NORTH SIDE ENERGY CENTER

Case No. 17-F-0598

1001.21 Exhibit 21

Geology, Seismology, and Soils

Contents

Tables

Figures

Appendices

Exhibit 21: Geology, Seismology, and Soils

This Exhibit will track the requirements of Stipulation 21, dated February 10, 2021, and therefore, the requirements of 16 New York Codes, Rules, and Regulations (NYCRR) § 1001.21. This Exhibit contains a comprehensive summary of the potential geology, seismology, and soil impacts resulting from proposed construction of the North Side Energy Center. This Exhibit provides identification and mapping of existing geological and surficial soil conditions, an impact analysis, definition of constraints resulting from these geological conditions, and discusses potential impact avoidance and mitigation measures.

Conclusions made within this Exhibit are based on the findings of a preliminary geotechnical investigation performed by Terracon Consultants-NY, Inc. (Terracon), conducted during October 2020 and the summary report dated January 7, 2020 (Appendix 21-1). A total of 24 borings, 12 test-pits, and 4 hard-auger borings were completed at the Project Area during the geotechnical exploration, as further detailed in the Preliminary Geotechnical Engineering Report provided as Appendix 21-1. A summary of the borings completed to date is presented in Table 21-1.

Table 21-1. Summary of Test Borings During Project Area Survey

Test Boring No.	Depth of Bore/Test Pit (feet)	Date Completed
NS-B1	20	9/11/2020
NS-B2	20	9/11/2020
NS-B3	19.3	9/10/2020
NS-B4	20	9/10/2020
NS-B5	20	9/14/2020
NS-B6	20	9/9/2020
NS-B7	20	9/16/2020
NS-B8	18.8	9/16/2020
NS-B9	18.8	9/15/2020
NS-B10	18.3	9/15/2020
NS-B11	20	9/15/2020
NS-B12	20	9/15/2020
NS-B13	20	9/10/2020
NS-B14	20	9/14/2020

Table 21-1. Summary of Test Borings During Project Area Survey

Test Boring No.	Depth of Bore/Test Pit (feet)	Date Completed
NS-B15	20	9/2/2020
NS-B16	16	9/9/2020
NS-B17	20	9/3/2020
NS-B18	20	9/9/2020
NS-B19	20	9/3/2020
NS-B20	19	9/16/2020
NS-B21	20	9/3/2020
NS-B22	20	9/9/2020
NS-B23	18.1	9/4/2020
NS-B24	19.4	9/9/2020
NS-TP1	9	9/14/2020
NS-TP2	8	9/14/2020
NS-TP3	10	9/14/2020
NS-TP4	11	9/14/2020
NS-TP5	10	9/14/2020
NS-TP6	10	9/14/2020
NS-TP7	10	9/15/2020
NS-TP8	10	9/15/2020
NS-TP9	10	9/15/2020
NS-TP10	8	9/15/2020
NS-TP11	6	9/15/2020
NS-TP12	10	9/15/2020
NS-HA1	8	9/15/2020
NS-HA2	8	9/15/2020
NS-HA3	8	9/16/2020
NS-HA4	8	9/16/2020

21(a) Existing Slopes Map

Slope data from the United States Geologic Survey (USGS) National Elevation Dataset was analyzed and mapped using Esri ArcGIS software, to delineate existing slopes (0-3%, 3-8%, 8-

15%, 15-25%, 25-35%, and 35% and over) on and within a mapped drainage area which may be influenced by Project development and associated interconnections. This data is visually represented in Figure 21-1. Slopes within the Project Area range from 0-3% to >35%, with 99.0% of the Project Area occurring on slopes less than 15% and most within the 0 – 3% range. Table 21-2, below, presents the percent coverage that each slope range encompasses within the Project Area.

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

Slope Range (%)	Percent within Drainage Area (%)
0 – 3	75.4
3 – 8	21.5
8 – 15	2.2
15 – 25	0.7
25 – 35	0.2
> 35	<0.1
Total	**100%**

21(b) Slope Impact Avoidance

No portions of the Project Area proposed for development exceed 15% grade and are too steep for panel installation. Project Components will be sited to avoid steep slopes. Therefore, impacts to steep slopes will not occur. No solar arrays will be installed on slopes exceeding 15%. An estimated 2.87 acres within the Project Area with steep slopes will be graded to slopes of 15% or less. Grading will be performed as indicated on the Preliminary Design Drawings presented in Appendix 11-1.

Earth moving and general soil disturbance associated with Project construction activities may increase the potential for wind/water erosion and sedimentation into surface waters and downstream areas. Steep slopes and highly erodible soils within the Project Area have the potential to be impacted by extreme rainfall or other natural events which could lead to severe erosion and downstream water quality issues. Implementing the erosion and sediment control measures as outlined in the Stormwater Pollution Prevention Plan (SWPPP) will minimize these impacts. The SWPPP for this Project is included as Appendix 23-3 and will be updated and filed with the Secretary before construction. In addition, impacts to soil will be further minimized by the following means, as necessary:

- 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 sedimentation. Erosion control devices will be monitored continuously throughout construction and restoration for function and effectiveness.
- During construction activities, straw bales, silt fence, and other appropriate erosion control measures will be placed as needed around disturbed areas and stockpiled soils.
- Public road ditches and other locations where Project-related runoff is concentrated will be armored with rip-rap to dissipate the energy of flowing water and to hold the soil in place.
- Following construction, all temporarily disturbed areas will be stabilized in accordance with approved plans.

Erosion and sediment control measures are described in greater detail within the SWPPP provided as Appendix 23-3 and are depicted in the Preliminary Design Drawings presented in Appendix 11-1.

21(c) Proposed Site Plan

A proposed preliminary Site Plan was prepared and included within the Preliminary Design Drawings presented in Appendix 11-1. The Site Plan shows existing and proposed contours at one-foot intervals for the Project Area and the location of on-site interconnection facilities. The Site Plan also identifies locations of all proposed infrastructure including all construction areas, solar panel locations, access roads, paved and vegetative surfaces, electrical collection line routes, 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 one-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 on 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 one-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 which will be excavated for construction. Calculations are provided for topsoil, sub-soil and rock layers separately based on information provided in the St. Lawrence County Soil Survey.

These calculations do not account for the collection line trenching operations as part of the equation. It is presumed that collection line trenching would return soils to near existing conditions with the backfilling of the trench after collection line placement, negating any net change in the soil strata (similar to procedures implemented on operational solar farms across New York State). Approximately 44,937 cubic yards of material, excluding topsoil to be re-distributed for grading, will be excavated from the Project Area. Approximately 39,546 cubic yards of fill will be required for the proposed construction, resulting in a net earthwork balance of approximately 5,390 cubic yards in excess of fill material. Approximately 12,600 cubic yards of topsoil will be stripped from areas that will be graded for access roads and equipment pads. An estimated 106,000 cubic yards of excavated topsoil will be stripped and re-distributed throughout the Project Area to restore the original site grading, to the maximum extent practicable. Approximately 14,599 cubic yards of gravel fill/crushed stone is 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, structural bases for foundations, and compacted fill for burial of electric lines.

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 throughout small sections of the northeast portion of the Project Area is 50 inches. Excavations are not expected to reach or exceed the depth to bedrock.

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 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

The Applicant has developed an Invasive Species Management and Control Plan (ISMCP) to outline best practices and control measures for identifying the presence of invasive species in spoil material and for preventing the introduction and spread of invasive species within or outside of the Project Area. The ISMCP is provided in Appendix 22-7. 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 linked to the construction and operation of the Project. The ISMCP will be appended to the Project construction contract, requiring the Contractor to implement the control measures outlined within the ISMCP. The principal construction-related control measure will include prohibiting fill material from being transported offsite from the Project Area. This action will minimize the potential for introduction and/or transport of invasive species identified within the Project Area 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 will be implemented based on best science regarding treatment and control options for a 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. Identification resources will be made available to Project staff and contractors to facilitate early identification of invasive species. A list of invasive species identified within the Project Area based on previously conducted field surveys is provided in Appendix 22-7. Of note, it should be stated that invasive species identified at the Project Area prior to construction are likely to spread even in the absence of further human intervention. It is therefore 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 resulting from actions directly attributable to Project construction and operation (i.e., significant distances between existing and novel populations such that could not occur through natural dispersal mechanisms).

Post-construction monitoring will be conducted in year 1, year 3, and year 5, following completion of construction and restoration. If, after five years, post-construction, all invasive species control requirements have not been achieved, the Applicant will evaluate the likely reasons for these results in consultation with NYSDEC, AGM, and DPS and submit an “Invasive Species Remedial Plan” to the Secretary for approval. The “Invasive Species Remedial Plan” will describe the likely reasons for not achieving NYSDEC requirements, describe the actions necessary to correct the situation, and the schedule for conducting the remedial work. Once approved, the “Invasive Species Remedial Plan” will be implemented according to the approved schedule

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. As stated previously, a preliminary calculation was performed utilizing existing and proposed three dimensional surfaces generated from one-foot contour data to estimate the quantity of cut and fill necessary for Project construction.

Fill material will be required for several purposes including subgrade material for access roads and burial of electrical lines, structural bases for solar array foundations, and site grading to achieve necessary construction grades. 39,546 cubic yards of soil backfill will be required for construction of the Project Area. Based on the calculation of cut and fill, the material excavated from the site will be utilized as fill for the Project Area. Importing additional graded fill material is not anticipated to be required for the construction of permanent access roads and the substation and switchyard, as on-site materials were determined suitable for use (Appendix 21-1). It is anticipated that approximately 14,599 cubic yards of crushed stone/gravel fill will be imported from off-site for construction of the access roads, substation, and switchyard. Excess material (~5,390 cubic yards) 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 Preliminary Design Drawings, provided in Appendix 11-1.

Based on the findings of the geotechnical report (Appendix 21-1), on-site materials are suitable for use as structural fill, therefore no specifications for imported fill materials were provided. At a minimum, imported materials will be free of organic matter and debris including recycled concrete, asphalt, bricks, glass, and pyritic shale rock. An aggregate base of 6 to 12 inches overlaying compacted native soils should be suitable for access road construction. The substation access road may also consist of 6 to 12 inches of aggregate base from on-site materials, or native soils reinforced with a geogrid. If soil conditions are particularly moist during construction, the aggregate base may require stabilization with additional aggregate or multiple layers of geo-textile fabric.

Additionally, imported 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.

Table 21-3. Estimated Quantity of Imported Material

Imported Material	Quantity (yd^3)
Gravel	14,599
Surface Material	0
Concrete	3,510
TOTAL	**18,109**

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 664 truckloads would be required to transport imported gravel fill material into the Project Area throughout the duration of construction. The concrete trucks presumed to be utilized for this Project have a capacity of approximately 8 cubic yards and weigh 70,000 pounds. An estimated 3,510 cubic yards of concrete will be required for this Project. Therefore 439 concrete truckloads will also be necessary to transport concrete materials on-site.

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(d), 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 contained by erosion and sediment controls along the construction corridors and incorporated in the site restoration where applicable, as described in further detail on the Preliminary Design Drawings provided in Appendix 11-1.

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

As stated in Section 21(e), access roads and site grading may be constructed using on-site soils and materials or compacted structural fill. These materials will be free of organic matter and debris including recycled concrete, asphalt, bricks, glass, and pyritic shale rock. To the extent possible, materials excavated onsite will be re-used to avoid the need for transporting materials to an off-site location.

21(g) Construction Methodology and Excavation Techniques

The proposed start date for the construction of the Project is currently late 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 (HDD) Methods

The Applicant is proposing to utilize trenchless excavation techniques to some degree, otherwise known as horizontal directional drilling (HDD). In typical HDD applications, the drill is usually passed four to six feet below ground surface. This method 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. Refer to the Preliminary Design Drawings in Appendix 11-1 for proposed HDD 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 Horizontal Directional Drilling (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, bentonite has the potential to adversely impact fish, fish eggs, aquatic plants, and benthic invertebrates. Therefore, to protect these natural resources, the Applicant has prepared an 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 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 (e.g., 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, ensure that all appropriate notifications are made immediately.

A detailed Inadvertent Return Plan was created for the Project and is included in Appendix 21-2 of this Application. Details within the Plan 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 in the unlikely event of an inadvertent return;
- Details outlining an effective clean up 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 and avoiding impacts, there is a remote risk for inadvertent releases of drilling fluid to the surface, which can have a detrimental impact on the environment. These releases occur as a result of seeps which 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.

The proposed HDD for the Project has a remote risk of inadvertent release based on 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 comprised of fine-grained silt, sand, and clay sediments underlain by sand, silt and gravel mixtures with occasional cobbles and boulders. The surficial and native soils layers are adequate for performing HDD operations. The surficial geology is composed of glacial till with substantial cobbles and boulders in some areas of the Project, which may result in difficulties when conducting drilling operations. Geotechnical investigations did not encounter bedrock at the maximum boring depth of 20 feet at any boring location. Publicly available sources estimate depth to bedrock in small portions of the Project Area may be at approximately four feet (Figure 21-3). The HDD bore depths will remain in the silt, sand, and gravel layers to the maximum extent practicable. Inadvertent return is not anticipated as a result of HDD operations and precautions will be taken to reduce the possibility of a release. Geotechnical factors will be significantly considered when finalizing the HDD bore locations and design in order to reduce the possibility of an inadvertent return event during HDD operations.

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

21(h) Construction Phases

Pre-Construction Survey and Environmental Monitoring

Prior to the commencement of Project related construction, an overall site survey will be performed in order 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 in order to oversee compliance with all applicable certificate conditions and other permit requirements. Prior to the start of construction at specific sites, the EM, with the 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., select wetlands and waterbodies, archaeological, or agricultural resources), as well as the limits of clearing, location of drainage features (e.g., culverts, ditches), location of existing underground pipelines, known locations of agricultural tile lines, and 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, as applicable. 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 in order to avoid future delays to Project construction timeframes.

Site Clearing and Preparation

After the pre-construction site review by the EM and construction personnel, wherein the limits of disturbance (LOD) and construction workspaces are established and sensitive resources are identified, Project-related construction will be initiated by clearing brush and woody vegetation within the 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 the LOD will be removed, organized, and disposed of on-site and outside any indicated sensitive sites (see Appendix 11-1). The definitive clearing impacts which will occur as a result of the Project will be based on final engineering design. For more information on clearing impacts, including their description and quantification, refer to Exhibit 22 of this Application.

Topsoil, forest mat and otherwise unsuitable or disturbed materials will be stripped and/or removed prior to placing fill. Stripped materials consisting of vegetation and organic materials will primarily be used to revegetate landscaped areas or exposed slopes after completion of grading operations. Soils that are suitable for reuse as fill will be temporarily stockpiled on site, and later distributed throughout the Project area in order to return disturbed areas to existing grades. Additional stripped materials containing vegetation or organic matter may be used to revegetate landscaped areas or exposed slopes following construction and grading.

Laydown Yard Construction

Laydown yard areas were selected for ease of accessibility, strategic location in the construction workflow, relatively flat ground surface, occurrence outside of sensitive resources (wetlands, waterbodies, cultural areas, etc.), and containing limited shrubby or woody vegetation in order to reduce impacts to natural vegetation areas. A majority of the laydown yard areas 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, compacted subgrade soils 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, the gravel fill and geotextile fabric will be removed, and topsoil stockpiles will be utilized to return laydown areas to existing grades and conditions. Subsoils at laydown yards staged in active agricultural areas 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 & Markets *Guidelines for Solar Energy Projects – Construction Mitigation for Agricultural Lands Revision 10/18/2019*, 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.

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 in order 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 in order to keep the excavations free of standing water and permit a safe and constructible environment. Dewatering methods will involve pumping the water to a dewatering facility located in a predetermined, well-vegetated area away from wetlands, waterbodies, and other sensitive resources. Dewatering facilities will include measures/devices to slow water velocities and trap suspended sediment (e.g., geotextile filter 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 Activity 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 as needed. 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 towards the edge of the road and/or down gradient 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 and 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 of sensitive resource areas and will be stabilized in accordance with the final Project SWPPP. Though none is proposed, if 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 and then grouted after the post is installed. Refer to the Preliminary Design Drawings for additional racking information. Based on the findings of the geotechnical investigation, soils are suitable for the use of driven steel piles for the support of solar arrays. In some areas of the Project (Zone 2; see Appendix 21-1) pile refusal may be encountered due to the presence of cobbles and boulders, however, most of the Project Area contains soils where refusal is not likely to be necessary and posts may be driven directly into the soil.

34.5 kV Electrical Collection Line Construction

The construction of the 34.5 kV collection circuits between solar arrays will involve multiple methods including direct burial and open trench 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. 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 in order 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 of the Facility fence line will be allowed to regenerate naturally. For more information on HDD drilling, refer to the subsection on *Inadvertent Return for Horizontal Directional Drilling (HDD)* above and the Inadvertent Return Plan located in Appendix 21-2.

Solar Array Delivery

The solar array segments and racking will be delivered to the designated construction locations through 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 is 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 within the substation footprint. After clearing, the topsoil will be stripped and stockpiled for later use during site restoration. Exposed subsoil will then be graded to specifications outlined in the Project's 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 by shallow mat/slab foundations. At this stage, the shallow mat/slab foundations will be poured. After the foundations have set, installation of electrical infrastructure (structural steel skeleton, conduits, cables, bus conductors, insulators, switches, circuit breakers, transformers, control house, 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 the direct vicinity of the substation and switchyard will be completed using stockpiled topsoil and the appropriate seed and mulch.

Blasting Operations

As stated previously, this Project involves excavation of soil for the installation of foundations for the placement of substation facilities. The excavation consists of drilling holes of various sizes and depths for the installation of foundations to support steel structures. Based upon the geotechnical investigation conducted at the Project Area, blasting is not anticipated.

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 steeper slopes on active agricultural land if deemed prudent (based on field conditions) to provide 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. 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.

Temporary Cut or Fill Storage Areas

In the initial siting and design process, the strategic placement and design of these components was undergone with the direct strategy of minimizing the amount of areas which 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. Cut and/or fill may be required for construction of access roads located 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 constructing access roads traversing an existing grade that exceeds the maximum design slope. It is anticipated that approximately 39,546 cubic yards of excavated materials will be used as soil backfill throughout the Project.

Based on site conditions presented in the preliminary Geotechnical Engineering Report, steel driven piles will be embedded to depths ranging from 9 to 12 feet below existing grade. Permanent access roads will be constructed using 6 to 12 inches of crushed gravel over compacted native soils that will be stockpiled for this 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 it was unearthed to the maximum extent practicable. This technique will aide in reducing the proliferation of non-native flora to uncolonized areas within Project.

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

Terracon, an engineering services company, conducted a geotechnical investigation at the Project Area. Twenty-four 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.

Twelve test pits were excavated to approximate depths between 6 and 11 feet. Laboratory corrosion series testing was performed at nine locations, and thermal resistivity dry-out curves were performed at eight locations. Field electrical resistivity testing was conducted at 10 locations within the solar array areas. Two additional field electrical resistivity planned at the proposed substation area were not performed at this time as a result of access constraints. Laboratory thermal resistivity dry-out curve testing was completed for eight locations within the solar array areas. Infiltration tests were conducted at 10 locations to depths of 4.5 to 5 feet below ground surface (bgs) and temporary groundwater monitoring wells were installed at seven (7) locations to depths ranging from 16 to 20 feet bgs.

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.

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)
NS-TP1	7.7	174	Nil	53	687	520	12060
NS-TP2	7.64	145	Nil	30	685	623	9380
NS-TP3	7.97	55	Nil	33	688	371	2513
NS-TP4	8.39	53	Nil	42	687	811	2680
NS-TP5	8.31	33	Nil	55	685	1299	1742
NS-TP6	8.38	28	Nil	70	692	314	2714
NS-TP7	8.05	30	Nil	50	689	423	2144
NS-TP8	8.17	83	Nil	48	690	461	4623
NS-TP9	7	94	Nil	32	689	346	14070
NS-TP10	8.07	155	Nil	48	685	744	7370
NS-TP11	7.64	190	Nil	45	687	1193	1943
NS-TP12	8.21	230	Nil	48	690	413	16415
NS-B10	8.18	139	Nil	18	686	1030	2278
NS-B21	8.17	101	Nil	70	686	1137	2479

In general, a chloride concentration greater than 500 parts per million (ppm), or a sulfate concentration greater than 2,000 ppm is considered to be indicative of a corrosive environment for most structures. Based on the test results, it appears that a corrosive environment does not exist, and standard Type I/II cement may be utilized on this Project.

Frost depth in the Project Area is 48 inches. The foundations for new site structures will be below this depth to prevent frost heave.

Organic-laden soil was encountered at the ground surface during the investigation. The depth of organic material in the topsoil was typically between 6 and 12 inches. This material will be stripped during earthwork so that new structures do not bear on organic-laden soil.

The geotechnical investigation indicated that the subsurface materials should be generally suitable for re-use as fill. The geotechnical investigation findings suggest that the two primary strata to be encountered at boring locations are:

- Stratum 1 – Glaciolacustrine Deposits containing fine-grained sand, silt and clay sediments
- Stratum 2 – Glacial till containing mixtures of sand and silt with gravel, cobbles and boulders

Stratum 1 – Silty sands and sandy silty clays containing some gravel were encountered from the soil surface to a depth of 20 feet. Soils are loose to medium dense, ranging from very soft to very stiff.

Stratum 2 – Mixtures of sand and silt with gravel, cobbles and boulders were encountered from the soil surface to depths of 20 feet below the ground. Soils were medium dense to very dense and contained occasional clay partings

Subsurface conditions varied over the Project Area, resulting in the designation of four distinct zones. In Zone 1, soils consisted of sand over medium to stiff clay. In Zone 2, soils were predominantly dense silty sand. Pile driving in this area may require pre-drilling. Zone 3 subsurface conditions were characterized by sand over soft clay, and in Zone 4 soils consisted of loose to medium dense sand.

During the geotechnical investigation, groundwater was encountered at 11 of the boring and test pit locations during drilling at depths ranging from 4 to 17.5 feet. Temporary water wells were installed at 7 boring locations to monitor stabilized groundwater levels. The temporary well locations indicated stabilized groundwater levels at depths ranging from soil surface to 4.9 feet, which should be indicative of the water table depths throughout the Project. Groundwater conditions can change based on factors such as season and weather.

21(k) 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 Blasting Plan has been prepared in the event that blasting is determined to be required. The Blasting Plan is provided in Appendix 21-3.

Soil conditions present throughout the Project Area indicate suitability for excavation using standard equipment. Some areas may contain cobbles or boulders which may require pre-drilling of holes for pile-drive supports. It is anticipated that the contractor for this Project can excavate with relatively little difficulty using an excavator, rock saw, cable trencher, or plow. Bedrock is unlikely to be encountered at proposed excavation depths. However, if bedrock is encountered, it is anticipated to be rippable, and thus will be excavated using large excavators, rock rippers, or chipping hammers. The method or combination of methods required will be tailored to the structural integrity, depth, and robustness of rock/bedrock encountered.

In the event that a unique situation requiring blasting arises, the Blasting Plan provided as Appendix 21-3, including procedural timeframes for notifying municipal officials, owners of existing infrastructure within the Project Area, and property owners (or persons residing at the location if different) within 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. However, it should be stated that 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.

21(l) Assessment of Potential Impacts from Blasting

Bedrock was not encountered during geotechnical investigations performed on site (Appendix 21-1). Blasting and/or rock excavation techniques are not anticipated; therefore, no impacts are expected.

If blasting is determined to be required, the Blasting Plan provided in Appendix 21-3 will be used as described in section 21(j) above. 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 that dictate the minimum distance for accessing blasting zones and protecting existing structures 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 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(m) 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 Contractor Blasting Plan. 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 Report of Investigation 8485 (USBM RI 8507 and USBM RI 8485). Mitigation measures will include alternative technologies and/or relocation of structures in order to eliminate the need for blasting. Where reasonable alternative measures cannot be employed, blast mats and backfill will be utilized to control any excessive rock movement where blasting occurs in close proximity to identified structures. Additionally, as explained above the Applicant will outline a plan for securing compensation for damages that may occur as a result of blasting, including pre- and post-blast property surveys, if applicable.

21(n) 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. The sources include the Soil Survey of St. Lawrence County (USDA, 2005), 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 within the St. Lawrence – Champlain lowland of New York State. The St. Lawrence – Champlain lowland is the northernmost physiographic province within the state and was formed by proglacial lake or marine like waters smoothing the area to a flat lake plain. The province is marked by a complex pattern of drumlins and drumlin-like hills surrounded by lacustrine silts, clays, and related sands (NYSDOT, 2013).

The St. Lawrence – Champlain lowlands is a low plain with few scattered rock ridges. Closer to the St. Lawrence River, relief becomes flatter and smoother. Elevations within the Project Area range from approximately 200 feet to 280 feet above mean sea level, according to the USGS web topographic maps, higher than typical elevations in the surrounding province (<75 ft.). At one point, mining for aluminum was prevalent in the northeast portion of the region where the Project is located.

Publicly available surficial geologic mapping suggests that the Project Area is primarily undifferentiated marine and lacustrine sand deposits of variable thickness ranging from 2 to 20 meters. These sand deposits are typically fine to medium grained, well sorted, containing both freshwater and saltwater fossils and shells and comprise 10% of the county. Soils are permeable. Small portions of the Project Area are underlain by glacial till formed into ridges. The texture of these deposits varies from containing small rock fragments to large boulders. Soils are poorly sorted and, in the Ontario-St. Lawrence-Champlain area are often characterized by silty clay to silt loam. Till deposits range in thickness from 1 to 50 meters and comprise 23% of the county. A detailed description of soils present in the Project Area is provided in Section 22(q). Bedrock material consists of quartzose dolostone to dolostone and limestone formed in the Ordovician age and are attributed to the Ogdensburg Dolostone Formation (USDA 2005).

Tectonic Setting and Seismology

According to USGS Seismic Hazards database (USGS 2018), the Project Area is in an area of moderate seismic activity with a 2% probability of a magnitude 5.0 earthquake occurring in the next 50 years of peak acceleration exceeding 20% of the force of gravity. This indicates moderate probability for seismic activity and bedrock shift in the vicinity of the Project area. In addition, the

USGS Earthquake Hazards Program does not list any faults within the vicinity of the Project Area. Refer to Figure 21-4 for seismic hazards mapping of the Project Area and surrounding area. No faults were identified in the vicinity of the Project Area in a review of publicly available fault mapping data provided by the USGS.

(1) Karst Topography

Publicly available mapping indicates that karst topography underlies the Project Area or the surrounding county (Weary and Doctor 2014). The karst features present are comprised of exposed carbonate rocks which are characterized by sinkholes, fissures, or underground caves. Typically, these karst features form small pits or fractures in exposed rock. Additionally, no vulnerable karst features such as caves, sinkholes, or fractures were documented during surveys and studies conducted in the Project Area.

(2) Karst Conditions Assessment

Risks and impacts to karst features have the potential to occur as a result of excavation, post installation operations, HDD operations, limited blasting operations, and other construction-related soils disturbance activities where exposed rock exists. The risks and impacts of post installation to karst formations are generally limited. Karst formations can make achieving the required post lengths for the required capacity challenging. The piles will be embedded to a depth of approximately 9 to 12 feet and, therefore, should not impact any potentially unmapped karst features which could be present 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 ground-water availability and quality. The HDD locations proposed for the Project are not located within the areas containing karst formations. The subsurface conditions found within the borings drilled near the proposed HDD locations generally consisted of glacial till soils over limestone. Because HDD is not proposed in areas with evidence of karst features, risks to karst features from directional drilling are not anticipated.

As described in Exhibit 23 and Appendix 23-2 (Preliminary Stormwater Pollution Prevention Plan [SWPPP]) of the Application, potential impacts to the local water table during the construction phase of the Project can be avoided and mitigated through the use of best management practices (BMPs) and the specific measures outlined in the Preliminary SWPPP. The Applicant will employ best management practices including utilization of erosion and sediment controls, stormwater management, and avoidance of sensitive features to preserve the existing geologic character of the Project Area wherever possible. 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. The Project Area will be revegetated following the completion of construction. 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.

(3) Local Rock Types

The Project Area is underlain by formations in the Beekmantown Group, including Fort Cassin, Rochdale, and Tribes Hill formations. Beekmantown Group formations consist primarily of limestone and dolomitic limestone, and lesser dolostone with minor chert throughout. In St. Lawrence county, bedrock formations are classified as Ogdensburg dolostone. Dolostones can be crushed and used as aggregate material, therefore these rock types are likely suitable for construction utilizing standard equipment. Based on geotechnical investigations, bedrock will not be encountered during excavations in the Project Area, however some limited refusal may be encountered due to cobbles and boulders in the subsurface soil layers. It is not anticipated that this will require the use of blasting techniques, rather standard construction equipment may be employed (Appendix 21-1)

21(o) Impacts to Regional Geology

Subsurface conditions, as determined through preliminary geotechnical investigations indicate that materials found throughout the Project Area are suitable for construction (Appendix 21-1). To the extent possible, siting of Project Components has been designed to minimize construction within areas requiring significant disturbance to and modification of existing topographical conditions. The Project is sited on relatively level terrain and while excavations may result in minor modifications, final grading will be designed to restore topography to original conditions to the maximum extent practicable. Construction impacts to geology outside of the Project Area, and within the surrounding region are not anticipated. Further, once the Project is operational, no impacts to geology are expected to occur.

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

The USGS Earthquake Hazard Program does not list any faults within the vicinity of the Project Area. Soils and bedrock encountered at the Project are consistent with a seismic site classification of D according to Section 20.4 of ASCE 7 and the International Building Code, indicating minimal potential for collapse under seismic loading. In addition, the USGS Earthquake Hazard Program does not identify any young faults within the vicinity of the Project Area. 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.

21(q) Soils Types Map

Figure 21-2 delineates soil types and areas of Prime Farmland 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(r) Soil Type Characteristics and Suitability for Construction

Information regarding on-site soils was obtained from on-site investigations conducted by Terracon and from existing published sources, including the Soil Survey of St. Lawrence County (USDA 2005), USDA Web Soil Survey (2019), and Soil Survey Geographic Database (SSURGO 2020).

The Soil Survey of St. Lawrence, New York (USDA 2005) and the USDA Web Soil Survey indicate that all proposed facilities and solar arrays are sited within 22 soil types. The surveys indicate that the Project Area predominantly consists of fine sands and stony loams, ranging from very poorly drained to well-drained soils.

Adjidaumo series consists of very deep, poorly to very poorly drained soils formed in fine marine sediments. The soils are found on marine plains and depressions or basins. The potential for surface runoff is very low with slow to ponded surface water movement. Adjidaumo soils are nearly level with slopes ranging from zero to three percent. Seasonal saturation occurs within three inches of the soil surface from November through May. Depth to carbonate rocks ranges from 24 to 60 inches.

Ak is Adjidaumo poorly drained. The soil unit is found on lake plains and in depressions, slopes ranging from zero to three percent. These soils are typically zero to 79 inches thick, with parent material consisting of silty and clayey deposits from pro-glacial lakes. Adjidaumo soils may also contain igneous and sedimentary rocks. Depth to a restrictive layer is greater than 60 inches. Shrink-swell potential is high. Potential for frost action and corrosivity to steel is high. This soil unit is poorly-drained and considered hydric.

Ao is Adjidaumo silty clay with zero to three percent slopes, frequently flooded. These soils are typically zero to 79 inches thick, with parent material consisting of silty and clayey deposits from pro-glacial lakes. Adjidaumo soils may also contain igneous and sedimentary rocks. Depth to a restrictive layer is greater than 60 inches. Shrink-swell potential is high. Potential for frost action and corrosivity to steel is high. This soil unit has a drainage class of poorly-drained and is considered hydric.

Croghan series consist of very deep, moderately well drained soils formed in the deltaic or glacio-fluvial deposits. The soil is formed in deltaic or glacial outwash sand that was deposited in or next to proglacial lake basins. The potential for surface runoff is negligible to low with high permeability throughout the mineral soil. Croghan soils are nearly level to moderately steep with slopes ranging from 0 to 15 percent.

CvB is Croghan loamy fine sand with three to eight percent slopes on terraces and plains. These soils, typically zero to 25 inches thick, are developed on glacial and deltaic outwash plains and dominated by quartz. Depth to a restrictive layer is greater than 60 inches. Shrink-swell potential is low. This soil has high risk of corrosion to steel. These soils have high to very high hydraulic conductivity and are moderately well drained. This soil is not rated as hydric.

Deford series consist of very deep, poorly drained soils formed in sandy glaciofluvial deposits on outwash plains, lake plains, stream terraces, and deltas. The soil is formed in flats or depressions of outwash plains, lake plains, stream terraces, and deltas. The potential for surface runoff is negligible. This soil series experiences seasonal saturation at the soil surface from January to April. Ponding potential has a representative depth from 0.2 to 0.5 foot. Deford soils are nearly flat with zero to two percent slopes. Depth to carbonates is from 25 to greater than 60 inches thick.

Dd is Deford loamy fine sand with zero to two percent slopes on plains and deltas. These soils, up to 72 inches thick, are developed through outwash plains and sandy glaciofluvial deposits. These soils are poorly drained and very poorly drained and are rated as hydric. Shrink-swell potential is low and risk of frost action is moderate. Corrosivity to steel is high.

Df is Deford mucky loamy fine sand with zero to two percent slopes in depressions. The parent materials consist of sandy glaciofluvial deposits with organic matter comprising 12 percent of the surface horizon. These soils are poorly drained and very poorly drained and are rated as hydric. The soil layer is up to 72 inches thick with low shrink-swell potential and moderate risk of frost action. Corrosivity to steel is high.

Elmwood series consist of very deep, moderately well drained soils that formed in a thin mantle of loamy outwash materials over clayey marine or lacustrine deposits on lake and marine plains, and outwash plains and deltas. Soils formed in loamy outwash or lacustrine materials underlain by fine-textured lacustrine or marine deposits. The potential for runoff is low and the soil is moderately well drained. Permeability is rapid in the loamy mantle and slow to very slow in the clayey substratum. Seasonal saturation occurs within 18 inches of the soil surface from November to May. Depth to bedrock is greater than 60 inches.

EmB is Elmwood fine sandy loam with three to eight percent slopes ranging up to 72 inches in thickness. The parent material consists of loamy fluvial and lacustrine deposits from pro-glacial lakes and deltas over clayey marine and lacustrine glacial tills. Depth to a restrictive layer ranges from 18 to 40 inches. This soil unit exhibits high potential for frost action and risk of corrosion to steel. The soil unit has a drainage class of moderately well-drained and is not hydric.

Flackville series consists of very deep, moderately well drained soils formed in sandy deposits that overlie clayey marine sediments. Soils occupy low-lying, nearly level to sloping landscapes on marine plains where sandy deposits overlie clayey sediments. These soils are moderately well drained with negligible through high potential for runoff. The sandy material is dominated by quartz derived from non-calcareous sandstones and granites. Flackville soils are nearly flat to moderately steep and range from 0 to 15 percent. Depth to bedrock is greater than 60 inches.

FkB is Flackville loamy fine sand with three to eight percent slopes found on proglacial lake plains. Parent material consists of sandy deltaic and glaciofluvial deposits over clayey marine and lacustrine glacial till. Depth to a restrictive layer ranges from 20 to 40 inches. Shrink-swell potential and potential for frost action are moderate. This soil poses high risk of corrosivity to steel. The soil unit drainage class is moderately well-drained and the soil is not hydric.

Grenville series consists of very deep, moderately well drained soils formed in sandy deposits that overlie clayey marine sediments. Soils occupy low-lying, nearly level to sloping landscapes on marine plains where sandy deposits overlie clayey sediments. These soils are moderately well drained with negligible through high potential for runoff. The sandy material is dominated by quartz derived from non-calcareous sandstones and granites. Flackville soils are nearly flat to moderately steep and range from 0 to 15 percent.

GrB is Grenville loam with three to eight percent slopes, found on ridges and till plains. Parent material contains calcareous loamy till derived from limestone. Depth to a restrictive layer ranges from 22 to 37 inches. Shrink-swell potential is low, and the risk of corrosion to steel is high. This soil unit has a drainage class of well-drained and is not rated as hydric.

Hogansburg series consists of very deep, moderately well drained soils formed in calcareous dense till. Soils occupy low hills and ridges on till plains. These soils are moderately well drained with medium runoff, occasionally ranging from very slow to rapid. The till has a high component dolomitic limestone with varying amounts of calcitic limestone, sandstone, schist, and granitic materials. Hogansburg soils are nearly flat to steep and range from 0 to 25 percent. Depth to bedrock is greater than 60 inches.

HnA is Hogansburg loam with zero to three percent slopes on ridges and till plains. These soils are developed calcareous loamy lodgment derived from limestone. Depth to a restrictive layer is between 20 to 43 inches. Shrink-swell potential is low. This soil has high risk of corrosion to steel. These soils are moderately well drained and are not rated as hydric.

HnB is Hogansburg loam with three to eight percent slopes on ridges and till plains. The parent material consists of calcareous loamy lodgment till derived from limestone. Depth to a restrictive layer is between 20 to 43 inches. Shrink-swell potential is low. This soil has high risk of corrosion to steel. These soils are moderately well drained. This soil is not rated as hydric.

HrB is Hogansburg and Grenville soils with zero to eight percent slopes, is very stony, and forms on ridges and till plains. The parent material consists of calcareous loamy lodgment till derived from limestone. Depth to a restrictive layer is between 20 to 43 inches. Shrink-swell potential is low. This soil has high risk of corrosion to steel. These soils are moderately well drained. This soil is not rated as hydric. Grenvile soils, which form 30 percent of this soil unit also exhibit low shrink-swell potential, high risk of corrosion to steel and are not hydric. Grenville soils are well-drained.

Malone series consists of very deep, somewhat poorly drained soils formed in calcareous dense till. Soils occupy nearly level flats, footslopes of low hills, and ridges on till plains. These soils formed in till deposits derived mainly from limestone and dolomite with some component of sandstone and gneiss. Soils are somewhat poorly drained with high to very high potential for runoff. Malone soils are nearly flat to moderately steep and range from 0 to 15 percent. Depth to bedrock is greater than 60 inches.

MaB is Malone loam with three to eight percent slopes on ridges and till plains. These soils are developed on calcareous loamy lodgment till derived from limestone. Depth to a restrictive layer is between 25 and 38 inches. Shrink-swell potential is low. This soil has high risk of corrosion to steel. These soils have a natural drainage class of somewhat poorly drained and do not meet hydric criteria.

MbB is Malone loam with zero to eight percent slopes, very stony on ridges and till plains. These soils are developed on calcareous loamy lodgment till derived from limestone. Depth to a restrictive layer is between 25 and 38 inches. Shrink-swell potential is low. This soil has high risk of corrosion to steel. These soils have a natural drainage class of somewhat poorly drained and do not meet hydric criteria.

Munuscong series consists of very deep, poorly drained, and very poorly drained soils formed in loamy glaciofluvial deposits over calcareous clayey materials on lake plains and ground moraines. Soils occupy lake plains and ground moraines. These soils are poorly drained or very poorly drained, with variable potential for surface runoff, ranging from negligible to very high. Munuscong soils are generally very flat with slopes ranging from zero to two percent. Depth to bedrock is greater than 60 inches.

Mn is Munuscong mucky fine sandy loam formed in depressions. These soils are developed on loamy glaciofluvial deposits over glacial lacustrine and marine deposits comprised of calcareous silt and clay materials. Depth to a restrictive layer is 20 to 40 inches. Shrink-swell potential is moderate. This soil has high risk of corrosion to steel. These soils are very poorly drained and frequently ponded. Mn soils are rated as hydric.

Muskellunge series consists of very deep, somewhat poorly drained soils formed in fine sediments deposited in marine lacustrine environments. Soils occupy marine or lacustrine plains and upland basins. These soils are somewhat poorly drained with high to very high potential to surface runoff. The marine and glaciolacustrine deposits in high clay formed these soils over time. Muskellunge soils are flat to moderately steep and range from 0 to 15 percent.

MsA is Muskellunge silty clay loam with zero to three parent slopes on marine and lake terraces. The parent material consists of calcareous silty and clayey glaciolacustrine deposits derived from igneous and sedimentary rock. Depth to a restrictive layer is more than 80 inches. Shrink-swell potential is moderate. The soil has high risk of corrosion to steel. These soils have very low to moderately low hydraulic conductivity, are somewhat poorly drained, and do not meet hydric criteria.

MsB is Muskellunge silty clay loam with three to eight percent slopes on lake and marine terraces. These soils, typically zero to 80 inches thick, are developed from calcareous silty and clayey glaciolacustrine deposits derived from igneous and sedimentary rock. Depth to a restrictive layer is more than 80 inches. Shrink-swell potential is moderate. This soil has high risk of corrosion of steel. These soils have very low to moderately low hydraulic conductivity, are somewhat poorly drained, and do not meet hydric criteria.

Naumburg series consists of very deep, poorly, and somewhat poorly drained soils that formed in sandy deltaic or glaciofluvial deposits. Soils occupy low-lying areas of sand plains or terraces. These soils are somewhat poorly and poorly drained with potential for runoff ranging from high to very high. The soil formed in glaciofluvial or deltaic sands predominantly from areas of gigantic rocks or acid sandstone. Naumburg soils are flat and range from 0 to 8 percent.

Na is Naumburg loamy fine sand on depressions, toeslopes, and treads. These soils are typically zero to 72 inches thick and are developed from sandy glaciofluvial or deltaic deposits derived mainly from crystalline rock or sandstone. Depth to a restrictive layer is greater than 80 inches. Shrink-swell potential is low. The soil has high risk of corrosion to steel. These soils have moderately high to high hydraulic conductivity, are poorly drained, and meet hydric criteria.

Redwater series consists of deep, somewhat poorly drained soils that have formed in recent alluvium along streams where the stream gradient is controlled by bedrock. Soils occupy flood plains and low gradient streams and rivers. These soils formed in post-glacial alluvium derived predominantly from sandstone, dolomitic sandstone, and less commonly in gneiss and marble. These soils are somewhat poorly drained with slow runoff and are commonly flooded for brief durations. Redwater soils are nearly flat ranging from zero to three percent slopes.

Rd is Redwater fine sandy loam on flood plains, footslopes, and talfs. These soils, typically zero to 60 inches thick, are developed from loamy alluvium, and are commonly flooded. Depth to a restrictive layer is 40 to 60 inches to lithic bedrock. Shrink-swell potential is low. The soil has high risk of corrosion to steel. These soils have very low to high hydraulic conductivity, are somewhat poorly drained, and do not meet hydric criteria.

Stockholm series consists of very deep, poorly drained soils formed in sandy deposits that overlie clayey marine sediments. Soils occupy low-lying, nearly level landscapes such as deltas or other similar sandy outwash sediments over marine deposits. These soils are poorly drained with negligible to very slow potential for runoff. The overlying sandy deposits are from predominately non-calcareous sandstones or from gigantic rocks. Stockholm soils are nearly flat with slopes ranging from zero to three percent.

Sg is Stockholm loamy fine sand on depressions, toeslopes, and treads. These soils, typically zero to 72 inches thick, were developed from sandy deltaic or glaciofluvial deposits over clayey glaciomarine or glaciolacustrine deposits. Depth to restrictive layer is 17 to 39 inches to strongly contrasting textural stratification. These soils have high risk of corrosion of steel and shrink-swell potential is moderate. These soils have very low to moderately low hydraulic conductivity, are poorly drained, and meet hydric criteria.

Swanton series consists of very deep, somewhat poorly drained to predominantly poorly drained soils formed in loamy outwash that overlie clayey marine or lacustrine sediments. Soils occupy low-lying, nearly level to sloping landscapes on marine plains where sandy deposits overlie clayey sediments. These soils are often found on deltas, outwash plains, or marine and lake plains with slopes of zero to three percent. Soils are somewhat coarse textured with a clayey substratum.

Water movement is low in the most restrictive layer, and while the soil is not hydric, soils may be saturated at 12 inches during spring and fall. Depth to bedrock is more than 60 inches

Sw is Swanton fine sandy loam with slopes of zero to three percent and is located on depressions within the Project Area. Depth to a restrictive layer is between 18 and 40 inches. This soil ranges in thickness up to 72 inches. Shrink-swell potential is moderate. Potential for frost action and risk of corrosion to steel are high. This unit has a drainage class of poorly-drained and is rated as hydric.

The remaining soils consist of gravel and sand pits (23.3 acres) and udorthents which have been used for storage of waste materials (2.4 acres) and contain refuse and fill materials up to several feet thick.

Table 21-5. Summary of Soil Types

Map Unit Symbol	Map Unit Name	Slope (%)	Acres within Project Area
Ak	Adjidaumo silty clay, 0 to 3 percent slopes	0-3	2.3
Ao	Adjidaumo silty clay, 0 to 3 percent slopes, frequently flooded	0-3	8.8
CvB	Croghan loamy fine sand, 3 to 8 percent slopes	3-8	4.4
Dd	Deford loamy fine sand		124.7
Df	Deford mucky loamy fine sand		1.5
EmB	Elmwood fine sandy loam, 3 to 8 percent slopes	3-8	14.7
FkB	Flackville loamy fine sand, 3 to 8 percent slopes	3-8	1.0
GrB	Grenville loam, 3 to 8 percent slopes	3-8	6.4
HnA	Hogansburg loam, 0 to 3 percent slopes	0-3	26.2
HnB	Hogansburg loam, 3 to 8 percent slopes	3-8	68.5
HrB	Hogansburg and Greenville soils, 0 to 8 percent slopes, very stony	0-8	251.0
MaB	Malone loam, 3 to 8 percent slopes	3-8	99.7
MbB	Malone loam, 0 to 8 percent slopes, very stony	0-8	182.8
Mn	Munuscong mucky fine sandy loam		102.2
MsA	Muskellunge silty clay loam, 0 to 3 percent slopes	0-3	401.7

Table 21-5. Summary of Soil Types

Map Unit Symbol	Map Unit Name	Slope (%)	Acres within Project Area
MsB	Muskellunge silty clay loam, 3 to 8 percent slopes	3-8	10.4
Na	Naumburg loamy fine sand		1.6
Pg	Pits, gravel and sand		23.3
Rd	Redwater fine sandy loam		72.9
Sg	Stockholm loamy fine sand		10.9
Sw	Swanton fine sandy loam		824.1
Uf	Urthodents, clayey		0.1
Un	Udorthents, refuse substratum		2.3

The vast majority of soils in the Project area are sandy or stony loams. Soil drainage among mapped soil units is variable, with approximately 76.4 percent of soils classified as somewhat poorly to 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 limit of disturbance (LOD) for the Project is approximately 1,100 acres. Based on the assumptions outlined in Table 22-2 of Exhibit 22, disturbance to soils from all anticipated construction activities will total approximately 1,100 acres. However, of this total, only approximately 14.6 acres will be permanent impacts where soils are converted to access roads, array foundations (posts), and structures, while the remaining will be restored and stabilized following the completion of construction. Actual disturbance will include overlap of some components and will vary based on the specific construction activity, the construction techniques employed, and soil/weather conditions at the time of construction. Additionally, an area of approximately 103 acres of grading is proposed. The remaining approximately 2,138-acres of land will not consist of permanent structures and will not be graded. Construction methods and minimization measures will be implemented to limit ground disturbances to the minimum amount required to facilitate construction.

Earth moving and general soil disturbance may increase the potential for wind/water erosion and sedimentation into surface waters. Soils within the Project Area exhibit low permeability, limited depth to saturation and low to moderate capacity for transmitting water and are therefore rated as being most limited in infiltration capacity for stormwater management. Implementing the erosion and sediment control measures outlined in the SWPPP will minimize impacts to steeper slopes and any highly erodible soils that may occur in the event of extreme rainfall or other events that could potentially lead to erosion and/or 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 rip-rap 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.

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 to moderate 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 within 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(s) Facility Construction and Operation Impacts to Drainage Features

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 and potential shallow water table. Based on the subsurface conditions encountered during the investigation performed to date, it appears that the primary geotechnical issue anticipated at the Project is instability in fine-grained soils found at the surface, particularly following precipitation events. The recommendation is to install effective drainage prior to construction, and to perform grading operations during drier periods of the year.

Given the nature of construction associated with Project development, minimal adverse impacts to drainage features 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 existing drainage features within the Project Area to the maximum extent practicable. The Project will comply, to the maximum extent practicable, with the Guideline requirements for construction, restoration, monitoring and remediation, and decommissioning as detailed in Section 21(w) below.

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

Figure 21-3 depicts anticipated depth of bedrock within the Project Area based on soils data from the USDA (USDA 2020). According to this figure, depth to bedrock within the Project Area is greater than 60 inches below the ground surface. However, restrictive layers may be encountered at shallower depths as described in Section 21(p).

Results of test borings performed to date by Terracon did not identify bedrock to the exploration depth of 20 feet. Groundwater was encountered at 7 of the boring locations at depths ranging from 0 to 17.5 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 Geotechnical Engineering 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(u) 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, 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. Equipment may be supported on shallow foundations. Based on the subsurface conditions encountered in the soil borings and test pits, the proposed collection substation and switchyard will be constructed at locations underlain by glacial till soils. Four zones were identified in the Project Area, segregated by soil conditions observed in the geotechnical investigations and suitability for construction. Foundation design specifications are provided for each foundation type by zone in the Geotechnical Engineering Report (Appendix 21-1). General considerations are described below.

Estimated total settlements will be less than one inch provided column loads are less than the estimated net allowable bearing pressure of 2,000 pounds per square foot (psf). Shallow foundation systems for support of lightly-loaded buildings and equipment pads will be acceptable provided these maximum loads are not exceeded.

All building structure foundations should bear on suitable natural soil, or on properly compacted structural fill. Compaction recommendations for structural fill are provided in the Geotechnical Engineering Report (Appendix 21-1).

(1) Preliminary Engineering Assessment

The Geotechnical Engineering Report analyzed isolated mat/slab foundations for the substation and switchyard foundations. The mat/slab foundations bearing on compacted fill or native soils were determined to be acceptable to support light-loaded buildings and equipment pads provided the maximum loads are not exceeded. Implementation of effective drainage systems early in construction and maintenance throughout as well as restricting construction to drier months should reduce the risk of undercutting or replacement of unstable subgrade. Refer the 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.

Solar array racking will be installed by one of three methods. First, the post may be driven directly into the soil. This is the primary method of installation. Second, a ground screw type post will be installed directly into the soil if the posts cannot be directly driven into the soil. Third, in cases of high ledge or bedrock, a post hole will be drilled into the rock to an appropriate depth, the post will be installed, and the post hole will be grouted. See Preliminary Design Drawings included in Appendix 11-1.

Design frost depth is four feet in the Project Area and foundations must bear below this depth to prevent movement due to frost heave. Additionally, the soil conditions observed on site indicate that embedment of 9 to 12 feet is required to support racking and panels.

The glacial till found throughout much of the Project Area 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. Assuming the foundation excavations are properly managed during construction, an allowable bearing pressure of 2,000 psf is appropriate for mat/slab foundations bearing on soils typical of the Project Area.

(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 in glaciolacustrine deposits or glacial till soils. Based on manufacturer specifications, approximately 400 posts/MW will be required for a total of approximately 115,000 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 approximately 150 days utilizing 4 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 manufacturer's recommendations. If refusal is encountered during installation, the posts will be installed into pre-drilled 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

In order to minimize impacts associated with noise, post installation activities will be designed to minimize impacts to nearby residences and existing structures. Post installation will be restricted to within the hours of 7:00 am to 7:00 pm on Monday through Saturday and will not occur on state or federal holidays.

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 undertaken 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 extent practicable, facilities have been sited to avoid existing structures. Based on acoustic modeling conducted by Epsilon Associates, no receptors were found to experience sound levels equal to or greater than 65 dB at 16, 31.5, or 63 Hz. This analysis is further discussed in Exhibit 19 and octave band modeling results are provided in Appendix 19-6.

Post installation for a solar facility is a 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 have much less vibrational impacts than equipment utilized for heavy infrastructure. The closest distance to a structure where post installation is proposed is over 126 feet and is well over 1,000 feet (529 of 599 receptors) in most locations.

As mentioned in Section 21(s)(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(v) 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 a 2% chance of an earthquake occurring in the next 50 years of peak acceleration exceeding 20% 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. Geophysical surveys are part of the overall scope of services but were not authorized for this phase of the investigation and no site-specific shear wave velocity data is available. The Project Area appears to have minimal vulnerability associated with seismic events based on review of publicly available data. The findings were provided in Section 21(o) above.

The Project is located entirely inland and is within close proximity of the St. Lawrence River which connects to the Atlantic Ocean. The mouth of the St. Lawrence River is over 500 miles to the northeast, and while Tsunami events have been recorded in the St. Lawrence Bay, it is unlikely the Project would experience the effects of such an event.

21(w) 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. Risk of corrosion to concrete and uncoated steel based on soil types varies across the Project Area, with higher potential in soils with a loamy fine sand texture which occurs on approximately 217 acres (9.6%) of the Project Area. Steel may need a protective coating and concrete may require additives in the mixture to protect against corrosion.

However, results of corrosivity analysis performed during geotechnical investigations indicated that soils within the Project Area pose low corrosion risk to construction materials proposed for use. During corrosion testing, 14 samples were collected at depths from 0 to 4 feet below the existing ground surface. The samples were tested for pH, water soluble sulfates, sulfides, chlorides, total salts, redox 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(x) Consistency with New York State Guidelines

The Project will be in compliance with the NYSAGM *Guidelines for Solar Energy Projects – Construction Mitigation for Agricultural Lands Revision 10/18/2019,* 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 NYSAGM 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 NYSAGM 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.

Guidelines for measures to mitigate impact to existing drainage features during construction, restoration, remediation and decommissioning are provided 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 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

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

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.

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(y) Soil Suitability and Shrink/Swell Potential

The extent to which a soil shrinks or swells changes with soil moisture content, and soils with high shrink-swell potential may cause damage to roads and structures. The shrink-swell potential is influenced by the amount and type of clay in the soil. The subsurface materials observed during geotechnical investigations consist of mixtures of fine-grained sands and stony loams (see

Appendix 21-1) and have low-to-minimal shrink/swell potential. As a result, specific construction procedures associated with potential expansive clay will likely not be required.

Frost action for the soils found in the Project Area is moderate to high throughout. Geotechnical investigations determined that soils within the Project Area are frost-susceptible and frost heave on pile foundations may be significant. Frost action may cause uplift of foundation systems which are not designed to withstand the forces of frost heave. 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 of the American Society for Civil Engineers (ASCE) 32 standards. Existing soils composed of sand and gravel are proposed for re-use as structural and/or compacted fill. Additionally, pile driven foundations will be designed to withstand frost heave of 1,500 psf along the pile perimeter to depths up to 36 inches, per recommendations provided in the geotechnical report (Appendix 21-1).

Soils on site will be suitable for re-use as structural fill, provided proper compaction occurs during construction. However, should construction occur during wet months, many of the on-site soils will have higher moisture content than recommended to achieve required compaction. Soils that have excessive moisture content and cannot be compacted will be removed from the site or used as common fill in non-structural areas to re-establish grade. Soil types meeting these designations are discussed in Appendix 21-1. Samples of material to be used as structural fill will be provided to the geotechnical engineer for evaluation prior to use.

21(z) Quarries and Mines Map

No mines or quarries or were identified in the Project Area based on publicly available data. A total of nine mines and quarries were identified within 2 miles of the Project (NYSDEC 2020a). Six of the nine quarries identified are listed as reclaimed sand and gravel pits, two are listed as active sand and gravel producers, one is listed as a past producer of gravel. All identified mines and quarries are located above ground. Reclaimed mines and quarries have been restored to wetlands, grassland or lakes. Both active mines have a permit expiration date prior to construction of the Project. The locations of these mines and quarries are shown in Figure 21-5.

21(aa) Existing Oil and Gas Wells

(1) Identification of Oil and Gas Wells

The NYSDEC Oil and Gas Database (NYSDEC 2020b) was reviewed to determine the location of existing oil and/or natural gas wells within the Project Area. Additionally, GIS data on the NYSDEC wells was extracted from the Rextag energy mapping database (Rextag 2019) and cross-referenced with the NYSDEC dataset. No wells were identified within the Project Area in the databases reviewed.

Based on the lack of evidence suggesting that wells may be located within the Project Area, the Applicant is not proposing to conduct a magnetometer study.

(2) NYSDEC Notification of Wells within the 100-Foot Buffer Area

No oil and gas wells were identified within the Project Area; therefore, no notification is required.

(3) Map of Existing Oil and Gas Wells and Proposed Project Components

No existing wells were identified in the NYSDEC Oil and Gas Database (NYSDEC 2019), in proximity to proposed Project Components (Figure 21-5).

(4) Minimizing Impacts to Existing Wells

No wells were identified within the Project Area, therefore no impacts to existing wells will result from Project development. In the event that a previously unmapped well feature is discovered, the area will immediately be marked off as a no-work zone, and all construction activities within the proximity of the feature will cease until consultation with NYSDEC can occur. The NYSDEC will be consulted within 24 hours of the discovery of features to determine the appropriate course of action pursuant to typical certificate conditions previously adopted by the Board.

(5) Protocols for Discovery of Petroleum-impacted Materials

In the event that petroleum-impacted materials are encountered during construction activities, the contractor will immediately suspend ground intrusion work and notify the NYSDEC Region 6 Regional Engineer, DPS, and the NYSDEC’s Spill Hotline of the discovery within two hours of the discovery if conditions are determined to pose an immediate danger to public safety, health or the environment. The EPC Contractor Project Supervisor and landowner will also be contacted and notified. In an emergency situation, the Applicant will work to contain impacted materials until spill response services arrive, to the extent measures can be implemented safely. In a non-emergency situation, 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 state and federal 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 which may be required, including identification of adequate staging areas where impacted soils would be temporarily stockpiled. If the landowner elects to undertake the remediation activities, the work will be performed under a plan prepared by the Applicant and approved by the NYSDEC Region 6 Regional Engineer. The Applicant will ensure that Contractors are equipped with a decontamination pad in the event that oil or gas infrastructures are discovered. If abandoned gas lines are identified, the Applicant will notify DPS Gas Safety Staff as soon as practicable.

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