed with the Secretary. To minimize impacts, blasting shall be designed and controlled to meet the limits for ground vibration set forth in United States Bureau of Mines (USBM) Report of Investigation (RI) 8507 Figure B-1 and air overpressure shall be under the limits set forth in the conclusion section in USBM RI 8485 (USBM RI 8507 and USBM RI 8485). Mitigation measures will include alternative technologies and/or relocation of structures to negate the need for blasting. Where reasonable alternative measures cannot be employed, blast mats and backfill will be utilized to control any excessive rock movement when blasting in close proximity to identified structures. Additionally, as explained above, the Applicant will outline a plan for securing compensation for damages that may occur due to blasting, including pre- and post-blast property surveys, if applicable.

21(m) Regional Geology, Tectonic Setting, and Seismology

In addition to the Geotechnical Engineering Report in Appendix 21-1, several existing published sources were used to better understand regional geology, tectonic setting, and seismology within the Project Area. These sources include USDA NRCS Web Soil Survey, statewide bedrock geology mapping (NYSM/NYS Geological Survey, 1970), New York State surficial geology mapping (NYSM/NYS Geological Survey, 1970), 2014 New York State Hazard Map (DHSES), and USGS Earthquake Hazard Program (USGS, 2015).

Regional Geology

The Project Area is located in central New York in the Erie and Ontario Lake Plain Section and is part of the Central Lowlands geomorphic province. It is characterized by its flatness and by shallow entrenchment of its drainages. In this section, there is a combination of level to gently rolling till-plain (glacial ground moraine), and flat lake plain. There are a few areas with broad, low ridges (glacial end moraines) generally trending parallel to the lakes' shorelines. Within New York State, there are moderately dissected till and drumlin plains on three low but notable "stairstep" escarpments, parallel to and below the northern margin of the Allegheny Plateau. Elevations range from 245 feet (75 meters), which is the mean elevation of the surface of Lake Ontario and extend up to 1,000 feet (300 meters) along the Appalachian Plateau border. Most of the land is under 800 feet (240 meters) in elevation.

Karst Topography

Publicly available mapping indicates that karst topography is present throughout the Project Area (see Figure 22-5). The USGS delineates a narrow band of carbonate rocks with karst potential, which extends east-west across the state from Buffalo to Albany, following the Onondaga Limestone. These areas are directly underlain by carbonate bedrock. This underlying geology creates the potential for sinkholes, caves, or other karst features at varying densities. Land subsidence, or sinkholes, are more commonly observed in karst formed by soluble or evaporated rock. Carbonate rock, consistent with that found within the Project Area is less soluble and such features take more time to form. Collapses are relatively rare, with the most recent occurrence in New York State reported over 20 years ago (DHSES, 2014).

Construction activities such as excavation, HDD, post installation, and in the unique circumstance, blasting, have the potential to increase sediment discharge, create loose or unstable soils, open voids in soils, and lower the water table. Impacts to karst features and aquifers may include sedimentation within caves, water quality deterioration, landform destruction, sinkhole development or collapse, and decreasing the amount of available water. The Applicant will minimize and avoid construction activities and excavation in karst-prone areas and aquifer regions wherever possible through the employment of best management practices. An assessment of the Project Area did not identify vulnerable karst features such as caves, sinkholes, and fractures.

The closest primary aquifer is the Tonawanda Aquifer approximately 2 miles southwest of the Project Area and the closest principal aquifers sit to the north and south of the Project Area and trend east-west following both the Onondaga and Niagara escarpments. Impacts to aquifers are not anticipated as a result of excavation, HDD operations, limited blasting operations, and other soil disturbance activities due to their relative location to the Project Area, as they are located approximately 3 miles south of the Project Area. General risks to karst features and aquifers associated with HDD include creating loose, unstable soils and open voids along the drill path.

More specifically, there may be a loss of drilling fluid to cave areas within a karst feature, creating fractures within the bedrock and possible sinkhole formation. Although HDD has proven to be a safe and reliable method of crossing surface features with very minimal impact, the potential still exists for inadvertent releases of drilling fluid, which can have a detrimental impact on the environment. These releases typically occur as a result of seeps that can form when pressure in the drill hole exceeds the capability of the overburden to contain it, or when fluids find a pre-existing fault in the overburden. Bore depths for HDD will consider site-specific factors such as soil type and bedrock composition; however, a minimum depth of approximately 25 feet in sound soil should be sufficient to prevent an inadvertent release and impacts to karst areas and aquifers. The subsurface conditions found within the borings drilled near the proposed HDD locations generally consisted of sandy silt. Because HDD is not proposed in areas of the site where evidence of karst features is found, risks to karst features from directional drilling are not anticipated. Refer to the Preliminary Design Drawings in Appendix 11-1 of the Application for additional information on the HDD crossing methods, and the Inadvertent Return Plan in Appendix 21-2, which outlines the operational procedures and responsibilities for the prevention, containment, and cleanup of an inadvertent release.

Risks and impacts to karst features and aquifers are not anticipated as a result of post installation operations. The risks and impacts of post installation as they pertain to the karst formations are generally limited. The main risk associated with post installation is the potential for highly variable depths to rock, which was indicated in select areas in the borings. Karst formations can make achieving the required post lengths for the required capacity challenging. The impacts of post installation on karst formations are expected to be minimal as long as the surface water is adequately diverted away from the post installation areas both during installation and for the lifetime of the Facility. The existing and proposed grades at the Project Area promote positive drainage away from the area where karst features were found; therefore, standing surface water is not expected. The piles will be embedded to a depth of approximately 5 feet; therefore, they should not impact the karst features and aquifers due to the shallow pile depths.

If blasting operations were to occur, blast-induced vibration and shock waves may result. Blasting could potentially cause fracturing of bedrock and limit groundwater availability and quality.

Best management practices will be used to reduce these potential impacts to karst and aquifer features, and the local water table to the maximum extent practicable. Best management practices include utilization of erosion and sediment controls, stormwater management, and avoidance of sensitive features. Stormwater management features proposed for the Project will route stormwater around or away from earth-disturbing activities and will slowly filter stormwater through the soil, preventing inundation of groundwater to underground features. Disturbed areas will be stabilized as soon as possible to prevent the transport of sediment and silt, and the Project Area will be revegetated following the completion of construction. If trenching is determined to be required in an area of moderate or steep slopes, in areas of excavation, trench breakers will be utilized to prevent erosion caused by the lateral movement of runoff of soil strata in the open trench. These breakers will be located within the trench on steep slopes above agricultural, cultural, or wetland/waterbody areas to avoid erosion, sediment build up, and the deposition of sediment into any of the predetermined sensitive resources in the Project Area. A preliminary SWPPP is contained in Appendix 23-3 of the Application.

Based on publicly available data, surficial geology within the Project Area consists of till and lacustrine silt and clay sediments of Quaternary age previously deposited by glacial activity. Bedrock units within the Project Area are of Upper Silurian age and consist of the Akron Dolostone and the Salina Group, which consists of the Camillus, Syracuse, and Vernon formations. The Akron Dolostone overlays the Salina Group. The Akron Dolostone is a formation of the Bertie Group, and is composed of dolostone with some shale layers. Within the Salina Group, the Camillus, Syracuse, and Vernon formations consist of shale, dolostone, salt, and gypsum layers. Carbonate rocks, such as dolostone, have the potential to dissolve in the presence of groundwater and produce karst topography and features. The construction method or combination of methods required in these soil types will be standard for the soil characteristics in this area. Regarding the construction activity and the karst topography in the Project Area, the Applicant will minimize and avoid construction activities and excavation in karst-prone areas and aquifer regions wherever possible and will utilize best management practices as previously described within this section. Additionally, there are no known primary or principal aquifers within the Project Area, or no vulnerable karst features of concern such as caves, sinkholes, and fractures.

The Geotechnical Engineering Report states that conditions encountered through the investigation are consistent with publicly available mapped surficial and bedrock geology. Near the surface, fine-grained sediments have the potential to become unstable during typical construction activities, especially following storm and precipitation events. Additionally, grading of these sediments could lead to possible undercutting if performed during the winter and spring months. As previously stated, best management practices, such as erosion and sediment control measures, will be used to minimize or mitigate any impacts to fine-grained sediment throughout the construction process.

Tectonic Setting and Seismology

According to USGS Seismic Hazards database, the Project Area is located in an area of relatively low seismic activity with a 3-percent probability of a magnitude 5.0 earthquake occurring in the next 50 years of peak acceleration exceeding 10 percent to 14 percent of the force of gravity. This indicates relative low probability for seismic activity and bedrock shift in the vicinity of the Project area. The Clarendon-Linden Fault System has been identified within Genesee County; however, seismic activity related to this fault system has not occurred since 1995 (see Section 21(o)). Refer to Figure 21-4 for seismic hazards mapping of the Project Area and surrounding area.

21(n) Facility Construction and Operation Impacts to Regional Geology

A Geotechnical Engineering Report has been completed and is included in Appendix 21-1. In general, the conditions encountered are favorable for the Project. The available information suggests that the solar array areas will be underlain by sand and silt with varying amounts of gravel, cobbles, and possible boulders, potential very dense soil, and shallow, weathered bedrock. Based on the subsurface conditions encountered during the investigation performed to date, it appears that the primary geotechnical issue anticipated at the Project is refusal of the installed posts within the proposed array areas. The recommended alternatives to driven posts are either pre-drilling the posts or utilizing a ground-screw system.

Given the nature of construction associated with Project development, minimal adverse impacts to regional geology and soils are expected during the construction phase, and little to no temporary or permanent impacts are expected once the facility is operational. Project facilities will be designed and sited to avoid or minimize impacts to geology, topography, and soils within the Project Area to the maximum extent practicable.

21(o) Seismic Activity Impacts on Project Location and Operation

The USGS Earthquake Hazard Program does not identify any young faults or a fault that has had displacement in Holocene time within the vicinity of the Project Area. The north-south trending Clarendon-Linden fault systems extends through Orleans, Genesee, Wyoming, and Allegany Counties, but is of Devonian age (Jacobi & Smith, 1999). The most recent seismic event was documented on May 25, 1995 (Genesee County Soil & Water Conservation District, 2020).

Therefore, the impact due to seismic activity is considered to be negligible. Also, the design of current solar array technology allows for operational control and emergency shut off in case of an emergency such as a significant seismic event. To properly avoid, minimize, or mitigate any potential impacts related to seismic activity, electrical storage system components on the Project will be designed in accordance with the New York State Uniform Code of American Society of Civil Engineers (ASCE 7). The Geotechnical Engineering Report has classified soils and bedrock as Seismic Site Classification D in accordance with section 20.4 of ASCE 7. The racks that hold the energy storage system modules will be braced to the floor and to adjacent racks. In addition, prior to construction, seismic calculations are performed to ensure the bracing is sufficient for the given site location.

21(p) Soils Types Map

Figure 21-2 delineates soil types within the Project Area utilizing the USDA NRCS Web Soil Survey application. A detailed discussion of each soil type is provided in Section 21(q) below.

21(q) Soil Type Characteristics and Suitability for Construction

The **Alden series** consists of very deep, very poorly drained soils in depressions and low areas on upland till plains. They formed in a silty local depositional mantle overlying till. Slopes range from 0 to 8 percent. Saturated hydraulic conductivity is moderately high or high in the surface layer and low to moderately high in the subsoil and substratum. A typical soil profile of this series consists of black mucky silt loam from 0 to 7 inches, grey silty loam from 7 to 15 inches, dark grey silt loam from 15 to 30 inches, and greyish-brown gravelly loam from 30 to 72 inches.

> **Ad** is Alden mucky silt loam, a very poorly drained soil that makes up approximately 0.8 percent of the Project Area. Alden and similar soils make up 80 percent of the series with the remaining 20 percent being minor components. Alden soils can be found in depressions and are developed from a parent material of a silty mantle of local deposition overlying loamy till. This map unit has a hydric rating of 100 percent and it is not prime farmland.

The **Appleton series** consists of very deep, somewhat poorly drained soils formed in calcareous loamy till. The soils are on low ground moraines and on foot slopes of glaciated hills, ridges, and drumlins. The potential for surface runoff is negligible to very high with moderately high or high hydraulic conductivity in the surface and subsoil, and moderately low to moderately high hydraulic conductivity in the substratum. Appleton soils are nearly level to slightly steep with slopes ranging from 0 to 15 percent. The typical soil profile of this series is very dark grayish-brown silt loam about 20 centimeters thick with reddish-brown and reddish-gray fine gravelly loam extending to a depth of 183 centimeters.

ApA is Appleton silt loam with 0 to 3-percent slopes. This somewhat poorly drained soil makes up approximately 10.7 percent of the Project Area. Appleton and similar soils make up 85 percent of the series with the remaining 15 percent being minor components. Appleton soils can be found on till plains, drumlins, and ridges, and are developed from a parent material of Calcareous loamy lodgment derived from limestone, sandstone, and shale. This map unit has a hydric rating of 4 percent and is considered prime farmland if drained.

ApB is Appleton silt loam with 3 to 8-percent slopes. This somewhat poorly drained soil makes up approximately 10.6 percent of the Project Area. Appleton and similar soils make up 80 percent of the series with the remaining 20 percent being minor components. Appleton soils can be found on till plains, drumlins, and ridges. They are developed from a parent material of Calcareous loamy lodgment derived from limestone, sandstone, and shale. This map unit has a hydric rating of 5 percent and is considered prime farmland if drained.

The **Arkport series** consist of very deep, well-drained soils formed in glacio-fluvial deposits having a high content of fine and very fine sand. These soils have thin horizontal bands of loamy material in the subsoil. Saturated hydraulic conductivity is high throughout the mineral soil. Slopes range from 0 to 60 percent. A typical soil profile of this series consists of brown very fine sandy loam from 0 to 15 inches, brown loamy very fine sandy from 15 to 28 inches, light reddish-brown very fine sand from 28 to 45 inches, light reddish-brown loamy fine sand from 45 to 58 inches, pinkish-grey loamy fine sand from 58 to 92 inches, and pinkish-grey fine sand from 92 to 106 inches.

ArB is Arkport very fine sandy loam with 1 to 6-percent slopes. This well-drained soil makes up approximately 0.7 percent of the Project Area. Arkport and similar soils make up 80 percent of the series with the remaining 20 percent being minor components. Arkport soils can be found on deltas and lake plains and are developed from a parent material of glaciofluvial or deltaic deposits with a high content of fine and very fine sand. This map unit has a hydric rating of 0 percent and all areas are prime farmland.

The **Aurora series** consists of moderately deep, moderately well-drained soils formed in till. They are nearly level through very steep soils on dissected upland plateaus and bedrock-controlled till plains. Bedrock is at depths of 20 to 40 inches. Saturated hydraulic conductivity is moderately high or high in the mineral surface layer and moderately low to moderately high in the subsoil. Slopes range from 0 through 75 percent. A typical soil profile for this series consists of dark grey silty loam from 0 to 8 inches, brown silt loam from 8 to 13 inches, brown silty clay loam from 13 to 25 inches, olive-brown silt loam from 25 to 32 inches, and dark grey calcareous shale bedrock at depths of 32 inches and greater.

AuA is Aurora silt loam with 0 to 3-percent slopes. This moderately well-drained soil makes up approximately 1.1 percent of the Project Area. Aurora and similar soils make up 70 percent of the series with the remaining 30 percent being minor components. Aurora soils can be found on till plains, ridges, and benches and are developed from loamy till parent material mainly derived from calcareous shale with some limestone and sandstone. This map unit has a hydric rating of 0 percent and is farmland of statewide importance.

AuB is Aurora silt loam with 3 to 8-percent slopes. This moderately well-drained soil makes up approximately 0.8 percent of the Project Area. Aurora and similar soils make up 75 percent of the series with the remaining 25 percent being minor components. Aurora soils can be found on till plains, ridges, and benches and are developed from loamy till parent material mainly derived from calcareous shale with some limestone and sandstone. This map unit has a hydric rating of 0 percent and is farmland of statewide importance.

The **Canandaigua series** consists of very deep, poorly and very poorly drained soils formed in silty glacio-lacustrine sediments. These soils are on lowland lake plains and in depressional areas on glaciated uplands. Slopes range from 0 to 3 percent. A typical soil profile for this series consists of very dark grey silt loam from 0 to 8 inches, light brownish-grey silt loam from 8 to 12 inches, grey silt loam from 12 to 19 inches, light brownish-grey silt loam from 19 to 30 inches, and grey and light brown thin strata of silt loam and very fine sandy loam from 30 to 72 inches.

CaA is Canandaigua silt loam with 0 to 2-percent slopes. This poorly drained soil makes up approximately 2.7 percent of the Project Area. Canandaigua and similar soils make up 75 percent of the series with the remaining 25 percent being minor components.

Canandaigua soils can be found in depressions and are developed from parent material consisting of silty and clayey glaciolacustrine deposits. This map unit has a hydric rating of 95 percent and is farmland of statewide importance.

CbA is Canandaigua mucky silt loam with 0 to 2-percent slopes. This poorly drained soil makes up approximately 0.1 percent of the Project Area. Canandaigua and similar soils make up 75 percent of the series with the remaining 25 percent being minor components. Canandaigua soils can be found in depressions and are developed from parent material consisting of silty and clayey glaciolacustrine deposits. This map unit has a hydric rating of 95 percent and is not prime farmland.

The **Cazenovia series** are very deep and deep, moderately well-drained soils formed in loamy till. They are nearly level to very steep soils on till plains. Saturated hydraulic conductivity is moderately high to high in the surface layer and subsoil and moderately low to moderately high in the substratum. Slopes range from 0 to 45 percent. A typical soil profile for this series consists of very dark grayish-brown silt loam from 0 to 10 inches, light brownish-grey silt loam from 10 to 12 inches, reddish-brown silty clay loam from 12 to 19 inches, reddish-brown silty clay loam from 19 to 31 inches, reddish-brown clay loam from 31 to 44 inches, and reddish-brown gravelly silty clay loam from 44 to 72 inches.

CeA is Cazenovia silt loam with 0 to 3-percent slopes. This moderately well-drained soil makes up approximately 0.1 percent of the Project Area. Cazenovia and similar soils make up 75 percent of the series with the remaining 25 percent being minor components. Cazenovia soils can be found in reworked lake plain and till plains and are developed from a loamy till parent material that contains limestone with a mixture of reddish lake-laid clays or reddish clay shale. This map unit has a hydric rating of 0 percent and all areas are prime farmland.

CeB is Cazenovia silt loam with 3 to 8-percent slopes. This moderately well-drained soil makes up approximately 5.1 percent of the Project Area. Cazenovia and similar soils make up 80 percent of the series with the remaining 20 percent being minor components. Cazenovia soils can be found in reworked lake plains and till plains and are developed from a loamy till parent material that contains limestone with a mixture of reddish lake-laid clays or reddish clay shale. This map unit has a hydric rating of 0 percent and all areas are prime farmland.

CeC is Cazenovia silt loam with 8 to 15-percent slopes. This moderately well-drained soil makes up approximately 0.5 percent of the Project Area. Cazenovia and similar soils make up 80 percent of the series with the remaining 20 percent being minor components. Cazenovia soils can be found in reworked lake plains and till plains and are developed from a loamy till parent material that contains limestone with a mixture of reddish lake-laid clays or reddish clay shale. This map unit has a hydric rating of 0 percent and is farmland of statewide importance.

CgD3 is Cazenovia silty clay loam with 15 to 25-percent slopes, eroded. This moderately well-drained soil makes up less than 0.1 percent of the Project Area. Cazenovia and similar soils make up 80 percent of the series with the remaining 20 percent being minor components. Cazenovia soils can be found in reworked lake plain and till plains and are developed from a loamy till parent material that contains limestone with a mixture of reddish lake-laid clays or reddish clay shale. This map unit has a hydric rating of 0 percent and is not prime farmland.

The **Collamer series** consists of very deep, moderately well-drained soils formed in silty glacio-lacustrine sediments. They occur on lake plains and till plains that have a thick mantle of lake sediments. Slopes range from 0 to 25 percent. A typical soil profile for this series consists of dark greyish-brown silt loam from 0 to 30 centimeters.

ClB is Collamer silt loam with 2 to 6-percent slopes. This moderately well-drained soil makes up approximately 3.1 percent of the Project Area. Collamer and similar soils make up 80 percent of the series with the remaining 20 percent being minor components. Collamer soils can be found in lake plains and are developed from a parent material composed of silty and clayey glaciolacustrine deposits. This map unit has a hydric rating of 0 percent and all areas are prime farmland.

The **Dunkirk series** consists of very deep, well-drained, silty soils on lake plains and along lower valley sides formed in glacio-lacustrine sediments. Saturated hydraulic conductivity is moderately high or high in the mineral surface and sub-surface layers and moderately low to high in the subsoil and substratum. Slopes range from 0 to 60 percent. A typical soil profile for this series consists of dark greyish-brown silt loam from 0 to 6 inches, yellowish-brown silt loam from 6 to 11 inches, brown silt loam from 11 to 42 inches, and dark greyish varves of silt and very fine sand from 42 to 72 inches.

DuC is Dunkirk silt loam with 6 to 12-percent slopes. This well-drained soil makes up less than 0.1 percent of the Project Area. Dunkirk and similar soils make up 80 percent of the series with the remaining 20 percent being minor components. Dunkirk soils can be found on lake planes and are developed from a parent material composed of silty and clayey glaciolacustrine deposits. This map unit has a hydric rating of 0 percent and is farmland of statewide importance.

The **Fonda series** consists of very deep, very poorly drained soils formed in fine-textured, water-sorted sediments. They are on glacial lake plains and sediment-filled depressions of upland till plains. Slopes range from 0 through 1 percent. A typical soil profile from this series consists of black organic matter from 0 to 2 inches, black mucky silt loam from 2 to 10 inches, dark grey silty clay loam from 10 to 18 inches, dark grey silty clay from 18 to 28 inches, gray silty clay varved with thin bands of silt from 28 to 44 inches, and dark grey varved clay and silty clay from 44 to 74 inches.

Fo is Fonda mucky silt loam. This very poorly drained soil makes up approximately 0.1 percent of the Project Area. Fonda and similar soils make up 80 percent of the series with the remaining 20 percent being minor components. Fonda soils can be found in depressions and are developed from a parent material composed of clayey glaciolacustrine deposits. This map unit has a hydric rating of 100 percent and is not prime farmland.

The **Fredon series** consists of very deep, poorly and somewhat poorly drained soils formed in glaciofluvial materials. Fredon soils are on outwash terraces and outwash plains. Saturated hydraulic conductivity is moderately high or high in the solum and high or very high in the substratum. Slopes range from 0 to 8 percent. A typical soil profile for this series consists of very dark grey silt loam from 0 to 7 inches, greyish-brown silt loam from 7 to 13 inches, grey gravelly fine sandy loam from 13 to 22 inches, dark greyish-brown gravelly loamy sand from 22 to 50 inches, and interbedded very dark to dark greyish-brown gravelly loam sand.

FpA is Fredon gravelly loam with 0 to 3-percent slopes. This somewhat poorly drained soil makes up approximately 0.3 percent of the Project Area. Fredon and similar soils make up 80 percent of the series with the remaining 20 percent being minor components. Fredon soils can be found on terraces and valley trains and are developed from a parent material composed of Loamy over sandy and gravelly glaciofluvial deposits. This map unit has a hydric rating of 10 percent and is considered prime farmland if drained.

The **Galen series** consists of very deep, moderately well-drained soils formed in sandy deltaic deposits. They are nearly level or gently sloping soils in lake plains. Saturated hydraulic conductivity is moderately high through high within the mineral solum and high in the substratum. Slopes range from 0 to 8 percent. A typical soil profile for this series consists of dark greyish-brown fine sandy loam from 0 to 8 inches, yellowish-brown fine sandy loam from 8 to 12 inches, light yellowish-brown loamy fine sand from 12 to 16 inches, brown fine sandy loam from 28 to 54 inches, and pale brown fine sand from 54 to 70 inches.

GnB is Galen very fine sandy loam with 2 to 6-percent slopes. This moderately well-drained soil makes up approximately 0.8 percent of the Project Area. Galen and similar soils make up 80 percent of the series with the remaining 20 percent being minor components. Galen soils can be found in deltas and lake plains and are developed from a parent material composed of deltaic deposits with a high content of fine and very fine sand. This map unit has a hydric rating of 0 percent and all areas are prime farmland.

The **Gravel Pits (GP**) do not have a drainage class listed and make up less than 0.1 percent of the Project Area. Gravel pits make up 80 percent of the series with the remaining 20 percent being minor components. This map unit does not have typical location, parent material, or a hydric rating listed and is not prime farmland.

The **Hilton series** consists of very deep, moderately well-drained soils formed in till of Wisconsin age, derived from sandstone and limestone. They are nearly level to sloping soils on till plains and glaciated dissected plateaus. Saturated hydraulic conductivity is moderately high or high in the mineral solum and moderately high to low in the substratum. Slopes range from 0 to 15 percent. A typical soil profile for this series consists of dark greyish-brown loam from 0 to 9 inches, brown loam from 9 to 17 inches, reddish-brown gravelly loam from 17 to 54 inches, and brown gravelly loam from 54 to 72 inches.

HlA is Hilton Loam with 0 to 3-percent slopes. This moderately well-drained soil makes up approximately 4.9 percent of the Project Area. Hilton and similar soils make up 85 percent of the series with the remaining 15 percent being minor components. Hilton soils can be found in till plains, ridges, and drumlins and are developed from a parent material composed of calcareous loamy lodgment till derived from limestone, sandstone, and shale. This map unit has a hydric rating of 0 percent and all areas are prime farmland.

HlB is Hilton Loam with 3 to 8-percent slopes. This moderately well-drained soil makes up approximately 5.3 percent of the Project Area. Hilton and similar soils make up 85 percent of the series with the remaining 15 percent being minor components. Hilton soils can be found in till plains, ridges, and drumlins and are developed from a parent material composed of calcareous loamy lodgment till derived from limestone, sandstone, and shale. This map unit has a hydric rating of 0 percent and all areas are prime farmland.

The **Lakemont series** consists of deep, poorly drained and very poorly drained soils of lake plains. They are nearly level soils formed in very slowly permeable reddish-colored clayey lacustrine sediments. Slopes range from 0 to 3 percent. Permeability is moderately slow in the surface and very slow in the subsoil sand substratum. A typical soil profile for this series consists of black silty clay loam from 0 to 8 inches, grey silty clay from 8 to 17 inches, pinkish-grey silty clay from 17 to 26 inches, and dark reddish-grey and reddish-brown silty clay loam from 26 to 60 inches.

La is Lakemont silty clay loam with 0 to 3-percent slopes. This poorly drained soil makes up approximately 1.8 percent of the Project Area. Lakemont and similar soils make up 85 percent of the series with the remaining 15 percent being minor components. Lakemont soils can be found in depressions and are developed from a parent material composed of red clayey glaciolacustrine deposits derived from calcareous shale. This map unit has a hydric rating of 95 percent and is considered farmland of statewide importance.

The **Lamson series** consists of very deep, poorly drained and very poorly drained soils formed in glacio-fluvial, glacio-lacustrine and deltaic deposits. They are level and nearly level soils in low areas on glacial lake plains. Slopes range from 0 to 3 percent but are mostly less than 2 percent. Saturated hydraulic conductivity is moderately high through high in the mineral soil. Atypical soil profile for this series consists of very dark brown very fine sandy loam from 0 to 9 inches, grey very fine sandy loam from 9 to 15 inches, brown fine sandy loam from 15 to 22 inches, greyish-brown fine sandy loam from 22 to 40, and stratified layers of fine sand and silt from 40 to 72 inches.

Ld is Lamson very fine sandy loam. This poorly drained soil makes up approximately 1.3 percent of the Project Area. Lamson and similar soils make up 80 percent of the series with the remaining 20 percent being minor components. Lamson soils can be found in depressions and are developed from a parent material composed of deltaic or glaciolacustrine deposits with a high content of fine and very fine sand. This map unit has a hydric rating of 90 percent and is not prime farmland.

Le is Lamson mucky very fine sandy loam. This very poorly drained soil makes up approximately 0.1 percent of the Project Area. Lamson and similar soils make up 75 percent of the series with the remaining 25 percent being minor components. Lamson soils can be found in depressions and are developed from a parent material composed of deltaic or glaciolacustrine deposits with a high content of fine and very fine sand. This map unit has a hydric rating of 90 percent and is not prime farmland.

The **Lime series** consists of very deep, moderately well-drained soils on till plains. They are nearly level to moderately steep soils formed in till that is strongly influenced by limestone and calcareous shale. The till may be dense. Saturated hydraulic conductivity is moderately high or high within the solum but is low through moderately high in the underlying substratum. Slopes range from 0 to 20 percent. A typical soil profile for this series consists of dark greyish-brown loam from 0 to 9 inches, brown loam from 9 to 16 inches, brown gravelly loam from 16 to 52 inches, and greyish-brown gravelly loam from 25 to 72 inches.

LmA is Lima silt loam with 0 to 3-percent slopes. This moderately well-drained soil makes up approximately 4.7 percent of the Project Area. Lima and similar soils make up 85 percent of the series with the remaining 15 percent being minor components. Lima soils can be found in drumlins, ridges, and till plains and are developed from a parent material composed of Calcareous loamy lodgment derived from limestone, sandstone, and shale. This map unit has a hydric rating of 1 percent and all areas are prime farmland.

LmB is Lima silt loam with 3 to 8-percent slopes. This moderately well-drained soil makes up approximately 12.8 percent of the Project Area. Lima and similar soils make up 85 percent of the series with the remaining 15 percent being minor components. Lima soils can be found in drumlins, ridges, and till plains and are developed from a parent material composed of calcareous loamy lodgment till derived from limestone, sandstone and shale. This map unit has a hydric rating of 1 percent and all areas are prime farmland.

The **Lyons series** consists of very deep, poorly and very poorly drained soils on upland till plains in depressions and low areas in the landscape. They are occasionally in areas of seeps on gently sloping landscapes. They formed in calcareous till derived from limestone, calcareous shale, and sandstone. Slopes range from 0 to 5 percent. A typical soil profile for this series consists of very dark grey silt loam from 0 to 9 inches, light brownish-grey silt loam from 9 to 11 inches, greyish-brown silt loam from 11 to 18 inches, greyish-brown gravelly loam from 18 to 36 inches, and light brownish-grey gravelly loam from 36 to 72 inches.

> **LoA** is Lyons soils with 0 to 3-percent slopes. This poorly drained soil makes up approximately 0.9 percent of the Project Area. Lyons and similar soils make up 75 percent of the series, Lyons frequently ponded and similar soils make up 15 percent of the series, with the remaining 10 percent being minor components. Lyons soils can be found in drainageways and depressions and are developed from a parent material composed of Calcareous loamy lodgment till derived from limestone, sandstone, and shale. This map unit has a hydric rating of 95 percent and is not prime farmland.

The **Madalin series** consists of very deep, poorly drained soils on lake plains and depressions in the uplands. They formed in water-deposited materials. Saturated hydraulic conductivity is moderately low or moderately high to low throughout the soil. Slopes range from 0 to 3 percent. A typical soil profile for this series consists of very dark grey silty loam from 0 to 20 centimeters; dark greyish-brown silty clay loam from 20 to 41 centimeters, brown silty clay from 41 to 64 centimeters, dark greyish-brown silty clay from 64 to 84 centimeters, and greyish-brown stratified silt and clay from 84 to 132 centimeters.

> **Ma** is Madalin silty clay loam with 0 to 3-percent slopes. This poorly drained soil makes up less than 0.1 percent of the Project Area. Madalin and similar soils make up 85 percent of the series with the remaining 15 percent being minor components. Madalin soils can be found in depressions and are developed from a parent material composed of brown clayey glaciolacustrine deposits derived from calcareous shale. This map unit has a hydric rating of 95 percent and is considered farmland of statewide importance.

The **Minoa series** consists of very deep, somewhat poorly drained soils formed in deltaic sediments. They are nearly level or gently sloping soils on lowland lake plains. Permeability is moderate in the solum, and moderate or moderately rapid in the substratum. Slopes range from 0 to 8 percent. A typical soil profile for this series consists of very dark greyish-brown fine sandy loam from 0 to 10 inches, brown loamy very fine sand from 10 to 14 inches, reddish-brown loamy very fine sand from 14 to 22 inches, greyish-brown loamy very fine sand from 22 to 38 inches, and light brownish-grey stratifies sand from 38 to 72 inches.

MnA is Minoa very fine sandy loam with 0 to 2-percent slopes. This somewhat poorly drained soil makes up approximately 0.3 percent of the Project Area. Minoa and similar soils make up 80 percent of the series with the remaining 20 percent being minor components. Minoa soils can be found in deltas on lake plains and are developed from a parent material composed of deltaic or glaciolacustrine deposits with a high content of fine and very fine sand. This map unit has a hydric rating of 5 percent and is considered prime farmland if drained.

The **Newstead series** consists of moderately deep, somewhat poorly drained soils formed in permeable till overlying limestone bedrock. These soils are in low areas or depressions on till plains. Bedrock is at a depth of 20 to 40 inches. Permeability is moderate throughout the soil. Slopes range from 0 to 8 percent. A typical soil profile for this series consists of very dark grey silt loam from 0 to 9 inches, dark yellowish-brown silt loam from 9 to 14 inches, brown flaggy silt loam from 14 to 24 inches, greyish-brown flaggy sandy loam from 24 to 26 inches, and dark grey limestone bedrock at a depth of 25 inches and beyond.

NeA is Newstead silt loam with 0 to 3-percent slopes. This somewhat poorly drained soil makes up approximately 0.3 percent of the Project Area. Newstead and similar soils make up 80 percent of the series with the remaining 20 percent being minor components. Newstead soils can be found in benches, till plains, and ridges and are developed from a parent material composed of loamy till derived from sandstone, shale, and granite. This map unit has a hydric rating of 5 percent and is considered prime farmland if drained.

The **Niagara series** consists of very deep, somewhat poorly drained soils formed in silty glacio-lacustrine deposits. These soils occur in level to slightly concave areas on lake plains and in valleys. Slopes range from 0 to 15 percent. A typical soil profile for this series consists of very dark greyish-brown silt loam from 0 to 5 inches, greyish-brown silt loam from 5 to 14 inches, and dark greyish-brown silt loam from 14 to 72 inches.

NgA is Niagara silt loam with 0 to 2-percent slopes. This somewhat poorly drained soil makes up approximately 2 percent of the Project Area. Niagara and similar soils make up 75 percent of the series with the remaining 25 percent being minor components. Niagara soils can be found in lake plains and are developed from a parent material composed of silty and clayey glaciolacustrine deposits. This map unit has a hydric rating of 5 percent and is considered prime farmland if drained.

The **Odessa series** consists of very deep, somewhat poorly drained soils formed in red, clayey lacustrine deposits. These soils are in moderately low areas on lake plains and valley terraces. Slopes range from 0 to 20 percent. A typical soil profile for this series consists of dark greyish-brown silt loam from 0 to 20 centimeters, brown silty clay loam from 20 to 25 centimeters, reddish-brown silty clay from 25 to 64 centimeters, and dark reddish grey silty clay from 64 to 183 centimeters.

OdA is Odessa silt loam with 0 to 3-percent slopes. This somewhat poorly drained soil makes up approximately 0.4 percent of the Project Area. Odessa and similar soils make up 85 percent of the series with the remaining 15 percent being minor components. Odessa soils can be found in lake terraces and are developed from a parent material composed of red clayey glaciolacustrine deposits derived from calcareous shale. This map unit has a hydric rating of 5 percent and is considered prime farmland if drained.

OdB is Odessa loam with 3 to 8-percent slopes. This somewhat poorly drained soil makes up approximately 1.1 percent of the Project Area. Odessa and similar soils make up 85 percent of the series with the remaining 15 percent being minor components. Odessa soils can be found in lake terraces and are developed from a parent material composed of red clayey glaciolacustrine deposits derived from calcareous shale. This map unit has a hydric rating of 4 percent and is considered prime farmland if drained.

The **Ontario series** consists of deep or very deep, well-drained soils formed in loamy till, which is strongly influenced by limestone and sandstone. They are nearly level to very steep soils on convex upland till plains and drumlins. Slopes range from 0 to 60 percent. A typical soil profile for this series consists of dark brown loam from 0 to 20 centimeters, brown loam from 20 to 53 centimeters, reddish-brown gravelly loam from 53 to 99 centimeters, and brown gravelly loam from 99 to 183 centimeters.

OnA is Ontario Loam with 0 to 3-percent slopes. This well-drained soil makes up approximately 3.2 percent of the Project Area. Ontario and similar soils make up 85 percent of the series with the remaining 15 percent being minor components. Ontario soils can be found in drumlins, ridges, and till plains and are developed from a parent material composed of Calcareous loamy lodgment till derived from limestone, sandstone, and shale. This map unit has a hydric rating of 0 percent and all areas are prime farmland.

OnB is Ontario loam with 3 to 8-percent slopes. This well-drained soil makes up approximately 11.7 percent of the Project Area. Ontario and similar soils make up 85 percent of the series with the remaining 15 percent being minor components. Ontario soils can be found in drumlins, ridges, and till plains and are developed from a parent material composed of calcareous loamy lodgment till derived from limestone, sandstone, and shale. This map unit has a hydric rating of 0 percent and all areas are prime farmland.

OnC is Ontario Loam with 8 to 15-percent slopes. This well-drained soil makes up approximately 0.7 percent of the Project Area. Ontario and similar soils make up 85 percent of the series with the remaining 15 percent being minor components. Ontario soils can be found in drumlins, ridges, and till plains and are developed from a parent material composed of calcareous loamy lodgment till derived from limestone, sandstone, and shale. This map unit has a hydric rating of 0 percent and is considered farmland of statewide importance.

OnD is Ontario loam with 15 to 25-percent slopes. This well-drained soil makes up less than 0.1 percent of the Project Area. Ontario and similar soils make up 85 percent of the series with the remaining 15 percent being minor components. Ontario soils can be found in drumlins, ridges, and till plains and are developed from a parent material composed of calcareous loamy lodgment till derived from limestone, sandstone, and shale. This map unit has a hydric rating of 0 percent and is not prime farmland.

OsB is Ontario loam with 3 to 8-percent slopes. This well-drained soil makes up approximately 0.8 percent of the Project Area. Ontario and similar soils make up 85 percent of the series with the remaining 15 percent being minor components. Ontario soils can be found in drumlins, ridges, and till plains and are developed from a parent material composed of calcareous loamy lodgment till derived from limestone, sandstone, and shale. This map unit has a hydric rating of 0 percent and all areas are prime farmland.

The **Ovid series** consists of very deep, somewhat poorly drained soils formed in moderately fine textured, reddish-colored till. Saturated hydraulic conductivity is moderately high to high in the mineral surface and subsurface layers, moderately high in the subsoil, and moderately low to moderately high in the substratum. Slopes range from 0 to 15 percent. A typical soil profile for this series consists of very dark greyish-brown silt loam from 0 to 9 inches, brown silt loam from 9 to 12 inches, and reddish-brown silty clay loam from 12 to 72 inches.

OvA is Ovid silt loam with 0 to 3-percent slopes. This somewhat poorly drained soil makes up approximately 6.1 percent of the Project Area. Ovid and similar soils make up 80 percent of the series with the remaining 20 percent being minor components. Ovid soils can be found in reworked lake plains and till plains and are developed from a parent material composed of loamy till with a significant component of reddish shale or reddish glaciolacustrine clays, mixed with limestone and some sandstone. This map unit has a hydric rating of 5 percent and is considered prime farmland if drained.

OvB is Ovid silt loam with 3 to 8-percent slopes. This somewhat poorly drained soil makes up approximately 9.8 percent of the Project Area. Ovid and similar soils make up 80 percent of the series with the remaining 20 percent being minor components. Ovid soils can be found in reworked lake plains and till plains, and are developed from a parent material composed of loamy till with a significant component of reddish shale or reddish glaciolacustrine clays, mixed with limestone and some sandstone. This map unit has a hydric rating of 5 percent and is considered prime farmland if drained.

The **Palms series** consist of very deep, very poorly drained soils formed in herbaceous organic materials 41 to 130 centimeters (16 to 51 inches) thick and the underlying loamy deposits in closed depressions on moraines, lake plains, till plains, outwash plains, and hillside seep areas, and on the back swamps of flood plains. Slopes range from 0 to 6 percent. A typical soil profile for this series consists of black muck from 0 to 89 centimeters and grey loamy clay from 89 to 203 centimeters.

Pd is Palms muck, a very poorly drained soil that makes up approximately 0.2 percent of the Project Area. Palms drained and similar soils make up 65 percent of the series, Palms undrained and similar soils make up 15 percent of the series with the remaining 20 percent being minor components. Palms drained and Palms undrained soils can be found in swamps and marshes, and are developed from a parent material composed of organic material over loamy glacial drift. This map unit has a hydric rating of 100 percent and is not prime farmland.

The **Palmyra series** consists of very deep, well-drained to somewhat excessively drained soils formed in glacial outwash. They are nearly level to very steep soils formed in loamy material overlying calcareous, stratified gravel and sand. Saturated hydraulic conductivity is moderately high or high in the solum and high or very high in the substratum. Slopes range from 0 to 40 percent. A typical soil profile for this series consists of dark greyish-brown gravelly loam from 0 to 9 inches, greyish-brown gravelly loam from 9 to 11 inches, brown gravelly loam from 11 to 24 inches, and greyish-brown gravel and sand from 24 to 60 inches.

PhA is Palmyra gravelly loam with 0 to 3-percent slopes. This well-drained soil makes up approximately 0.1 percent of the Project Area. Palmyra and similar soils make up 80 percent of the series with the remaining 20 percent being minor components. Palmyra soils can be found in deltas, terraces, and outwash plains, and are developed from a parent material composed of loamy over sandy and gravelly glaciofluvial deposits that are mainly derived from limestone and other sedimentary rock. This map unit has a hydric rating of 0 percent and all areas are prime farmland.

PhB is Palmyra gravelly loam with 3 to 8-percent slopes. This well-drained soil makes up approximately 0.6 percent of the Project Area. Palmyra and similar soils make up 80 percent of the series with the remaining 20 percent being minor components. Palmyra soils can be found in deltas, terraces, and outwash plains and are developed from a parent material composed of loamy over sandy and gravelly glaciofluvial deposits that are mainly derived from limestone and other sedimentary rock. This map unit has a hydric rating of 0 percent and all areas are prime farmland.

PhC is Palmyra gravelly loam with 8 to 15-percent slopes. This well-drained soil makes up approximately 0.4 percent of the Project Area. Palmyra and similar soils make up 80 percent of the series with the remaining 20 percent being minor components. Palmyra soils can be found in deltas, terraces, and outwash plains, and are developed from a parent material composed of loamy over sandy and gravelly glaciofluvial deposits that are mainly derived from limestone and other sedimentary rock. This map unit has a hydric rating of 0 percent and is considered farmland of statewide importance.

PkD is Palmyra and Arkport soils with 15 to 25-percent slopes. This well-drained soil makes up less than 0.1 percent of the Project Area. Palmyra and similar soils make up 45 percent of the series, Arkport and similar soils make up 40 percent of the series, with the remaining 15 percent being minor components. Palmyra soils can be found in outwash plains, deltas, and terraces and are developed from a parent material composed of loamy over sandy and gravelly glaciofluvial deposits that are mainly derived from limestone and other sedimentary rock. Arkport soils can be found in deltas on lake plains and are developed from parent material composed of glaciofluvial or deltaic deposits with a high content of fine and very fine sand. This map unit has a hydric rating of 0 percent and is not prime farmland.

The **Phelps series** consists of very deep, moderately well-drained soils formed in glacial outwash. They are nearly level and gently sloping soils formed in loamy material overlying calcareous, stratified gravel, and sand. Saturated hydraulic conductivity is moderately high or high in the mineral solum and high or very high in the sand and gravel. Slopes range from 0 to 8 percent. A typical soil profile for this series would consist of very dark greyish-brown gravelly loam from 0 to 9 inches, dark yellowish-brown gravelly loam from 9 to 14 inches, dark reddish-brown gravelly clay loam from 14 to 34 inches, and brown stratified gravel and sand from 34 to 60 inches.

PsA is Phelps Gravely Loam with 0 to 3-percent slopes. This moderately well-drained soil makes up less than 0.1 percent of the Project Area. Phelps and similar soils make up 80 percent of the series with the remaining 20 percent being minor components. Phelps soils can be found in terraces and valley trains and are developed from a parent material composed of loamy glaciofluvial deposits over sandy and gravelly glaciofluvial deposits, containing significant amounts of limestone. This map unit has a hydric rating of 5 percent and all areas are prime farmland.

PsB is Phelps Gravely Loam with 3 to 8-percent slopes. This moderately well-drained soil makes up approximately 0.1 percent of the Project Area. Phelps and similar soils make up 80 percent of the series with the remaining 20 percent being minor components. Phelps soils can be found in terraces and valley trains and are developed from a parent material composed of loamy glaciofluvial deposits over sandy and gravelly glaciofluvial deposits, containing significant amounts of limestone. This map unit has a hydric rating of 0 percent and all areas are prime farmland.

The **Romulus series** consists of very deep, poorly drained soils formed in till or mixed lake sediments and till. They are nearly level to gently sloping soils on upland till plains. Permeability is slow or very slow throughout the soil. Slopes range from 0 to 8 percent. A typical soil profile for this series consists of very dark grey to light brown silty clay loam from 0 to 60 inches.

RsA is Romulus silt loam with 0 to 3-percent slopes. This poorly drained soil makes up approximately 1.1 percent of the Project Area. Romulus and similar soils make up 75 percent of the series with the remaining 25 percent being minor components. Romulus soils can be found in depressions and are developed from a parent material composed of loamy till derived from reddish calcareous shale, limestone, and sandstone, in places intermixed with glaciolacustrine deposits. This map unit has a hydric rating of 85 percent and is considered farmland of statewide importance.

The **Schoharie series** consists of very deep, moderately well-drained soils formed in clayey lacustrine sediments. They are on glacial lake plains and uplands mantled with lake sediments. Saturated hydraulic conductivity is moderately high or high in the mineral surface and subsurface and low through moderately high in the subsoil and substratum. Slopes range from 0 through 60 percent. A typical soil profile for this series consists of dark brown silt loam from 0 to 8 inches, ale brown silt loam from 8 to 11 inches, reddish-brown silty clay from 11 to 18 inches; reddish-brown clay from 18 to 33 inches, and reddish-brown silty clay from 33 to 72 inches.

ShC3 is Schoharie silty clay loam with 6 to 12-percent slopes. This moderately well-drained soil makes up less than 0.1 percent of the Project Area. Schoharie and similar soils make up 85 percent of the series with the remaining 15 percent being minor components. Schoharie soils can be found in lake terraces and are developed from a parent material composed of red clayey glaciolacustrine deposits derived from calcareous shale. This map unit has a hydric rating of 0 percent and is not prime farmland.

The **Teel series** consists of very deep, moderately well-drained soils on floodplains. They formed in nearly level, silty alluvial deposits. Permeability is moderate throughout the solum. Slopes range from 0 to 3 percent. A typical soil profile for this series consists of very dark to normal greyish-brown silt loam from 0 to 72 inches in depth.

Te is Teel silt loam, a moderately well-drained soil that makes up approximately 0.2 percent of the Project Area. Teel and similar soils make up 80 percent of the series with the remaining 20 percent being minor components. Teel soils can be found in flood plains and are developed from a parent material composed of silty alluvium. This map unit has a hydric rating of 5 percent and all areas are prime farmland.

The **Wakeville series** consists of very deep, somewhat poorly drained soils on flood plains. They formed in silty alluvium. They are nearly level soils that are subject to flooding. Permeability is moderate throughout the soil. Slopes range from 0 to 3 percent. A typical soil profile for this series consists of very dark greyish-brown silt loam to dark yellowish-brown silt loam from 0 to 72 inches in depth.

Wk is Wakeville silt loam, a somewhat poorly drained soil that makes up approximately 1.7 percent of the Project Area. Wakeville and similar soils make up 70 percent of the series with the remaining 30 percent being minor components. Wakeville soils can be found in flood plains and are developed from a parent material composed of silty alluvium washed from areas of glacial drift derived from shale, siltstone, and sandstone with some limestone. This map unit has a hydric rating of 10 percent and is considered prime farmland if drained.

The **Wassaic series** consists of moderately deep, well-drained soils formed in loamy till. They are on bedrock-controlled till plains. Bedrock is at depths of 20 to 40 inches. Permeability is moderate or moderately slow in the subsoil and substratum. Slopes range from 0 to 50 percent. A typical soil profile for this series consists of dark greyish-brown silty loam from 0 to 9 inches, greyish-brown loam from 9 to 10 inches, brown silt loam from 10 to 14 inches, brown gravelly silt loam from 14 to 23 inches, brown gravelly loam from 23 to 28 inches, and grey hard limestone at a depth of 28 inches and beyond.

WsB is Wassaic silt loam with 2 to 8-percent slopes. This well-drained soil makes up approximately 0.5 percent of the Project Area. Wassaic and similar soils make up 80 percent of the series with the remaining 20 percent being minor components. Wassaic soils can be found in ridges, benches, and till plains and are developed from a parent material composed of loamy till mainly derived from limestone with varying amounts of sandstone, shale, and crystalline rock. This map unit has a hydric rating of 0 percent and all areas are prime farmland.

The **Wayland series** consists of very deep, poorly drained and very poorly drained, nearly level soils formed in recent alluvium. These soils are in low areas or slackwater areas on flood plains. Saturated hydraulic conductivity is moderately high or high in the mineral soil. Slopes range from 0 to 3 percent. A typical soil profile for this series consists of very dark greyish-brown silt loam from 0 to 30 centimeters, greyish-brown silt loam from 30 to 36 centimeters, grey silt loam from 46 to 117 centimeters, and grey silty clay loam from 117 to 183 centimeters.

Wy is Wayland soils complex with 0 to 3-percent slopes, frequently flooded. This poorly drained soil makes up approximately 0.2 percent of the Project Area. Wayland and similar soils make up 60 percent of the series, Wayland very poorly drained and similar soils make up 30 percent of the series, and the remaining 20 percent are minor components. Wayland and Wayland very poorly drained soils can be found in flood plains and are developed from a parent material composed of silty and clayey alluvium, which are derived in turn from interbedded sedimentary rocks. This map unit has a hydric rating of 90 percent and is not prime farmland.

Table 21-5. Summary of Soil Types

Map Unit Symbol	Map Unit Name	Slope (%)	Acres within Project Area
Ad	Alden mucky silt loam	0-3	26.7
ApA	Appleton silt loam	0-3	367.5
ApB	Appleton silt loam	3-8	24.2
ArB	Arkport very fine sandy loam	1-6	36.8
AuA	Aurora silt loam	0-3	6.3
AuB	Aurora silt loam	3-8	26.2
CaA	Canandaigua silt loam	0-2	91.8
CbA	Canandaigua mucky silt loam	0-2	4.3
CeA	Cazenovia silt loam	0-3	2.9
CeB	Cazenovia silt loam	3-8	172.9
CeC	Cazenovia silt loam	8-15	16.7
CgD3	Cazenovia silty clay loam	15-25	1.3
ClB	Collamer silt loam	2-6	106.0
DuC	Dunkirk silt loam	6-12	0.2
Fo	Fonda mucky silt loam	0-1	2.0
FpA	Fredon gravelly loam	0-3	11.4
GnB	Galen very fine sandy loam	0-6	26.4
GP	Gravel pits	N/A	1.3
HlA	Hilton loam	0-3	166.8
HlB	Hilton loam	3-8	179.2
La	Lakemont silty clay loam	0-3	62.5
Ld	Lamson very fine sandy loam	0-3	44.0
Le	Lamson mucky very fine sandy loam	0-3	1.9
LmA	Lima silt loam	0-3	161.3

Table 21-5. Summary of Soil Types

Map Unit Symbol	Map Unit Name	Slope (%)	Acres within Project Area
LmB	Lima silt loam	3-8	437.6
LoA	Lyons soils	0-3	32.2
Ma	Madalin silty clay loam	0-3	1.2
MnA	Minoa very fine sandy loam	0-2	11.7
NeA	Newstead silt loam	0-3	8.9
NgA	Niagara silt loam	0-2	69.2
OdA	Odessa silt loam	0-3	12.9
OdB	Odessa silt loam	3-8	38.9
OnA	Ontario loam	0-3	110.5
OnB	Ontario loam	3-8	403.5
OnC	Ontario loam	8-15	22.9
OnD	Ontario loam	15-25	0.8
OsB	Ontario loam, stony	3-8	27.2
OvA	Ovid silt loam	0-3	211.1
OvB	Ovid silt loam	3-8	336.4
Pd	Palms muck	0-6	8.3
PhA	Palmyra gravelly loam	0-3	2.8
PhB	Palmyra gravelly loam	3-8	19.7
PhC	Palmyra gravelly loam	8-15	13.2
PkD	Palmyra and Arkport soils	15-25	1.6
PsA	Phelps gravelly loam	0-3	1.2
PsB	Phelps gravelly loam	3-8	2.0
RsA	Romulus silt loam	0-3	37.0
ShC3	Schoharie silty clay loam	6-12	1.0
Te	Teel silt loam	0-3	7.4
Wk	Wakeville silt loam	0-3	59.6
WsB	Wassaic silt loam	2-8	17.4
Wy	Wayland soils complex, frequently flooded	0-3	5.8

Soil drainage among mapped oil units within the Project Area varies. Within the Project Area, approximately 1,879 acres of soil units are classified as moderately well drained, approximately 1,118 acres are classified as somewhat poorly drained, approximately 298 acres are poorly drained, approximate 92 acres are well drained, and approximately 48 acres are very poorly drained. For additional information about agricultural resources within the Project Area, including designated Agricultural District lands, see Exhibit 4 and Exhibit 22 of this Application.

The primary impact to the physical features of the Project Area will be the disturbance of soils during construction. The LOD for the Project is approximately 1,712 acres. Based on the assumptions outlined in Exhibit 22, disturbance to soils from all anticipated construction activities will total approximately 156 acres. Of this total, only approximately 49 acres will be permanent impacts where soils are converted to access roads, array posts, and structures, while the remaining will be restored and stabilized following the completion of construction. The area of disturbance calculations presented above assumes significant soil disturbance will occur in all areas in which construction occurs. Actual disturbance will include overlap of some components and will be highly variable based on the specific construction activity, the construction techniques employed, and soil/weather conditions at the time of construction.

Earth moving and general soil disturbance will increase the potential for wind/water erosion and sedimentation into surface waters. Soils within the Project Area exhibit low permeability and limited depth to bedrock and are rated as most to somewhat limited infiltration capacity. Implementing the erosion and sediment control measures outlined in the Preliminary SWPPP will minimize impacts to steep slopes and highly erodible soils that may occur in the event of extreme rainfall or other events that could potentially lead to severe erosion and downstream water quality issues. In addition, impacts to soils will be further minimized by the following means:

- Public road ditches and other locations where Project-related runoff is concentrated will be armored with riprap to dissipate the energy of flowing water and to hold the soils in place.
- Prior to commencing construction activities, erosion control devices will be installed between the work areas and downslope areas, to reduce the risk of soil erosion and siltation. Erosion control devices will be monitored continuously throughout construction and restoration for function and effectiveness.
- During construction activities, hay bales, silt fence, or other appropriate erosion control measures will be placed as needed around disturbed areas and stockpiled soils.
- Following construction, all temporarily disturbed areas will be stabilized and restored in accordance with approved plans.

- A third-party Environmental Monitor (EM) will be on site during construction to regularly inspect erosion and sediment control measures.

Impacts to soil resources will be minimized by adherence to best management practices that are designed to avoid or control erosion and sedimentation and stabilize disturbed areas. In addition, erosion and sedimentation impacts during construction will be minimized by the implementation of an erosion and sedimentation control plan developed as part of the SPDES General Permit for the Facility. Erosion and sediment control measures shall be constructed and implemented in accordance with a SWPPP (in Appendix 23-3). All excavations will comply with state and federal regulations.

Construction excavations may encounter areas of perched groundwater if construction occurs during a time when a seasonally high-water table may be present. In addition, construction during rainy periods may see an increase in perched groundwater due to the low hydraulic conductivity and soil permeability within the Project Area. Temporary de-watering may be required during the construction if perched water, groundwater, or seepage is encountered. Open sump pumping method is the most common and economical method of dewatering and is anticipated to be sufficient based on relatively low permeability soils anticipated at the site. As stated previously, the water will be discharged properly to an area identified in the Final SWPPP. Dewatering methods will involve pumping the water to a predetermined well-vegetated discharge point, away from wetlands, waterbodies, and other sensitive resources. Discharge of water will include measures/devices to slow water velocities and trap any suspended sediment.

21(r) Potential Impacts to Existing Natural and Artificial Drainage Features

Prior to the start of construction at specific sites, the EM, with support of construction management personnel, will conduct site reviews in locations to be impacted, or potentially impacted, by associated construction activities. Pre-construction site review will direct attention to previously identified sensitive resources to avoid (e.g., wetlands and waterbodies, archaeological, or agricultural resources), as well as the limits of clearing, location of drainage features (e.g., culverts, ditches), location of agricultural tile lines, and layout of erosion and sediment control measures.

The Applicant is committed to minimizing impacts to agricultural operations and will work with landowners/farm operators to address unanticipated post-construction impacts. The Applicant will work with affected landowners/farmers regarding potential drainage issues on their properties and will utilize trench breakers in areas of moderate to steep slopes on active agricultural land if deemed prudent (based on field conditions) to ensure that the deposition of impacted or stockpiled soils do not occur over agricultural lands.

Existing drain tiles will be identified and located before construction as much as is reasonably possible based primarily on consultation with the landowner. During and after construction operations, any existing drain tiles within the area of disturbance will be checked for damage, and damaged drain tiles will be repaired or replaced as specified in landowner lease agreements and will be performed by qualified drain-tile specialists. The Applicant will coordinate with the landowner to continue to monitor drain tiles post-construction to ensure repairs are properly functioning.

21(s) Bedrock and Underlying Bedrock Maps, Figures, and Analyses

Figure 21-3 shows the bedrock geology and the depth to the high water table within the Project Area. The depth to bedrock is mapped between 0 inches to greater than 79 inches within the Project Area. The depth to the water table ranges from at ground surface to greater than 6 feet (see Figure 21-3).

Results of test borings performed to date by Terracon indicate that the majority of bedrock is shale bedrock at 34 feet bgs. The depth to bedrock, as identified on the available logs, varies across the boring locations and ranges from 17 feet bgs to 28 feet bgs. The bedrock extended to at least 34 feet bgs, which was the maximum depth explored in the borings. The majority of the bedrock encountered consists primarily of unweathered to slightly weathered, thinly bedded, medium strong shale that is fractured with occasional gypsum seams.

The Rock Quality Designation (RQD) of the coreable rock ranges from 27 percent to 72 percent, indicating a “poor” to “fair” condition using a standard RQD classification. The RQD was recorded from borings ESS-1 and ESS-2. The RQD of 27 percent was experienced from a depth of 28 feet bgs to 31 feet bgs. The shale bedrock at this depth was unweathered to slightly weathered, thinly bedded, medium strong and fractured with occasional gypsum seams. The RQD of 33 percent was experienced from a depth of 28 feet bgs to 29 feet bgs. The RQD of 72 percent was experienced from a depth of 29 feet bgs to 34 feet bgs. The shale bedrock from depths of 28 feet bgs to 34 feet bgs was unweathered to slightly weathered, thinly bedded, medium strong, sound, and fractured with occasional gypsum seams and partings.

Groundwater was encountered at 16 of the boring locations at depths ranging from 0 feet bgs to 25 feet bgs. The groundwater conditions may vary with seasonal changes and weather conditions. A more detailed geotechnical investigation will need to be completed prior to any site improvements to determine the actual elevations of groundwater in the area of the proposed solar array.

Maps, figures, and analyses on depth to bedrock, underlying bedrock types, vertical profiles of soil, bedrock, water table, seasonal high groundwater roadways to be constructed, and all off-site interconnections required to serve the Project are provided in the Preliminary Geotechnical Investigation Report, provided as Appendix 21-1. Additionally, Appendix 21-1 provides an evaluation of the potential impacts due to Project construction and operation, including any on-site water disposal systems. These analyses were based on information obtained from publicly available maps, scientific literature, a review of technical studies conducted on and in the vicinity of the Facility, and on-site field observations, test pits, and/or borings as available.

21(t) Evaluation of Suitable Building and Equipment Foundations

Foundation construction for Project Components within the collection substation and switchyard occurs in several stages, which typically include: excavation; pouring of the concrete mud mat, rebar installation, and bolt cage assembly; outer form setting, casting, and finishing of the concrete; removal of the forms; backfilling and compacting; and site restoration. Excavation and foundation construction will be conducted in a manner that will minimize the size and duration of excavated areas required to install foundations.

(1) Preliminary Engineering Assessment

The Geotechnical Engineering Report analyzed spread footing and isolated slab foundations and drilled shaft foundation alternatives for the substation and switchyard foundations. The spread footing and isolated slab foundations were determined to be acceptable to support light-loaded structures and equipment pads provided the maximum loads are not exceeded. If drilled shaft foundations are utilized for the Project, a minimum shaft diameter of 30 inches is recommended for the foundations. Refer to Appendix 21-1 for additional information regarding the foundation engineering assessment and design recommendations.

The available information suggests that substation and point-of-interconnection (POI) switchyard foundations will be underlain by glacial till and bedrock. Solar array racking will be installed by driving the posts directly into the subsurface. If refusal is encountered while driving the posts directly into the subsurface, there are three alternative methods for installation. A helical post (i.e., pile screw) can be installed directly into the subsurface. In cases of high ledge or bedrock, undersized holes can be pre-drilled into the rock to an appropriate depth prior to driving the post. In situations with very hard rock, an oversized hole may need to be pre-drilled, then grouted after the post is installed. See Preliminary Design Drawings included in Appendix 11-1.

Design frost depth is 4 feet in the Project Area, and foundations must be at or below this depth to prevent movement due to frost heave. Additionally, the manufacturer specifications indicate that standard embedment of 5 to 7 feet is required to support racking and panels.

The glacial till typically provides high-bearing strength and good short-term excavation stability if it is left undisturbed. The glacial till contains a significant percentage of silt and sand and loses strength rapidly if saturated and subjected to dynamic loading such as that imparted by construction equipment. Due to the potential for a variable rock surface, there is the potential for foundations to be partially founded on bedrock, natural soils, and/or compacted structural fill. If a mixed bearing grade condition exists, where the bearing surface transitions from bedrock to soil, the rock will be undercut at least 12 inches over a length extending back at least 10 feet from the transition to soil. The undercut will be backfilled with compacted imported structural fill.

(2) Pile Driving Impact Assessment

Pile-driven foundations are not proposed for the substation and switchyard foundations; therefore, engineering feasibility and impact assessments were not conducted. If pile driven foundations are determined to be necessary for Project construction, the foundation will be assessed for impacts to surrounding properties and structures, mitigation methods for vibration will be evaluated, and the daily and total pile-driving work estimates will be determined. It is anticipated that the posts for the panel racking system will be installed with end bearing either in the glacial till soils or directly on weathered rock or rock. Based on manufacturer specifications, approximately 450 posts/megawatt (MW) will be required for a total of 409,488 posts. Posts are galvanized steel and load-carrying capacity will vary based on post dimensions and installation methods. Installation is typically completed using an excavator equipped with a vibratory driving attachment or drilling, setting, and backfilling posts. It is anticipated that the posts can be installed in 170 days utilizing four post installation crews working 10 hours per day.

Based on soil types throughout the Project Area, the posts are anticipated to be driven with a vibratory hammer. Helical posts (i.e., pile screws), if utilized, will be installed with the minimum required torque per the manufacturer's recommendations. If refusal is encountered during installation, undersized holes will be pre-drilled, then the posts will be driven or will be installed in oversized holes and filled with grout.

The primary impacts from post installation operations are noise and vibration. The equipment used in post installation is not expected to generate any off-site noise impacts (see Exhibit 19).

(3) Pile Driving Mitigation

Post installation activities will be designed to minimize sound impacts to nearby residences and existing structures. Section 19(i) of Exhibit 19 describes noise abatement measures for construction activities.

As mentioned in Section 21(s)(2), pile driven foundation systems are not considered to support the collection substation and switchyard. Mitigation measures are not required for these Components.

(4) Vibrational Impacts

All post installation operations that occur adjacent to residences, buildings, structures, utilities, or other facilities will be undergone with specific planning and insight from industry professionals, contractors, inspectors, and the Applicant, with full consideration for all forces and conditions involved and with safety as the top priority. To the maximum extent practicable, facilities have been sited to avoid existing structures. Based on air-borne-induced vibration modeling conducted by Epsilon Associates, Inc., no receptors were found to experience sound levels equal to or greater than 65 decibels (dB) at 16, 31.5, or 63 hertz (Hz), which are the outdoor criteria established in annex D of American National Standards Institute (ANSI) standard S12.9-2005/Part 4 and applicable portions of ANSI 12.2 (2008). This analysis is further discussed in Exhibit 19 and provided in Appendix 19-1.

Post installation for a solar facility is smaller scale compared to pile driving for heavy infrastructure (i.e., building foundations or bridges). Typically, posts are driven into the ground using hydraulic ram machinery, which is about the size of a small tractor or forklift and has much less vibrational impacts than equipment utilized for heavy infrastructure. Additionally, some posts in the array may require pre-drilling holes, which will minimize the use of the hammer to install the posts. As such, no vibrational impacts are anticipated. The closest distance to a non-participating landowner where post installation is proposed is approximately 204 feet.

As mentioned in Section 21(t)(2), pile driven foundation systems are not considered to support the collection substation and switchyard. Mitigation measures for vibrational impacts are not required for these Components.

21(u) Evaluation of Earthquake and Tsunami Event Vulnerability at the Project Area

The Project Area is located in an area of relatively low seismic activity. The USGS Seismic Hazards database indicates only a 3-percent chance of an earthquake occurring in the next 50 years of peak acceleration exceeding 10 percent to 14 percent of the force of gravity in the Project Area. The Project Area has a dense soil cover and will not provide significant amplification of seismic waves. The Project Area appears to have minimal vulnerability associated with seismic events based on a review of publicly available data and, given the lack of large waterbodies capable of having such an event, tsunami concerns are not applicable.

21(v) Evaluation of Corrosion Potential

Some soil units found within the Project Area are considered to be acidic. Acidic soils are likely to be corrosive to steel and concrete. Steel may need a protective coating and concrete may require additives in the mixture to protect against corrosion.

During corrosion testing, 18 samples were collected at depths from 0 to 4 feet below the existing ground surface. The samples were tested from pH, water soluble sulfate, sulfides, chlorides, total salts, red-ox potential, and electrical resistivity. Refer to Table 21-4 and section 21(i) above for more detailed corrosion testing information. Additional corrosion potential information is included in the Geotechnical Engineering Report in Appendix 21-1. Detailed design requirements will be determined during the final engineering phase.

21(w) Consistency with New York State Guidelines

The Project will comply with the NYSDAM Guidelines for Solar Energy Projects – Construction Mitigation for Agricultural Lands requirements, dated October 18, 2019, and other applicable NYSDAM guidance documents that are in effect during construction, to the maximum extent practicable.

The Applicant will hire an EM to oversee construction and restoration work on agricultural land. The EM will coordinate with the NYSDAM Division of Land and Water Resources as necessary to ensure the guidelines are being met to the maximum extent practicable. The EM will contact the NYSDAM Division of Land and Water Resources if a farm resource concern, management matter pertinent to the agricultural operation, and/or site-specific implementation conditions, cannot be resolved.

The Project will comply, to the maximum extent practicable, with the guideline requirements for construction, restoration, monitoring and remediation, and decommissioning as detailed below.

Construction Requirements

The measures to be followed for the construction of the Project to comply, to the maximum extent practicable, with the NYSDAM's October 2019 guidance document "Guidelines for Solar Energy Projects – Construction Mitigation for Agricultural Lands" are detailed as follows.

- Before any topsoil is stripped, representative soil samples shall be obtained from the areas to be disturbed. The soil sampling shall be consistent with Cornell University's soil testing guidelines, and samples should be submitted to a laboratory for testing PH, percent organic material, cation exchange capacity, Phosphorus/Phosphate (P), and Potassium/Potash (K). The results are to establish a benchmark that the soil's PH, Nitrogen (N), Phosphorus/Phosphate (P), and Potassium/Potash (K) are to be measured again upon restoration. Should soil sampling not be performed, the Applicant will obtain fertilizer and lime application recommendations for disturbed areas at: https://www.agriculture.ny.gov/ap/agservices/Fertilizer_Lime_and_Seeding_Recommendations.pdf.
- Stripped topsoil shall be stockpiled from work areas (e.g. parking areas, electric conductor trenches, along access roads, equipment pads) and kept separate from other excavated material (rock and/or sub-soil) until the completion of the facility for final restoration. For proper topsoil segregation, at least 25 feet of additional temporary workspace (ATWS) will be provided along "open-cut" underground utility trenches. All topsoil will be stockpiled as close as is reasonably practical to the area where stripped/removed and shall be used for restoration on that particular area. Any topsoil removed from permanently converted agricultural areas (e.g. permanent roads, etc.) shall be temporarily stockpiled and eventually spread evenly in adjacent agricultural areas within the project Limits of Disturbance (LOD); however not to significantly alter the hydrology of the area. Topsoil

stockpile areas and topsoil disposal areas will be clearly designated in the field and on construction drawings; changes or additions to the designated stockpile areas may be needed based on field conditions in consultation with the Environmental Monitor (EM). Sufficient LOD (as designated on the site plan or by the EM) area shall be allotted to allow adequate access to the stockpile for topsoil replacement during restoration.

  - Topsoil stockpiles on agricultural areas left in place prior to October 31st shall be seeded with Aroostook Winter Rye or equivalent at an application rate of three bushels (168 lbs.) per acre and mulched with straw mulch at rate of two to three bales per 1000 square feet.
  - Topsoil stockpiles left in place between October 31st and May 31st shall be mulched with straw at a rate of two to three bales per 1000 square feet to prevent soil loss.

- The surface of access roads located outside of the Project's security fence and constructed through agricultural fields shall be level with the adjacent field surface. If a level road design is not feasible, all access roads should be constructed to allow a farm crossing (for specific equipment and livestock) and to restore/ maintain original surface drainage patterns.
- Culverts and waterbars shall be installed to maintain the natural drainage patterns.
- Vehicles or equipment will not be allowed outside the planned LOD without the EM seeking prior approval from the landowner (and/or agricultural producer), and associated permit amendments as necessary. All vehicle and equipment traffic, parking, and material storage will be limited to the access road and/or designated work areas, such as laydown areas, with exception the use of low ground pressure equipment. Where repeated temporary access is necessary across portions of agricultural areas outside of the security fence, preparation for such access shall consist of either stripping / stockpiling all topsoil linearly along the access road, or the use of timber matting.
- Proposed permanent access shall be established as soon as possible by removing topsoil according to the depth of topsoil as directed by the EM. Any extra topsoil removed from permanently converted areas (e.g. permanent roads, equipment pads, etc.) shall be temporarily stockpiled and eventually spread evenly in adjacent agricultural areas within the project Limits of Disturbance (LOD); however not to significantly alter the hydrology of the area.
- For open-cut trenching, topsoil will be stripped from the work area adjacent to the trench (including segregated stockpile areas and equipment access). Trencher or road saw like

equipment will not be allowed for trench excavation in agricultural areas, as the equipment does not segregate topsoil from subsoil. HDD installations, primarily designed to avoid impacts to wetlands and an existing pipeline, will also help to minimize agricultural ground disturbances. Any HDD drilling fluid inadvertently discharged will be removed from agricultural areas. Narrow open trenches less than 25 feet long involving a single directly buried conductor or conduit (as required) to connect short rows within the array, will be considered exempt from topsoil segregation.

- Electric collection, communication and transmission lines installed above ground can create long term interference with mechanized farming on agricultural land. Thus, interconnect conductors outside of the security fence are proposed to be buried in agricultural fields wherever practicable. Where overhead utility lines are required, (e.g., from the switchyard to the POI) installation will be located outside field boundaries or along permanent access road(s) wherever possible. Should overhead utilities must cross farmland, agricultural impacts will be minimized by using taller structures that provide longer spanning distances and locate poles on field edges to the greatest extent practicable.
- All buried utilities located within the Project's security fence will have a minimum depth of 18-inches of cover if buried in a conduit or a minimum depth of twenty-four inches of cover if directly buried (e.g. not routed in conduit).
- The following requirements shall apply to all buried utilities located outside of the generation facility security fence:
    - In cropland, hayland, and improved pasture buried electric conductors shall have a minimum depth of 48 inches of cover. In areas where the depth of soil over bedrock is less than 48 inches, the electric conductors shall be buried below the surface of the bedrock if friable/rippable, or as near as possible to the surface of the bedrock.
    - In unimproved grazing areas or on land permanently devoted to pasture the minimum depth of cover shall be 36 inches.
    - Where electrical conductors are buried directly below the Project's access road or immediately adjacent (at road edge) to the access road, the minimum depth of cover shall be 24 inches. Conductors shall be close enough to the road edge as to be not subject to agricultural cultivation/subsoiling.
- Should buried utilities alter the natural stratification of soil horizons and natural soil drainage patterns, the Applicant will rectify the effects with measures such as subsurface

intercept drain lines. The Applicant shall consult the local Soil and Water Conservation District concerning the type of intercept drain lines to install to prevent surface seeps and the seasonally prolonged saturation of the conductor installation zone and adjacent areas. The Applicant shall install and/or repair all drain lines according to NRCS conservation practice standards and specifications. Drain tiles shall meet or exceed the AASHTO M-252 specifications. Repair of subsurface drains tiles shall be consistent with the NYSDAM's details for "Repair of Severed Tile Line" found in the pipeline drawing A- 5[1].

- In pasture areas, it may be necessary to construct temporary fencing (in addition to the Project's permanent security fences) around work areas to prevent livestock access to active construction areas and areas undergoing restoration. For areas returning to pasture, temporary fencing will be erected to delay the pasturing of livestock within the restored portion of the LOD until pasture areas are appropriately revegetated. Temporary fencing including the project's required temporary access for the associated fence installations shall be included within the LOD as well as noted on the construction drawings. The Applicant will be responsible for maintaining the temporary fencing until the EM determines that the vegetation in the restored area is established and able to accommodate grazing. At such time, the Applicant shall be responsible for removal of the temporary fences.

Restoration Requirements

Agricultural areas temporarily disturbed during construction will be de-compacted to a depth of 18 inches to a level no more than 250 pounds per square inch when measured with a soil penetrometer. In areas where topsoil was stripped, soil decompaction will be conducted prior to replacing the topsoil. Rocks four inches and larger will be removed from the subsoil surface prior to topsoil replacement. The topsoil will be replaced to the original depth and contours where possible.

Rocks four inches and larger will be removed from the surface of the topsoil. Subsoil decompaction and topsoil replacement will be avoided after October 1. If areas are restored after October 1, provisions will be made to restore and reseed eroded and exposed areas the following spring to establish proper vegetative cover.

[1] (http://www.agriculture.ny.gov/ap/agservices/Pipeline-Drawings.pdf)

Access roads will be re-graded as needed to allow farm equipment crossing and to restore the original drainage patterns or incorporate the newly designed drainage pattern. Existing drain tiles will be identified and located before construction as much as is reasonably possible based primarily on consultation with the landowner. During and after construction operations, any existing drain tiles within the area of disturbance will be checked for damage, and damaged drain tiles will be repaired or replaced consistent with the NYSDAM's details for "Repair of Severed Tile Line" to the maximum extent practicable. The Applicant will coordinate with the landowner to continue to monitor drain tiles post-construction to ensure repairs are properly functioning.

Restored agricultural areas will be seeded as specified by the landowner to maintain consistency with the surrounding areas.

Restoration practices will be postponed until favorable soil conditions exist. Restoration will not occur when soils are in a wet or plastic state of consistency. Regrading stockpiled topsoil and de-compacting subsoils will not occur until the plasticity, as determined by the Atterberg field test, is adequately reduced. Restoration activities will not occur on agricultural fields between October and May unless favorable soil conditions exist.

Construction debris will be removed from the Project Area following restoration efforts and disposed of in a licensed facility.

Monitoring and Remediation

The Applicant will provide monitoring and remediation for a period no less than 365 days following the date upon which the solar arrays are in commercial operations. The monitoring and remediation will identify remaining agricultural impacts associated with construction that need mitigation and follow-up restoration.

Monitoring efforts will assess the topsoil thickness, relative content of rock and large stones, trench settling, crop production, drainage and repair/replacement of severed subsurface drain line, fences, etc. If necessary, topsoil will be imported to the Project Area to repair trench settling and topsoil deficiency issues. Visual inspection will determine the presence of excessive amounts of rock and oversized stone material. Excess rocks and large stones will be removed as appropriate.

Should the subsequent crop productivity within affected areas fall to less than half that of adjacent unaffected agricultural land, the Applicant and other associated parties must determine the appropriate rehabilitation measures to be implemented.

Decommissioning

When the solar arrays are decommissioned, all above ground structures will be removed from the Project Area. Concrete piers, footer, and other supports will be removed to a depth of 48 inches below the soil surface and underground electrical lines will be abandoned in place. The Project Area will be restored to as close to the previous condition as practicable. Previous agricultural lands will be restored with recommendations from the landowner, the Soil and Water Conservation District, and the Department of Agriculture and Markets. Access roads and landscaping in agricultural areas will be removed unless specified otherwise by the landowner.

21(x) Evaluation of Risk of Damage or Displacement to Foundations and Underground Cables

According to soil maps for the Project Area, mapped soil units indicate moderate to high risk for frost action. Frost heaves exert pressure on underground structures resultant from intermittent freezing and thawing of soil. The additional pressure causes soils to lift, which may result in displacement of underground structures (e.g., foundations, cables, etc.) that are constructed above the frost line. Frost depth in New York State averages from 36 to 48 inches. In accordance with the New York State Building Code, concrete foundations and/or piers will be constructed to a minimum depth of 30 inches and adhere to all the American Society for Civil Engineers (ASCE) 32 standards. Existing soils composed of sand and gravel or imported granular materials are proposed for re-use as structural and/or compacted fill. The subsurface materials observed during geotechnical investigations consist of mixtures of sand, silt, clay and gravel over weathered bedrock and have low-to-minimal shrink/swell potential. As a result, specific construction procedures associated with potential expansive clay will likely not be required for the Facility.

21(y) Evaluation of Mines/Quarries, Oil and Gas Wells, and Bedrock Quarrying from the Project Area

Figure 21-5 depicts mines and quarries and oil and gas wells within the Study Area. The New York State Department of Environmental Conservation (NYSDEC) database of maps, wells, and quarries was evaluated to determine the location and proximity of these features within and adjacent to the Project.

Bedrock quarrying is not anticipated as part of the construction or operation of the proposed Project. Bedrock in the Project Area consists of shale and is considered to be rippable as previously stated in Section 21(j).

21(z) Identification of Oil and Gas Wells located in Proximity to the Project Area

Based on publicly available data, there are six oil and gas wells in or within 500 feet of the Project Area (NYSDEC, 2014). A magnetometer survey was conducted in January 2020 identifying three natural gas wells located within the Project Area. Wells identified included the Bater Well, drilled by F.E. Petroleum located at 43.07471°N, -78.09998°W; the Keif Well, located at 43.06102°N, -78.09559°W; and the Starowicz Well, located at 43.05209°N, -78.11480°W. The wells identified through this study correspond with the locations of known regulated wells identified by the NYSDEC. Locations for all identified wells within 500 feet of the Project Area are provided in Table 21-6 below.

Table 21-6. NYSDEC-Regulated Oil and Gas Wells within 500 Feet of the Project Area

Well Name	API Well Number	NYSDEC Reported Status	Well Type	Lat	Lon
Welch 1	31037000000000	Plugged Well	Dry Hole Plugged	43.06666	-78.06454
Tyler 1	31037000000000	Unplugged Well	Dry Hole	43.04293	-78.07707
Starowicz	31037100000000	Unplugged Well	Gas Well	43.05212	-78.1148
Bater	31037100000000	Plugged Well	Dry Hole Plugged	43.0747	-78.09993
Britt 1	31037100000000	Unplugged Well	Gas Well	43.06043	-78.09057
Keif	31037100000000	Unplugged Well	Gas Well	43.06139	-78.09581

The Project will be designed and sited to avoid a 100-foot buffer area surrounding the three wells located within the Project Area. The other three wells identified are greater than 100 feet from the Project Area boundaries and will not be impacted by the Project. As the Project layout evolves, the Applicant will notify the NYSDEC of any encroachment of the buffer surrounding known wells within the Project Area prior to submitting the Compliance Filings.

In the event that an unknown existing or abandoned well is discovered during construction, the contractor will immediately suspend ground intrusion work and notify the affected landowner, the NYSDEC Chief of the Energy Project Management Bureau, and the NYSDEC Region 8 Regional Engineer of the discovery. The Project Supervisor and landowner will be contacted and notified.

The Applicant and its contractors shall have a decontamination pad for construction equipment in the event that oil or gas infrastructure is encountered. The Applicant will consult with the Department of Public Service (DPS) Gas Safety Staff if abandoned gas lines are identified as soon as reasonably practicable. The performance of any site cleanup, including containment or remediation of any existing contamination, to cap, plug, remove, or otherwise contain any existing wells or pipelines that it might discover will be subject to applicable laws. The GPS coordinates for and access to the newly discovered well location will be provided by the Engineering, Procurement, and Construction (EPC) Contractor Project Supervisor to the NYSDEC Region 8 Regional Engineer and the NYSDEC Division of Environmental Permits, Chief of the Energy Project Management Bureau, subject to the requirements of the Project's certificate conditions.

In the event that that petroleum-impacted materials are encountered during construction activities, the contractor will immediately suspend ground intrusion work and notify the NYSDEC Region 8 Regional Engineer, DPS, and the NYSDEC's Spill Hotline of the discovery. The EPC Contractor Project Supervisor and landowner will also be contacted and notified. In addition, the excavated impacted material will be segregated and temporarily stored on the site until the material can be delivered to the disposal facility. Any impacted stockpiled material will be placed on 20-mil polyethylene sheeting and will be covered with heavy duty tarps specifically manufactured for this purpose and secured with heavy sandbags. All impacted material will be managed and transported in accordance with applicable laws and regulations, including but not limited to 6 NYCRR Part 360 and Part 364. Any construction equipment that comes in contact with the impacted material will be washed with potable water and a detergent and rinsed with potable water to remove impacted material adhered to the tires, tracks, undercarriage, and other parts of vehicle exteriors. The wash water and solids from the decontamination activities will be collected, contained, tested, removed from the site, and properly disposed at a licensed and approved facility. Decontamination will be performed on a decontamination pad specifically set up for that purpose. The pad will be curbed and lined with an impermeable membrane to contain the used cleaning solution, including any overspray, and any impacted debris removed during the cleaning process. All cleaning solution and impacted materials will be collected and transported by a waste hauler with a valid 6 NYCRR Part 364 Waste Transporter Permit. To the extent practicable, the Applicant and Project engineer will adjust ground intrusive construction activities at the site to avoid working within the limits of impacted material discovered during construction. If the limits of impacted material cannot be avoided, the Applicant, in consultation with the landowner, will evaluate options for planning and implementing remediation activities. Any necessary remediation activity work will be performed under a plan prepared by the Applicant and approved by the NYSDEC Region 8 Regional Engineer.

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