BROOKSIDE SOLAR, LLC

Matter No. 21-00917

900-2.11 Exhibit 10

Geology, Seismology, and Soils

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Acronym List

ASCE	American Society of Civil Engineers
bgs	below ground surface
HDD	horizontal directional drilling
IBC	International Building Code
Ksat	saturated hydraulic conductivity
NRCS	Natural Resources Conservation Service
NYCRR	New York Codes, Rules and Regulations
NYSED	New York State Education Department
PV	Photovoltaic
SPT	Standard Penetration Test
SWPPP	Stormwater Pollution Prevention Plan
USCs	Uniform Standards and Conditions
USDA	United States Department of Agriculture
USGS	United States Geological Survey

Glossary Terms

Facility	The proposed components to be constructed for the collection and distribution of energy for the Brookside Solar Project, which includes solar arrays, inverters, electric collection lines, and the collection substation.
Facility Site	The parcels encompassing Facility components, which totals 1,471 acres in the Towns of Burke and Chateaugay, Franklin County, New York (Figure 2-1).

Exhibit 10: Geology, Seismology, and Soils

This Exhibit addresses the requirements specified in Section 900-2.11 Exhibit 10: Geology, Seismology, and Soils. This Exhibit contains a study of the geology, seismology, and soils impacts of the Brookside Solar Facility (Facility) including the identification and mapping of existing conditions within the approximately 1,471-acre property on which the Facility is proposed (Facility Site), and proposed impact avoidance and mitigation measures.

10(a) Geology, Seismology, and Soils Impacts of the Facility

A study of the geology, seismology, and soils impacts resulting from the Facility, consisting of the identification and mapping of existing conditions, an impact analysis, and proposed impact avoidance and mitigation measures have been included in the following sections.

(1) Existing Slopes Map

Based on the topographic survey completed for the Facility Site, it is not expected that Facility construction will occur on slopes greater than 25 percent. With respect to the erodibility of natural soils, the topographic relief of the Facility Site ranges from flat to mildly sloped. The Facility is also well-vegetated. These conditions should minimize the potential for appreciable erosion.

Figure 10-1 has been provided, which includes a map delineating existing slopes (0-3%, 3-8%, 8-15%, 15-25%, 25-35%, greater than 35%) within the Facility Site potentially influenced by the Facility and interconnections.

(2) Proposed Site Plan

Design Drawings for the Facility are included as Appendix 5-1 of Exhibit 5 to this Application. They include existing and proposed contours at 2-foot intervals for the Facility Site and interconnections at a scale sufficient to show all proposed buildings, structures, paved and vegetated areas, and construction areas, per Section 900-2.11 of the Section 94-c regulations.

(3) Construction Methodology and Excavation Techniques

- Photovoltaic (PV) solar array support posts will be driven to a depth between 8 and 12 feet below ground surface (bgs). Should bedrock refusal be encountered shallower than

the design embedment depth, it is anticipated that the location will be pre-drilled, and the support posts will be installed in place. Any spoils generated by drilling activities will be re-placed into the hole as backfilled or spread within the Facility Site to maintain site grade and minimize offsite disposal.

- Equipment foundations within the solar array will generally be steel skid on 10 to 12-foot-deep piles or placed on slab-on-grade foundations with an anticipated embedment depth of between 12 and 18 inches underlain by free-draining granular fill. Foundation sizes will be apportioned based on the allowable bearing capacities recommended within the Geotechnical Report (Appendix 10-1). Excavation of slab-on-grade foundations will be performed with traditional excavation equipment, such as backhoes or tracked excavators.

- Direct burial methods using appropriate industry equipment including but not limited to a cable plow, backhoe, rock saw, rock wheel, and/or trencher will be used during the installation of underground electrical collection system whenever possible. When direct burial methods are utilized on agricultural land, the agricultural topsoil will be separated where necessary. Direct burial involves the installation of bundled cable (electrical and fiber optic bundles) directly into a narrow cut or “rip” in the ground. The narrow cut disturbs an area approximately 2 to 3 feet wide with bundled cable installed to a minimum depth of about 36 to 48 inches in most areas.

- At locations where an electrical collection line crosses a sensitive area, such as wetlands, road crossings, and transmission rights-of-way, it is anticipated that a trenchless technology such as horizontal directional drilling (HDD) will be used. This technique involves installing the conduit underground using boring equipment set up on either side of the crossing. No surface disturbance is required between the bore pits and existing vegetation may remain in place. As HDD techniques will depend on the installation contractor, it is anticipated that an Inadvertent Return Flow Plan will be prepared and submitted as a Compliance Filing, per subpart 900-10.2(f)(5).

- Excavations in the substation area will generally consist of foundation and underground electrical installations. Concrete foundations for major equipment and structural supports will be placed, followed by the installation of various conduits, cable trenches, and grounding grid conductors. It is anticipated that the spread footings will be used for the

substation equipment. Therefore, most, if not all, of the excavations within the substation can be performed by traditional excavation equipment. However, drilled or driven piers may prove to be a more economical solution for some structures within the substation, such as dead-end/takeoff structures. Drilled piers are constructed by drilling a hole in the ground, installing a steel-reinforced cage, and backfilling with concrete.

- Culverts will be installed to maintain natural drainage patterns where necessary. Where haul roads must cross wetlands with flowing water, a temporary pump-around or coffer dam may be used to install crossings “in the dry.” Appropriate sediment and erosion control measures will be installed and maintained according to the Facility-specific Stormwater Pollution Prevention Plan (SWPPP), which has been included as Appendix 13-3.

Cut or fill to achieve the final grades are currently not anticipated for the solar array area of the Facility. It is planned that, to the extent possible, the topography will be accommodated in the design to minimize the impact of grading and site disturbance, as well as the need for removal and disturbance of vegetation. During design stages, topographic survey data collected using aerial methods was used to minimize areas of cut and fill, and in order to maintain existing drainage patterns.

It is anticipated that the site development activities will consist of installation of posts for solar module racking, small foundation slabs for ancillary structures, and limited, narrow excavations for installation of cables. The construction of haul roads across the site will also be accomplished with minimal cut and fill. In situations where haul roads traverse an existing grade that exceeds the maximum design slope, construction of the road is proposed on a side slope, or if there is need to flatten the top of an existing high point, limited cut-and-fill activities may occur.

The areas planned for the solar-related facilities are relatively flat and open. Therefore, there are minimal areas which will require re-grading, with the exception of some of the haul roads. Based on the design, cut and fill may be required to achieve proposed finished grades.

A geotechnical investigation was completed at the Facility Site to evaluate the surface profile. The findings of this investigation can be found in the Geotechnical Report included as Appendix 10-1 of this exhibit. ANS Geo completed 44 soil borings across the Facility Site, most of which

were able to advance to the targeted depth of 20 feet bgs. Bedrock was not encountered in any of the soil borings and test pits advanced at the Facility Site. Auger refusal was experienced as shallow as 13 feet bgs due to the presence of boulders and cobbles. Coarse to fine gravel was present in the majority of soil borings, but most soil boring were able to advance to the targeted depth of 20 feet bgs. Very limited re-grading is anticipated; therefore, very little mass excavation of rock will be required for grading and trenching. Rock coring conducted during the geotechnical field investigation indicated that the rock material is strong, slightly weathered to fresh sandstone. Rock removal is not anticipated; however, if removal of rock is necessary, it is anticipated that rock removal techniques such as ripping, hammering, or pre-drilling can be completed to allow construction of the proposed Facility. It is not anticipated that rock blasting will be required.

If cut-and-fill activities are required, any material that is moved is anticipated to be re-used onsite to the greatest extent possible. It is not anticipated that any fill will be transported offsite, which will minimize the potential for introduction and/or transportation of invasive species. No fill material, other than gravel for road surfacing and sand for trench bedding, will be required from offsite areas. However, cut-and-fill activities are not anticipated as part of the Facility's construction.

(4) Characteristics and Suitability of Material Excavated for Construction

A geotechnical investigation was conducted to evaluate the nature of soils, bedrock, and groundwater conditions on and within the vicinity of the Facility Site. As part of this evaluation the following items were reviewed and reported as part of the Geotechnical Report:

- Subsurface Soils – Section 3 of the Geotechnical Report
- Bedrock Conditions – Section 3 of the Geotechnical Report
- Groundwater and Hydrogeologic Conditions – Section 3 of the Geotechnical Report
- Drainage Characteristics – Section 3 of the Geotechnical Report, and Section 12 of this Exhibit
- Karst Features – Section 9 of this Exhibit
- Chemical Properties (corrosivity) – Section 4.3 of the Geotechnical Report
- Engineering Properties – Section 7.3 of the Geotechnical Report

- Frost Risk – Section 7.2 of the Geotechnical Report
- Laboratory Testing – Section 4 of the Geotechnical Report
- Seismic Considerations – Section 6 of the Geotechnical Report
- Construction Suitability Analysis and Recommendations – Section 8 of the Geotechnical Report

It was observed that the subsurface conditions generally encountered across the Facility Site were broken into two parts – a North and South section. The North section of the Facility Site consisted of approximately 6 to 10 inches of topsoil, followed by layers of medium stiff to hard clay and silt with interbedded cobbles and boulders. The South section of the Facility Site consisted of approximately 6 to 10 inches of topsoil, followed by a layer of very stiff silt, and underlaid by a layer of dense to very dense silty sand. As indicated in Section 5.2 of the Geotechnical Report, the results of site-specific soil samples collected for corrosivity evaluation indicated a moderate to high risk of soil-related corrosion to both steel and concrete elements. Notwithstanding, this corrosivity concern can be handled by proper coating of steel elements (which is typical, and expected), as well as the use of fly ash in concrete. In addition, frost considerations and mitigation measures by engineering design and construction-phase measures to accommodate frost and potential shallow bedrock have been outlined in the Geotechnical Report.

HDD will be employed to avoid and/or minimize impacts to wetlands or streams within the Facility Site. Specifically, HDD will be used to minimize impacts associated with connecting the Facility Site underneath wetlands W-JJB-3, W-NSD-3, and W-WCR-5, and streams S-WCR-1 and S-WCR-4. Soils within these wetlands consisted of loam and sand. Dominant soil unit types within these areas include Colton and Constable gravelly and cobbly loamy sands (Ccc) and Sun stony loam (Sma). Descriptions of these soil unit types can be found in Section 10(a)(12) below, with more information of the associated wetlands included in Exhibit 14. Further information regarding subsurface conditions within the Facility Site are included within the Geotechnical Report. To address the feasibility of HDD within the Facility Site, an Inadvertent Return Plan will be submitted as a compliance filing (Section 900-10.2(f)(5)). Additionally, HDD will be used under Stuart Road, U.S. Route 11, County Road 23, and around inverters 2, 12, and 17. Further information regarding soils within wetland W-WCR-5 can be found in Exhibit 14.

Based on the findings of the geotechnical investigation, as indicated in Section 2.4 of the Geotechnical Report, the Facility Site is considered suitable for the proposed Facility.

(5) Preliminary Plan for Blasting Operations

Bedrock was not encountered at the Facility Site, but boulder and cobbles were observed across the site as shallow as 2 feet below grade but generally 6 feet or deeper below grade. In the event that rock is encountered, it is anticipated that rock removal techniques such as ripping, hammering, or pre-drilling can be completed to allow construction of the proposed Facility. Therefore, blasting is not anticipated for the Facility and a Blasting Plan has not been included as part of the Application.

(6) Assessment of Potential Impacts from Blasting

Blasting will not be required during construction of the Facility. It is believed that rock removal techniques, such as ripping, hammering, or pre-drilling, can be completed to allow construction of the proposed Facility. The depth to a restrictive layer is identified for each soil type within the Facility Site in Section (a)(12) of this Exhibit.

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

No blasting will occur during construction of the Facility and thus, no mitigation related to blasting impacts is required.

(8) Regional Geology, Tectonic Setting, and Seismology

As described in the Geologic Review (Section 3) conducted as part of the Geotechnical Report, surficial geologic mapping provided by the New York State Education Department (NYSED) indicates that the Facility Site is predominantly mapped within a till unit. The available mapping indicates that the native surficial soils are predominantly classified as “till” which are described as poorly sorted, boulder to clay size material. A smaller portion of the Facility Site resides within soils classified as “lacustrine delta” which are described as generally well-sorted coarse to fine sand and gravel material.. In addition, review of publicly available surficial soil mapping provided by the Natural Resources Conservation Service (NRCS) Web Soil Survey identifies the Facility to be primarily composed of the Brayton stony loam and Moira stony loam units. The

site-specific geologic field investigation conducted was in general conformance with this publicly available mapping. Figure 10-2 provides a Surficial Geology Map that identifies the surficial geology expected across the Facility Site.

Bedrock geology within the Facility Site boundary is mapped as sedimentary rock of the North American platform, Cambrian in age. Based on the “Geologic Map of New York, Adirondack Bedrock Sheet” prepared by NYSED, it is understood that the specific bedrock formation within the Facility Site boundary is the Potsdam Sandstone Formation, described as Upper portion (Keeseville Member): relatively pure cream to white quartzitic sandstones. Middle portion (Ausable Member): pink to gray feldspathic sandstones, thick local quartz pebble lenses and arenaceous shale interbeds. Lower portion (Allens Falls Member): maroon, red, and green arenaceous shales, maroon argillaceous, hematitic sandstones, and pebble to boulder. The site-specific geologic field investigation conducted was also in general conformance with this publicly available data. Figure 10-3 provides a Bedrock Geology Map, which identifies the bedrock geology expected across the Facility Site, based on data from the New York State Geological Survey (NYSGS) and NYSED.

From a tectonic and seismic setting, as noted by the Isachsen, et. al (1990), the Facility Site is located in a “tectonically passive” region of New York State. This reference indicates sedimentary rocks are of the North American platform, Late Proterzoic to Paleozoic in age, which were deposited in shallow seas on the stable North American craton. Bedrock in the Facility Site was deposited in shallow seas on the stable North American craton, with geologic setting in the Interior Lowlands adjacent to Lake Ontario. Figure 10-4 identifies seismic hazard potential and the relative distances of documented prior epicenters from the Facility based on the 2018 United States Geological Survey (USGS) Long-term National Seismic Hazard Model (Petersen et al., 2019). Mapping reveals a moderate hazard for seismic hazard. The USGS Model defines the potential for earthquake ground shaking for various probability levels across the conterminous United States and is applied in seismic provisions of building codes, insurance rate structures, risk assessments, and other public policy. According to the USGS, the model represents an assessment of the best-available science in earthquake hazards and incorporates new findings on earthquake ground shaking, seismicity, and long-period amplification over deep sedimentary basins.

A full description of the regional geology, tectonic setting, and seismology of the Facility has been provided in the Section 6 of the attached Geotechnical Report. In addition, data obtained

from the geotechnical investigation, including soil boring and test pit logs, was used to determine the Seismic Site Class for the Facility Site.

In accordance with the Standard Penetration Test (SPT) average N-value method, as prescribed in Chapter 20 of the American Society of Civil Engineers (ASCE) Standard 7-16 design manual, Site Class D for "dense soil" applies to the northern extent of the Facility Site. The following seismic ground motion values were also obtained from the USGS Seismic Hazard Maps for this portion of the Facility Site (Site Class D):

- 0.2 second spectral response acceleration, S_S= 0.541 g[1]
- 1 second spectral response acceleration, S_1= 0.112 g
- Maximum spectral acceleration for short periods, S_{MS}= 0.739 g
- Maximum spectral acceleration for a 1-second period, S_{M1}= 0.265 g
- 5% damped design spectral acceleration at short periods, S_{DS}= 0.493 g
- 5% damped design spectral acceleration at 1-second period, S_{D1}= 0.177 g

(9) Facility Construction and Operation Impacts to Regional Geology

Based on review of publicly available USGS Digital Karst Map Compilation and Database (hereafter, USGS Karst Map), as well as the "Geologic Map of New York, Adirondack Sheet" prepared by NYSED, the bedrock formation beneath the Facility consists of sedimentary rock including sandstone.

Based on a review of publicly available data and the results of the geotechnical investigation, there is a low risk of karst impacts as a result of Facility development. No karst geological features or surficial depressions were identified onsite during field reconnaissance. In addition, limited earthwork is proposed, and panel post foundations will be shallow concrete and/or posts.

[1] The unit "g" represents the acceleration due to gravity.

(10) Seismic Activity Impacts on Facility Location and Operation

The USGS Earthquake Hazards Program did not identify any young faults within the vicinity of the Facility and, therefore, the Facility Site is at a low risk of impact from seismic activity.

(11) Soils Types Map

Maps depicting soil units within the Facility Site are included in Attachment H of the Geotechnical Report. In addition, Figure 10-5 has been prepared to highlight each of the NRCS soil types within the Facility Site Boundary.

(12) Soil Type Characteristics and Suitability for Construction and Dewatering

Information regarding onsite soils was obtained from onsite investigations by ANS Geo Inc., and from existing published sources, including the Soil Survey of Franklin County (United States Department of Agriculture [USDA] 1958) and the USDA NRCS Web Soil Survey (USDA, 2020). NRCS identified the Facility Site to be primarily composed of the Brayton stony loam and Moira stony loam unit. A summary of predominant soil unit properties has been provided in Table 10-1 below. A table of all soils identified within the Facility Site has been included in Section 15(b)(5) of Exhibit 15.

Table 10-1. NRCS Soil Properties

Soil Unit	Drainage Class	Available Water Storage	Erosion Hazard
Brayton stony loam	Somewhat poorly drained	Very low (~2.8 inches)	Slight
Moira stony loam	Moderately well-drained	Low (~3.9 inches)	Slight

Individual soil map units that occur within the Facility Site, as well as their respective hydrologic soil group rating, acreage within the Facility Site, percent of the Facility Site, and NRCS soil properties are included in Attachment H of the Geotechnical Report.

Representative soil samples collected during the geotechnical investigation were submitted to an accredited geotechnical laboratory for testing of material index properties for engineering design in accordance with their applicable ASTM International standards. A summary of laboratory testing data is provided as Section 4 of the Geotechnical Report.

Descriptions of individual soil map units sampled during the geotechnical investigation based on the NRCS Web Soil Survey and the Soil Survey of Franklin County are as follows:

Brayton Series consists of very deep, poorly drained soils on toe slopes and depressions of glaciated uplands. These soils formed in dense till with slopes ranging from 0 to 25 percent. Mean annual temperatures range from 3 to 8 degrees Celsius.

Bea is Brayton stony loam, with 0 to 3-percent slopes. Parent material consists of a loamy till derived primarily from granite and other noncalcareous rock. Depth to a restrictive feature is 16 to 24 inches. These soils are somewhat poorly drained, have a hydric rating of 10, and are considered farmland of statewide importance. This soil unit contains 1.79 percent organic matter. The saturated hydraulic conductivity (Ksat) is moderately low to moderately high and the infiltration rating is most limited, with a low permeability rating of 0.5. Within the Facility Site, these soils are typically found in flat areas being cultivated for hay. The low permeability rating, somewhat poorly drained classification, and hydric rating of 10 likely result in a low infiltration rate.

Beb is Brayton stony loam with 3 to 8-percent slopes. Parent materials include loamy till derived from granite and other noncalcareous rock. Depth to a restrictive feature is 16 to 24 inches. These soils are somewhat poorly drained, have a hydric rating of 10, and are considered farmland of statewide importance. The soil contains 1.79 percent organic matter. The Ksat is moderately low to moderately high and the infiltration rating is most limited with a low permeability rating of 0.5. Within the Facility Site, these soils typically occur in flat areas being cultivated for hay. The somewhat poorly drained classification, hydric rating, and low permeability likely result in a low infiltration rate.

Bfb is Brayton very stony loam with 0 to 8-percent slopes. Parent materials include loamy till derived from granite and other noncalcareous rock. Depth to a restrictive feature is 16 to 24 inches. These soils are somewhat poorly drained, have a hydric rating of 10, and are considered not prime farmland. The soil contains 1.79 percent organic matter. The Ksat is moderately low to moderately high with an infiltration rating of most limited and a low permeability rating of 0.5. Within the Facility Site, these soils typically occur within flat, forested areas adjacent to delineated streams and likely have a low infiltration rate.

Colton Series consists of well-drained to somewhat excessively drained soils. In most areas, these soils have developed on gravelly deposits derived from sandstone, granitic gneiss, and anorthosite. These soils occur in deltas, outwash plains, and rolling kames.

Caa is Colton and Constable gravelly loamy sands with 0 to 3-percent slopes. Parent materials include sandy and gravelly glaciofluvial deposits of granite, sandstone, and schist. Depth to a restrictive layer is greater than 80 inches. These soils are excessively drained, have a hydric rating of 0, and are considered farmland of statewide importance. The soil contains 11.27 percent organic matter. The Ksat is moderately high to high with a most limited infiltration rating, and an excessive permeability rating of 1.0. These soils are located within an area being cultivated for hay and thus, are heavily vegetated. The high Ksat and excessive permeability ratings likely cause high infiltration within these soil units.

Cab is Colton and Constable gravelly loamy sands with 3 to 8-percent slopes. Parent materials include sandy and gravelly glaciofluvial deposits of granite, sandstone, and schist. Depth to a restrictive layer is greater than 80 inches. These soils are excessively drained, have a hydric rating of 0, and are considered farmland of statewide importance. The soil contains 11.27 percent organic matter. The Ksat is moderately high to high with an infiltration rating of most limited, and an excessive permeability rating of 1.0. These soils are located within a forested area, uphill of a delineated wetland within the Facility Site. The high Ksat, excessive permeability rating, and excessively drained characteristic of these soils likely results in high infiltration rates.

Cbb is Colton and Constable gravelly cobbly loamy sands with 3 to 8-percent slopes. Parent materials include sandy and gravelly glaciofluvial deposits of granite, sandstone, and schist. Depth to a restrictive layer is greater than 80 inches. These soils are excessively drained, have a hydric rating of 0, and are considered farmland of statewide importance. The soil contains 11.27 percent organic matter. The Ksat is moderately high to high with an infiltration rating of most limited, and an excessive permeability rating of 1.0. These soils are located within an area being cultivated for hay, adjacent to a stream. The high Ksat, excessive permeability, and proximity to a stream likely results in high infiltration rates.

Ccc is Colton and Constable gravelly and cobbly loamy sands with 8 to 15-percent slopes. Parent materials include sandy and gravelly glaciofluvial deposits of granite, sandstone, and schist. Depth to a restrictive layer is more than 80 inches. These soils are excessively

drained, have a hydric rating of 0, and are considered not prime farmland. The soil contains 11.27 percent organic matter. The Ksat is moderately high to high with an infiltration rating of most limited, and an excessive permeability rating of 1.0. These soils are located within an area currently being cultivated for hay, adjacent to a stream. The high Ksat, excessive permeability, and proximity to a stream likely result in high infiltration rates.

Ccd is Colton and Constable gravelly and cobbly loamy sands with 15 to 25-percent slopes. Parent materials include sandy and gravelly glaciofluvial deposits of granite, sandstone, and schist. Depth to a restrictive layer is more than 80 inches. These soils are excessively drained, have a hydric rating of 0, and are considered not prime farmland. The soil contains 11.27 percent organic matter. The Ksat is moderately high to high with an infiltration rating of most limited, and an excessive permeability rating of 1.0. These soils are located within an area being cultivated for hay and is intersected by a stream. The high Ksat, excessive permeability, and proximity to a stream likely result in high infiltration rates.

Duane Series consists of moderately well-drained soils that have developed on coarse-textured sandstone and granitic rock. These soils occur mainly on the bottoms of deltas and outwash plans.

Daa is Duane gravelly sandy loam with 0 to 3-percent slopes. Parent materials include sandy glaciofluvial deposits of sandstone, granite, and gneiss. Depth to a restrictive layer is greater than 80 inches. These soils are moderately well-drained, have a hydric rating of 0, and are considered farmland of statewide importance. The soil contains 9.65 percent organic matter. The Ksat is moderately high to high with an infiltration rating of most limited, and an excessive permeability rating of 0.5. These soils are located within an area being cultivated for hay, and directly abuts a stream. The high Ksat, excessive permeability, and proximity to a stream likely result in high infiltration rates.

Empeyville Series consists of moderately well-drained soils which have developed on medium-textured stony glacial till that was derived from sandstone and limestone.

Eaa is Empeyville very fine sandy loam with 0 to 3-percent slopes, stony. Parent materials include loamy till derived from sedimentary rock. Depth to a restrictive layer is 14 to 35 inches. These soils are moderately well-drained, have a hydric rating of 3, and are considered farmland of statewide importance. The soil contains 4.39 percent organic matter. The Ksat is

very low to moderately high with an infiltration rating of most limited, and a low permeability rating of 1.0. These soils are located within an area being cultivated as hay, adjacent to a delineated wetland and stream along a steep slope. The location low permeability and Ksat, as well as the adjacent slope is likely to result in a low infiltration rate.

Eab is Empeyville very fine sandy loam with 3 to 8-percent slopes, stony. Parent material is a loamy till derived from sedimentary rock. Depth to a restrictive layer is 14 to 35 inches. These soils are moderately well-drained, have a hydric rating of 3, and are considered farmland of statewide importance. The soil contains 8.16 percent organic matter. The Ksat is very low to moderately high with an infiltration rating of most limited, with a low permeability rating of 1.0. These soils are located primarily within areas being cultivated for hay and row crops, with small forested portions intermixed, and is intersected by delineated streams. The location low permeability and Ksat likely to result in a low infiltration rate.

Eac is Empeyville very fine sandy loam with 8 to 15-percent slopes, stony. Parent material is a loamy till derived from sedimentary rock. Depth to a restrictive layer is 14 to 35 inches. These soils are moderately well-drained, have a hydric rating of 3, and are considered farmland of statewide importance. The soil contains 8.16 percent organic matter. The Ksat is very low to moderately high with an infiltration rating of most limited, with a low permeability rating of 1.0 and a slope rating of 0.5. These soils are located within flat areas being cultivated for row crop agriculture. The lack of year-round vegetation, low Ksat, and low permeability rating likely result in a low infiltration rate.

Ecd is Empeyville very fine sandy loam with 15 to 25-percent slopes, stony. Parent material is a loamy till derived from sedimentary rock. Depth to a restrictive layer is 14 to 35 inches. These soils are moderately well-drained, have a hydric rating of 3, and are considered not prime farmland. The soil contains 8.16 percent organic matter. The Ksat is very low to moderately high with an infiltration rating of most limited, a low permeability rating and slope of 1.0. These soils are located adjacent to a stream and a steep slow. The slope, low Ksat, and low permeability rating likely result in a low infiltration rate.

Edc is Empeyville very fine sandy loam with 8 to 25-percent slopes, very stony. Parent material is a loamy till derived from sedimentary rock. Depth to a restrictive layer is 14 to 35 inches. These soils are moderately well-drained, have a hydric rating of 3, and are considered not prime farmland. The soil contains 8.16 percent organic matter. The Ksat is very low to

moderately high with an infiltration rating of most limited, a low permeability rating of 1.0, and a slope of 1.0. These soils occur within an area currently cultivated for row crop agriculture and are intersected by a stream. The low Ksat, low permeability rating, and high slope likely result in a low infiltration rate.

Moira Series consists of moderately well-drained soils that have developed on medium-textured glacial till derive mainly from sandstone, but partially from limestone. These soils occupy convex slopes on smooth till plains.

Mea is Moira stony loam with 0 to 3-percent slopes. Parent material is a loamy till derived from acid sandstone. Depth to a restrictive layer is 14 to 25 inches. The soils are moderately well-drained, have a hydric rating of 0, and are considered farmland of statewide importance. The soil contains 9.56 percent organic matter. The Ksat is moderately low to moderately high with an infiltration rate of most limited, and a low permeability rating of 1.0. These soils are located within areas being cultivated for hay and row crop agriculture and intersects one delineated wetland. The low Ksat and permeability rating like result in a low infiltration rate.

Meb is Moira stony loam with 3 to 8-percent slopes. Parent material is a loamy till derived from acid sandstone. Depth to a restrictive layer is 14 to 25 inches. The soils are moderately well-drained, have a hydric rating of 0, and are considered farmland of statewide importance. The soil contains 9.56 percent organic matter. The Ksat is moderately low to moderately high with an infiltration rating of most limited, and a low permeability rating of 1.0. These soils are located primarily within areas being cultivated for hay and row crop agriculture. The low Ksat and low permeability rating likely result in a low infiltration rate.

Mec is Moira stony loam with 8 to 15-percent slopes. Parent material is a loamy till derived from acid sandstone. Depth to a restrictive layer is 14 to 24 inches. The soils are moderately well-drained, have a hydric rating of 0, and are considered farmland of statewide importance. The soil contains 9.56 percent organic matter. The Ksat is moderately low to moderately high with an infiltration rating of most limited, a low permeability rating of 1.0, and a slope rating of 0.5. These soils are located primarily within areas being cultivated for hay and row-crop agriculture. The slope, low permeability rating, and short depth to a restrictive layer likely results in a low infiltration rate.

Mha is shallow muck. Parent material is organic material. Depth to a restrictive layer is more than 80 inches. The soils are very poorly drained, have a hydric rating of 100, and are considered not prime farmland. The soil contains 66.46 percent organic matter. The Ksat is moderately high to high. The hydric rating of 100, high Ksat, and very poorly drained classification likely result in a high infiltration rate.

Saco Series consists of very poorly drained soils that have developed on recent alluvium derived from sandstone and granitic crystalline rock.

Saa is Saco and Sloan soils with 0 to 2-percent slopes. Parent material is silty alluvium derived from crystalline rock, shale, and sandstone. Depth to a restrictive layer is more than 80 inches. The soils are very poorly drained, having a hydric rating of 90, and are considered farmland of statewide importance. The soil contains 2.76 percent organic matter. The Ksat is moderately high to high. These soils primarily occur within forested areas of the Facility Site. The high Ksat, hydric rating of 90, and very poorly drained classification likely results in a high infiltration rate.

Scarboro Series consists of very poorly drained soils that have developed on sand and occupy level, sandy plains or the beds of deltas. The surface horizon tends to be higher in organic matter than other associated soils.

Sea is Scarboro fine sandy loam with 0 to 3-percent slopes. Parent material is sandy glaciofluvial deposits. Depth to a restrictive layer is more than 80 inches. The soils are very poorly drained, with a hydric rating of 85, and are considered not prime farmland. The soil contains 3.39 percent organic matter. The Ksat is high to very high with an infiltration rating of most limited, and an excessive permeability rating of 0.5. These soils occur within areas being cultivated for hay within the Facility Site. The high Ksat, very poorly drained classification, and excessive permeability rating likely result in high infiltration.

Runeberg Series consists of very deep and very poorly drained soils formed in loamy glacial till fields. These soils have moderately slow or slow permeability.

Sma is Runeberg soils with 0 to 5-percent slopes. Parent material is calcareous loamy lodgment till derived from limestone. Depth to a restrictive layer is more than 80 inches. The soils are poorly drained, have a hydric rating of 96, and are considered not prime farmland. The soil contains 3.62 percent organic matter. The Ksat is moderately low to very high. These soils

primarily occur within agricultural portions of the Facility Site, with small portions intersecting forested areas. The poorly drained classification and hydric rating of 96 likely result in a high infiltration rate.

Sna is Runeberg soils with 0 to 5-percent slopes, very stony. Parent material is calcareous loamy lodgment till derived from limestone. Depth to a restrictive layer is more than 80 inches. The soils are poorly drained, have a hydric rating of 96, and are considered not prime farmland. The soil contains 3.62 percent organic matter. The Ksat is moderately low to very high, with an infiltration rating of most limited, and a low permeability rating of 0.5. These soils typically occur along forest edge portions of the Facility Site. The poorly drained classification and hydric rating of 96 likely result in a high infiltration rate.

Tughill Series consist of very poorly drained soils developed on glacial till derived from sandstone. These soils occupy nearly level or slightly depressed areas.

Tca is Tughill and Dannemora stony, very fine sandy loams, with 0 to 3-percent slopes. Parent material is gravelly loamy till, derived from acid siliceous rocks, and scoured by glacial meltwater. Depth to a restrictive layer is more than 80 inches. The soils are very poorly drained, have a hydric rating of 90, and are considered not prime farmland. The soil contains 18.34 percent organic matter. The Ksat is moderately low to moderately high with an infiltration rating of most limited, and a low permeability rating of 1.0. These soils occur within an area being cultivated for hay within the Facility Site. The very poorly drained classification and hydric rating of 90 likely result in a high infiltration rate.

Tda is Tughill and Dannemora very stony, very fine sandy loams with 0 to 3-percent slopes. Parent material is gravelly loamy till, derived from acid siliceous rocks, and scoured by glacial meltwater. Depth to a restrictive layer is more than 80 inches. The soils are very poorly drained, have a hydric rating of 90, and are considered not prime farmland. The soil contains 18.11 percent organic matter. The Ksat is moderately low to moderately high with an infiltration rating of most limited, and a low permeability rating of 1.0. These soils occur within a portion of the Facility Site being cultivated for hay. The very poorly drained classification and hydric rating of 90 likely result in a high infiltration rate.

Walpole Series consists of poorly drained soils which occur on smooth sand plains, outwash deposits, and deltas.

Wca is Walpole sandy loam with 0 to 6-percent slopes. Parent material is sandy glaciofluvial deposits. Depth to a restrictive layer is more than 80 inches. The soils are poorly drained, have a hydric rating of 85, and are considered farmland of statewide importance. The soil contains 2.77 percent organic matter. The Ksat is high with an infiltration rating of most limited, and an excessive permeability rating of 0.5. These soils occur within portions of the Facility Site being cultivated for hay and row crop agriculture. The poorly drained classification, hydric rating of 85, high Ksat, and excessive permeability rating likely result in a high infiltration rating.

Westbury Series consists of soils that are somewhat poorly drained and have developed on medium-textured glacial till derived from sandstone.

Wma is Westbury and Dannemora stony, very fine sandy loams with 0 to 3-percent slopes. Parent material is loamy till derived from acid sandstone and siltstone. Depth to a restrictive feature is 10 to 24 inches. The soils are somewhat poorly drained, with a hydric rating of 40, and are considered farmland of statewide importance. The soil contains 10.22 percent organic matter. The Ksat is moderately low to moderately high with an infiltration rating of most limited, and a low permeability rating of 1.0. These soils primarily occur within portions of the Facility Site being cultivated for hay and row crop agriculture. The somewhat poorly drained classification, hydric rating, and low permeability rating likely results in a moderate infiltration rate.

Wmb is Westbury and Dannemora stony, very fine sandy loams with 3 to 8-percent slopes. Parent material is loamy till derived from acid sandstone and siltstone. Depth to a restrictive feature is 10 to 24 inches. The soils are somewhat poorly drained, with a hydric rating of 45, and are classified as farmland of statewide importance. The soil contains 10.22 percent organic matter. The Ksat is moderately low to moderately high with an infiltration rating of most limited, and a low permeability rating of 1.0. These soils primarily occur within portions of the Facility Site being cultivated for row crop agriculture. The low permeability rating, somewhat poorly drained classification, and hydric rating likely result in a moderate infiltration rate.

Worth Series consists of well-drained soils which have developed from glacial till derived from sandstone. These soils occur on slightly convex slopes with gently rolling topography.

Wqb is Worth very fine sandy loam with 3 to 8-percent slopes, stony. Parent material is loamy till derived from sedimentary rock. Depth to a restrictive feature is 18 to 38 inches. The soils are well-drained, have a hydric rating of 0, and are classified as prime farmland. The soil contains 10.03 percent organic matter. The Ksat is very low to moderately high with an infiltration rating of most limited, and a low permeability rating of 1.0. These soils occur within a forested portion of the Facility Site. The well-drained classification, hydric rating of 0, and low permeability rating likely result in a low infiltration rate.

Wsd is Worth very fine sandy loam, 8 to 25-percent slopes, very stony. Parent material is loamy till derived from sedimentary rock. Depth to a restrictive layer is 18 to 38 inches. The soils are well-drained, have a hydric rating of 0, and are classified as not prime farmland. The soil contains 10.03 percent organic matter. The Ksat is very low to moderately high with an infiltration rating of most limited, a low permeability rating of 1.0, and a slope of 0.5. These soils occur within an agricultural portion of the Facility Site. The well-drained classification, hydric rating of 0, low permeability rating, and slope likely result in low infiltration rates.

Wte is Worth very fine sandy loam, with 25 to 60-percent slopes, very stony. Parent material is loamy till derived from sedimentary rock. Depth to a restrictive layer is 18 to 38 inches. The soils are well-drained, have a hydric rating of 0, and are classified as not prime farmland. The soil contains 10.03 percent organic matter. Ksat is very low to moderately high with an infiltration rating of most limited, a low permeability rating of 1.0, and a slope of 1.0. These soils primarily occur within forest edge and agricultural portions of the Facility Site, adjacent to a wetland. The well-drained classification, hydric rating of 0, low permeability rating, and slope likely result in a low infiltration rate.

Groundwater was identified at depths between 6.9 to 19.3 feet bgs or greater at the time of the geotechnical investigation; therefore, dewatering is not anticipated. If excavations are affected by groundwater or stormwater, the selected contractor during construction will be prepared to manage groundwater or infiltrated stormwater using pump-and-sump or similar techniques to allow for foundation construction in-the-dry, if necessary. If determined necessary, water will be discharged to an appropriate upland area identified within the 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.

The Facility Site is relatively flat with elevations ranging from approximately 750 feet above mean seal level in the northeastern portion of the Facility Site, along the Chateaugay River, to approximately 1,050 feet in the southern portion of the Facility Site. The Facility Site is composed of predominantly medium infiltration areas. The Facility Site consists primarily of agricultural fields with some undeveloped natural meadows and wooded areas. Most of the Facility Site is, and will continue throughout the life of the Facility, to be heavily vegetated. Considering this, impacts to recharge/infiltration will be minimal.

Based on the evaluation and field investigations, the Facility Site is considered suitable for construction and operation of the Facility.

(13) Bedrock and Underlying Bedrock Maps, Figures, and Analyses

Bedrock geology within the Facility Site boundary is mapped as sedimentary rock of the North American platform, Late Proterozoic to Paleozoic in age. Based on the “Geologic Map of New York, Adirondack Sheet” prepared by NYSED, it is understood that the specific bedrock formation within the Facility Site boundary is the Potsdam Sandstone Formation, which consists of:

- Upper portion (Keeseville Member): relatively pure cream to white quartzitic sandstones.
- Middle portion (Ausable Member): pink to gray feldspathic sandstones, thick local quartz pebble lenses and arenaceous shale interbeds.
- Lower portion (Allens Falls Member): maroon, red, and green arenaceous shales, maroon argillaceous, hematitic sandstones, and pebble to boulder.

The site-specific geologic field investigation conducted was also in general conformance with this publicly available mapping (Isachsen and Fisher, 1970). Bedrock was not encountered within the Facility boundaries. Boulders and cobbles were observed as shallow as 2 feet below grade, but typically at 6 feet and deeper. Bedrock was not encountered within the depth of the geotechnical investigation, which was proposed to depths at which elements of the proposed PV facility would extend. Figure 10-3 has been prepared to highlight the bedrock geology across the Facility footprint and substation.

Section 3 of the Geotechnical Report describes the subsurface conditions of soil and bedrock underlying the Facility Site. Table 1 of the Geotechnical Report lists the generalized subsurface

profiles within the Facility Site. The average depth, soil material, average consistency, and descriptions are detailed for onsite soils within 20 feet of the surface. Additionally, Attachment B of the Geotechnical Report provides the soil boring logs that were analyzed to complete Table 1. Bedrock is not present across the Facility Site at a depth at which it will impact the constructability or viability of the proposed PV facility.

The Surficial Geologic Map figure (Figure 10-2) identifies the Facility Site boundaries as well as the various surficial geology units across the region based on the “Geologic Map of New York, Adirondack Sheet” prepared by the New York State Geological Survey. Review of this publicly available reference and Figure 10-2 identifies that the Facility Site is located within an area almost wholly described as “Till” material. The description of the “Till” unit in the Surficial Geologic Map indicates this soil unit as “thickness variable (1 – 50 meters)”, which indicates that publicly available regional information of this Till layer expects this deposit to be as thick as 1 to 50 meters and bedrock to be deeper than this range of depth.

10(b) Evaluation of Suitable Building and Equipment Foundations

The following provides an evaluation of suitable building and equipment foundations.

(1) Preliminary Engineering Assessment

Driven and/or drilled and driven embedded H-piles are proposed to be installed to support the proposed PV racks. In general, installation of shallow foundations will be limited to depths of 5 feet bgs and installation of driven piles will be limited to depths of 12 feet bgs, however, actual foundations sizes and embedment depths will be apportioned based on recommended capacities provided in the Geotechnical Report.

Conventional shallow foundation elements, such as sonotubes, spread footings, or similar systems, are proposed to be installed to support equipment pads (e.g., inverter skids, medium voltage transformers) within the solar arrays as well as the substation transformers and equipment. Inverters will likely arrive onsite as a single package on steel skids, which may be similarly supported by concrete footings, sonotubes, or driven steel piles. These foundation elements are also anticipated to support lightly loaded equipment within the substation area.

A preliminary engineering assessment was performed as part of the geotechnical evaluation for the Facility Site. The results of the engineering assessment are provided as Section 7 of the

Geotechnical Report. The recommendations use the latest version of the International Building Code (IBC) and standard industry accepted design standards.

(2) Pile Driving Impact Assessment

Solar panels will be supported by steel H-piles driven to a depth of approximately 8 to 12 feet bgs. It is likely that either pre-drilling of piles or vibratory hammers may be required prior to the installation of the posts, as shallow boulders and cobbles were documented during field investigations. The parameters provided in Section 7.3 of the Geotechnical Report have been used to size the H-piles. The number of installed piles for solar racking is estimated to be between 25,000 and 35,000 posts, depending on the final configuration of the racking system, module layout, and panel configuration (two in-portrait or one in-portrait). It is anticipated that the piles will be installed in 90 days using six pile installation crews working 10 hours per day.

It is not anticipated that a traditional, large crane-operated pile driving hammer used for heavily-loaded structures will be employed. Should pre-drilling be required, it will likely be completed by using an excavator outfitted with an auger or drill attachment, or rock drill such as Ingersoll-Rand ECM-350 or similar machine. Based on the relatively small pile cross-section and the anticipated installation methods, ground-borne vibrations will be minimal and will not create any risk with respect to surrounding properties and structures.

(3) Pile Driving Mitigation

Solar tracker pile installation is commonly performed using vibrating pile drivers with no offsite vibration effects. The expected pile driver type is the Vermeer PD10 vibratory hammer, Gayk HRE4000, or similar, which will exert a maximum driving energy between 750 and 850 pound-feet using a hammer weight of 8,000 pounds while driving the pile to depth of 8-12 feet. The pile driver for the inverter skids and substation equipment, if required, will have similar specifications. Pile-driving activities will not pose risk with respect to surrounding properties or structures and will be performed in compliance with the Section 94-c regulations. The well survey responses that were received from the landowners within the Facility Site identified 22 wells within the Facility Site that are used for domestic purposes. Of the 22 wells, four of them are located under proposed solar arrays. If piles need to be installed within 100 feet of the existing, active drinking water supply wells, then earth screws will be used. No impacts to

surrounding properties from pile driving are anticipated; therefore, mitigation measures and a compensation plan are not applicable.

(4) Evaluation of Earthquake and Tsunami Event Vulnerability at the Facility Site

Based on observation of subsurface conditions, computed Site Class ratings, and review of USGS's 2014 National Seismic Hazard Map, there is a moderate risk of significant seismic activity within the Facility Site that could cause damage to the Facility.

Figure 10-4 depicts the Facility Site in relation to seismic hazard potential and known prior epicenters based on the 2018 USGS Long-term National Seismic Hazard Model (Petersen et al., 2019). Mapping also reveals a moderate hazard for seismic activity. The USGS Model defines the potential for earthquake ground shaking for various probability levels across the conterminous United States and is applied in seismic provisions of building codes, insurance rate structures, risk assessments, and other public policy. According to the USGS, the model represents an assessment of the best-available science in earthquake hazards and incorporates new findings on earthquake ground shaking, seismicity, and long-period amplification over deep sedimentary basins.

Based on its geographic location, the Facility Site is not subject to risk of a tsunami event.

Conclusions

The Facility Site is relatively flat and open and there are minimal areas that will require re-grading to achieve proposed finished grades with the exception of some of the haul roads. Therefore, existing drainage patterns can be maintained, and impacts to existing grade, vegetation, and recharge/infiltration will be minimal. Based on data from the 2018 USGS Long-term National Seismic Hazard Map the potential for seismic activity at the Facility Site is moderate. Although the geotechnical investigation identified the presence of shallow boulders and cobbles, rock removal techniques such as ripping, hammering, or pre-drilling can likely be completed without the requirement of blasting. Due to the presence of shallow boulders and cobbles, pile pre-drilling may be required. However, ground-borne vibrations will be minimal and will not create any risk with respect to surrounding properties and structures. The Facility has been designed to comply with 19 New York Codes, Rules and Regulations (NYCRR) Section

900-2.11 and the Uniform Standards and Conditions (USCs) and impacts related to geology, seismology, and soils have been avoided and minimized to the maximum extent practicable.

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