Hecate Energy
Cider Solar Farm

Exhibit 10: Geology, Seismology, and Soils

Cider Solar Farm
Towns of Oakfield and Elba
Genesee County, New York

Matter No. 21-01108

EXHIBIT 10: GEOLOGY, SEISMOLOGY, AND SOILS

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Abbreviations

BMP	Best Management Practices
ERT	Electrical Resistivity Tomography
HDD	Horizontal Directional Drilling
IBC	International Building Code
IR	Inadvertent Return
ISAT	International Seismic Application Technologies
NEHRP	National Earthquake Hazard Reduction Program
NFS	Non-Frost Susceptible
NRCS	Natural Resource Conservation Service
NYCRR	New York Codes, Rules, and Regulations
NYOITS	New York Office of Information Technology Services
NYSDAM	New York State Department Agriculture and Markets
NYSDEC	New York State Department of Environmental Conservation
NYSGPO	New York State ITS GIS Program Office
NYSM	New York State Museum
O&M	Operation and Maintenance
PV	Photo-voltaic
RQD	Rock Quality Designation
SPDES	Stormwater Pollution Discharge Elimination System
SPT	Standard Penetration Test
SSURGO	Soil Survey Geographic Database
STATSGO	State Soil Geographic Database
SWPPP	Stormwater Pollution Prevention Plan

USDA	United States Department of Agriculture
USGS	United States Geological Survey

Glossary of Terms

Applicant	Hecate Energy Cider Solar LLC
Project	Refers to the proposed Cider Solar Farm, an up to 500-megawatt utility scale solar project that will be comprised of photovoltaic panels, inverters, access driveways, electrical collection lines, point of interconnection/substation, construction staging areas, fencing and plantings, located on private land in the towns of Elba and Oakfield, Genesee County, New York.
Project Site	Refers to those privately owned parcels under option to lease, purchase, easement, or other real property interests with the Applicant in which all Project components will be sited totaling approximately 4,650 acres.
Project Area	Refers to the Project Site and surrounding/adjacent land totaling approximately 7,518 acres.
Project Footprint	Refers to the limit of temporary and permanent disturbance caused by the construction and operation of all components of the Project totaling approximately 2,452 acres.

The content of Exhibit 10 is provided in conformance with Chapter XVIII, Title 19 of NYCRR Part 900 § 900-2.11, as follows.

a) Geology, Seismology, and Soils Impacts of the Project

1) Map of Existing Slopes

Figure 10-1: *Slopes within the Project Area* depicts the existing slopes (0–3%, 3–8%, 8–15%, 15–25%, 25–35%, and 35% and over) within the drainage area potentially influenced by the Project, including the interconnections. Data was obtained from the New York State ITS GIS Program Office (NYSGPO) and is based on its 1-m Digital Elevation Model (NYOITS 2019). The Project Area is generally flat, with the majority of the area having slopes in the ranges of 0–3% and 3–8%. The areas with slopes in the ranges of 8–15% and 15–25% are located in the central and eastern portion of the Project Area, primarily in the following locations: along Lockport Road, between Graham Road and Orchard Road; along Ridge Road between Graham Road and Oak Orchard Road; and to the south of North Byron Road, near the intersection of Miller Road.

The Project Area is located within the Oak Orchard-Twelve-mile watershed (HUC 04130001), which is nearly level to rolling topography on the Ontario Lake Plain. The Project is located on the southern portion of the watershed, where the elevation is highest, relative to the rest of the watershed. The Project Area generally drains to the north and northwest, where the streams in the Project eventually connect to Oak Orchard Creek.

Existing and proposed grades are also identified in Appendix 5-A: *Civil Design Drawings* in Exhibit 5: *Design Drawings* of this Application. Project components are sited to avoid steep slopes; therefore, impacts to steep slopes are not expected. Based upon the current solar panel equipment, the Project is designed to accommodate a 7% maximum slope in the panel areas as a conservative approach to managing the potential earthwork. The Project will likely select a panel system that will not require grading in the panel areas. Proposed contours depicted in the Design Drawings take into consideration the conservative grading approach to achieve a 7% maximum slope throughout the panel areas.

2) Proposed Site Plan

Design Drawings illustrate the proposed Site Plan at 1:200 foot scale showing existing and proposed contours at 2-foot intervals for the Project Site, including interconnection, are provided as part of Exhibit 5. Existing contours were created using a boundary and topographic survey of the Project Site and adjacent properties, which was prepared by MJ Engineering and Land Survey, P.C., under the direction of a New York Licensed Land Surveyor. The survey compiled from 2019 USGS/FEMA LiDAR data with break lines added and field verification to confirm data quality to create a digital terrain model and 2-foot interval contours. Existing and proposed contours (2-foot intervals) are depicted on the plan view sheets of the Design Drawings (Appendix 5-A).

3) Proposed Excavation Techniques

Project construction will be performed in several stages and will include the main phases described below.

i) Pre-Construction Activities

Before the commencement of Project construction, a site survey will be performed to stake out the limits of disturbance, location of proposed Project components and previously identified sensitive resources (e.g., wetlands and waterbodies, cultural resources, agricultural resources, drain tiles). Work area limits will be defined by flagging, fencing and/or staking. Pre-construction activities will also include setting up temporary construction trailers and delivering equipment and materials.

Prior to construction, appropriate erosion and sediment control measures will be installed according to the Project's SWPPP (see Appendix 13-C: Stormwater Pollution Prevention Plan of this Application), which has been prepared in accordance with the NYS SPDES General Permit for Stormwater Discharges from Construction Activity and the NYS Standards and Specifications for Erosion and Sediment Control.

The Applicant will employ an Environmental Monitor pursuant to 19 NYCRR § 900-6.4(b) to oversee Project construction and ensure compliance with all applicable environmental regulations and guidelines.

ii) Site Preparation for Construction

Project construction will be initiated by clearing brush/woody vegetation from the locations of all proposed Project components, access roads, temporary staging areas and laydown yards, parking areas, and electrical collection line routes. Construction will require cut or fill to achieve the final grades. These cut or fill activities include constructing access roads that traverse an existing grade that exceeds the maximum design slope, constructing on a side slope, or flattening the top of an existing high point. The grading has been developed using conservative maximum slope of 7% in the array areas. This results in the greatest extent of possible earthwork quantities. It is anticipated that during final design a racking system will be selected that can be installed on slopes greater than the maximum design slope, thus minimizing or potentially eliminating the need for mass earth moving. Topographic survey data was utilized during the initial design process. The intent of the grading design is to identify the greatest extent of possible cut and fill while maintaining existing drainage patterns.

Up to 6 temporary laydown areas comprised of 19.3 acres will be constructed and utilized during construction. All laydown yard areas were selected for their ease of accessibility, strategic location in the construction work, relatively flat ground surface, occurrence outside sensitive resources (wetlands, waterbodies, cultural areas, etc.), and content of limited shrubby or woody vegetation to reduce impacts to natural vegetation areas. All laydown 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 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.

Based on the preliminary design, it is anticipated that approximately 350,000 cubic yards of cut will be required and used as onsite fill to achieve proposed finished grades. The area of earthwork is approximately 370 acres, which is approximately 15% of the Project Footprint. Of the required cut/fill material, it is estimated that roughly 170,000 cubic yards will be composed of topsoil and will be redistributed over disturbed areas.

All excavated material will be re-used on-site. No fill material, other than gravel for road surfacing and sand for trench bedding, will be required from offsite areas. Nor will any fill be transported offsite from the Project, thereby minimizing the potential for introduction and/or transport of invasive species.

iii) Access Road Construction

Wherever practicable, existing roads have been utilized to avoid construction of new roads and minimize impacts of Project construction. Where an existing road is unavailable or unsuitable, new gravel access roads will be installed, and will measure 20 feet wide, including shoulders. Based upon the geotechnical investigation conducted at the Project Area, blasting is not anticipated (refer to further discussion in Section (v) below). In areas of access road construction and major cuts, the existing topsoil will be stripped and stockpiled for redistribution, and the subgrade will be boxed out and proof-rolled to accommodate installation of the gravel road section while maintaining existing drainage patterns where practicable. Where required, a native soil or gravel feather wedge will be constructed. In areas with bulk earthwork, the subgrade will be boxed out and proof-rolled for the gravel section. A geotextile fabric will be installed beneath the road surface, if necessary, to provide separation of material. Proposed gravel road cross section details and notes are provided in Exhibit 5 of this Application.

The Applicant will retain current surface drainage patterns and install a significant surface drainage system in accordance with the Project SWPPP comprised of dry swales, slope protection, storm pipes, culverted crossings of surface water features, and vegetated filter strips that accommodate water quantity generated by the Project. Where drainage features such as swales, agricultural ditches and drainages, and culverts are impacted by Project construction, they will be repaired and restored. The construction contractor will promptly mark and record any exposed or damaged culverts or pipes revealed during grading, excavation, land compaction, or topsoil stripping, and will immediately notify the Environmental Monitor. As land disturbance conditions require, a site-specific plan will be prepared, in consultation with the landowner, for the replacement or repair of crushed/severed culverts and pipes. In situations where damage to a surface or subsurface drainage feature is discovered by the environmental monitor or construction contractor, prompt repair or replacement will be completed prior to the restoration phase, to the extent feasible.

Culverts or shallow water crossings will be installed to maintain natural drainage patterns where necessary. Where access 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 maintained and modified or augmented as construction progresses to address the drainage patterns at the time of regular inspection. All sediment and erosion control features will be inspected on a regular basis and maintained according to the Project-specific SWPPP (Appendix 13-C).

iv) Racking System and Array Foundation Construction

Photovoltaic (PV) solar array support posts will be driven to a minimum depth between 6 and 12 feet, with the final depth to be determined during the detailed design phase of the Project. Bedrock throughout the site is generally well below the anticipated depth of posts, the shallowest encountered at soil boring location CSSB-2, which was at a depth of approximately 40 feet below the existing surface. Should bedrock refusal be encountered shallower than the design embedment depth, the location of support posts will be pre-drilled, and the support posts will be grouted in place. It is anticipated that array areas requiring pre-drilling, if any, will be limited to less than 5 acres.

Equipment foundations within the solar array will generally be slab-on-grade construction with an anticipated embedment depth of between 12 inches and 18 inches underlain by free-draining granular fill or stone. Foundation sizes will be apportioned based on the allowable bearing capacities recommended within the Geotechnical Report (Appendix 10-A: *Preliminary Geotechnical Engineering Report*). Driven piles may also be considered for support of the equipment foundations or skids.

v) Electrical Collection System Installation

The construction of buried electrical collection system between solar arrays will be installed via direct burial or open trench methods. Direct burial methods for underground installation of the electrical collection system will utilize appropriate industry equipment including, but not limited to, use of a cable plow, rock saw, rock wheel and/or trencher during the installation of underground electrical collection system whenever possible. Direct burial involves the installation of bundled cable (electrical and fiber optic bundles) directly into a narrow cut or “rip” in the ground. The rip 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. Where direct burial is not possible or cost effective, an open trench would be excavated 2 to 3 feet wide. Using this installation technique, topsoil and subsoil are excavated, segregated, and stockpiled adjacent to the trench. Following cable installation, the trench is backfilled and compacted with suitable fill material and any additional spoils are spread out or otherwise spread on site. Following installation of the buried collection line, areas would be returned to pre-construction grades. One or more soil screening areas may be established on site to screen excavated material to the required specification for trench backfill. It is anticipated that the excavated material can be screened to provide sufficient quantities of backfill material. During excavation of the trenches, it may be determined that additional backfill is required. Additional backfill would be imported to the Project Site. The Project will be constructed in accordance with the NYSDAM Guidelines.

At locations where an electrical collection line crosses existing rail beds, pipelines, streams, or flooded wetlands, trenchless technologies, such as jack-and-bore or directional drill techniques may be used. There are up to 23 such crossing proposed for the Project, and these crossings may vary in length from approximately 60 to 150 feet to cross a public roadway, to over 1,000 feet to cross a large, forested wetland complex. Both techniques involve 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. The Applicant is proposing to utilize horizontal directional drilling (HDD) on the Project, under obstacles, including seven wetlands and seven streams. The proposed HDD locations include delineated wetlands WL20, WL22, WL34, WL56, WL70, WL73, WL117, and streams ST04, ST32, ST39, ST46, ST61, ST74, and ST75 (refer to Exhibit 5). HDD requires the use of water and bentonite clay slurry as a lubricant and stabilizer during the construction process. To address the potential for a release of the slurry into waterbodies, an Inadvertent Return (IR) Plan has been prepared (see Appendix 10-B: *Inadvertent Return Plan for Horizontal Directional Drilling (HDD)*). In addition, when a dry crossing of wetlands and streams is possible, the open trench method may be used.

vi) Substation

Substation construction will begin with clearing the Project Footprint followed by grading the substation area for installing cables and equipment foundations. Relatively little cut and fill is anticipated. Concrete foundations for major equipment and structural supports will be placed, followed by the installation of various conduits, cable trenches, and grounding grid conductors. Two test pits were located near the proposed substation location, CSSB-1 and CSSB-2. At CSSB-1, groundwater was observed at a depth of 8 feet, at the completion of drilling. At CSSB-2, groundwater was observed at a depth of 7.5 feet at the completion of drilling, and at a depth of 4 feet after pulling the augers out of the ground. In the event excavations are affected by groundwater, perched water, or stormwater, the Applicant's contractor(s) 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. The contractor(s) will grade the surface, as necessary and to the extent possible, to direct stormwater away from open excavation.

Aboveground construction in the substation areas will include, but is not limited to, the installation of structural steel; bus conductors and insulators; switches; circuit breakers; transformers; and control buildings. Upon completion of above ground structures, crushed stone will be laid across each substation footprint and a chain-link fence will be installed to encompass the substation. Restoration of the area immediately adjacent to each substation will then be completed.

vii) Restoration

The areas of the Project that were previously utilized for agricultural purposes will be restored to their preconstruction condition and land use, in accordance with 19 NYCRR § 900-6.4. Topsoil reserved during construction and stored in long-term berms will be used if available and supplemented with comparable soils.

Portions of the Project that have been excavated and back-filled will be graded to restore land contours as near as practicable to preconstruction conditions. Soils compacted during de-construction activities will be de-compacted, as necessary, to restore the land to pre-construction land use. If present, drain tiles that have been damaged will be repaired or replaced to maintain appropriate drainage.

4) Suitability for Construction

Table 10-1: *Soil Map Units Present at the Project Area* provides a list of NRCS soil map units underlying the Project Area. The dominant soil types are Hilton and Ontario loams, and Ovid silt loams, comprising 16.45%, 19.39%, and 12.66% of the Project Area, respectively.

Table 10-1: Soil Map Units Present at the Project Area

Map Unit Name	Percent Slope	Hydrologic Soil Group[1]	Percent Organic Matter	Corrosivity		Acres within the Project Area (acres)	Percentage of Project Area
				Steel	Concrete		
Alden mucky silt loam	0 to 3	C/D	17.5	High	Low	68.8	0.88
Appleton silt loam	0 to 3	B/D	5	High	Low	365	4.65
Appleton silt loam	3 to 8	B/D	5	High	Low	2.1	0.03
Arkport very fine sandy loam	1 to 6	A	3	High	Moderate	60.9	0.78
Arkport very fine sandy loam	6 to 12	A	3	High	Moderate	9.1	0.12
Bergen muck	0 to 3	C/D	87	High	Low	8.0	0.10
Canandaigua silt loam	0 to 2	C/D	9.5	Moderate	Low	422.6	5.39
Canandiagua mucky silt loam	0 to 2	C/D	15	Moderate	Low	216.4	2.76
Carlisle muck	0 to 2	A/D	84.5	High	Moderate	14.8	0.19
Cazenovia silt loam	3 to 8	C/D	5.5	High	Low	8.6	0.11
Cazenovia silt loam	8 to 15	C/D	5.5	High	Low	1.6	0.02
Cazenovia silty clay loam, eroded	8 to 15	C/D	5.5	High	Low	6.3	0.08
Cazenovia silty clay loam, eroded	15 to 25	C/D	5.5	High	Low	1.2	0.02
Collamer silt loam	2 to 6	C/D	3.5	High	Low	118.8	1.51
Colonie loamy fine sand	2 to 6	A	1.5	Low	High	6.6	0.08
Darien silt loam	0 to 3	C/D	5.5	High	Low	1.9	0.02
Dunkirk silt loam	2 to 6	C	4.5	High	Moderate	10.6	0.14
Edwards muck	0 to 6	C/D	65	High	Low	0.3	0.00
Fonda mucky silt loam	0 to 1	C/D	17.5	High	Low	87.5	1.12
Fredon gravelly loam	0 to 3	B/D	6	High	Low	4.7	0.06
Galen very fine sandy loam	0 to 2	A/D	3	High	Moderate	40.1	0.51

Map Unit Name	Percent Slope	Hydrologic Soil Group[1]	Percent Organic Matter	Corrosivity		Acres within the Project Area (acres)	Percentage of Project Area
				Steel	Concrete		
Galen very fine sandy loam	2 to 6	A/D	3	High	Moderate	33.1	0.42
Gravel pits	-	-	-			73	0.93
Halsey silt loam	0 to 4	B/D	4	Moderate	Low	8.8	0.11
Hamlin silt loam	0 to 3	B	4	High	Low	4.5	0.06
Hilton loam	0 to 3	B/D	3	High	Moderate	322.1	4.11
Hilton loam	3 to 8	B/D	3	High	Moderate	968.8	12.35
Lakemont silty clay loam	0 to 3	D	8	High	Low	216.3	2.76
Lamson very fine sandy loam	0 to 3	A/D	5.5	Moderate	Low	98.8	1.26
Lamson mucky very fine sandy loam	0 to 3	A/D	11.5	Moderate	Low	54.6	0.70
Lima silt loam	0 to 3	B/D	3	High	Low	50.2	0.64
Lima silt loam	3 to 8	B/D	3	High	Low	179.1	2.28
Lyons soils	0 to 3	C/D	10	High	Low	181.5	2.31
Madalin silty clay loam	0 to 3	C/D	84.5	Moderate	Low	119.6	1.52
Minoa very fine sandy loam	0 to 2	B/D	4	High	Moderate	14.4	0.18
Niagara silt loam	0 to 2	C/D	6	High	Low	92	1.17
Odessa silt loam	0 to 3	D	6	High	Low	250.9	3.20
Odessa silt loam	3 to 8	D	3	High	Low	72.2	0.92
Ontario loam	0 to 3	B	3	Low	Moderate	154.7	1.97
Ontario loam	3 to 8	B	3	Low	Moderate	879.9	11.21
Ontario loam	8 to 15	B	3	Low	Moderate	422.7	5.39
Ontario loam	15 to 25	B	4.5	Low	Moderate	64.1	0.82
Ovid silt loam	0 to 3	C/D	4.5	High	Low	515.5	6.57
Ovid silt loam	3 to 8	C/D	87	High	Low	477.6	6.09
Palms muck	0 to 6	B/D	5	High	Moderate	216.7	2.76
Palmyra gravelly loam,	3 to 8	A	5	High	Moderate	47.4	0.60
Palmyra gravelly loam	8 to 15	A	5	High	Moderate	46.1	0.59

Map Unit Name	Percent Slope	Hydrologic Soil Group[1]	Percent Organic Matter	Corrosivity		Acres within the Project Area (acres)	Percentage of Project Area
				Steel	Concrete		
Palmyra and Arkport soils	15 to 25	A	5	High	Moderate	32.5	0.41
Palmyra and Arkport soils	25 to 40	A	4.5	High	Moderate	1.4	0.02
Phelps gravelly loam	0 to 3	B/D	4.5	High	Low	40.7	0.52
Phelps gravelly loam	3 to 8	B/D	5	High	Low	51.5	0.66
Rhinebeck silt loam	0 to 3	C/D	7	High	Low	274.6	3.50
Romulus silt loam	0 to 3	C/D	72.5	Moderate	Low	126.4	1.61
Saprists and Aquents, ponded	0 to 1	A/D	72.5	High	Moderate	10.9	0.14
Teel silt loam	0 to 3	B/D	4	High	Low	39.5	0.50
Wakeville silt loam	0 to 3	B/D	4	High	Moderate	144.4	1.84
Warners mucky loam	0 to 8	B/D	6	Moderate	Low	0.7	0.01
Wayland soils complex, frequently flooded	0 to 3	B/D	9	Moderate	Low	141.5	1.80
					TOTAL	**7845.8**	

Source: NRCS 2019, Terracon 2020

[1]Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Terracon Consultants-NY, Inc. conducted the preliminary geotechnical investigation for the Project Footprint and the preliminary geotechnical investigation report is provided in Appendix 10-A. The preliminary geotechnical investigation included a desktop review of publicly available information and site investigations with associated laboratory analyses. The site investigations included drilling 24 Standard Penetration Test (SPT) borings (CSB-1 to CSB-24) sited in areas containing solar arrays and 2 SPT borings (CSSB-1 and CSSB-2) at the proposed substation site, 4 test pits (CSTP), Electrical Resistivity Transmography (ERT) testing, laboratory thermal resistivity dry-out curve testing, and laboratory corrosion tests.

Electrical resistivity and conductance are important for design of grounding systems at substations, as well as evaluation of cabling requirements. Terracon conducted ERT testing on November 20, 2020, at four locations sited in areas containing solar arrays and two locations within the proposed substation area to determine the natural ground formation’s conductivity. GEOTHERM USA conducted laboratory thermal resistivity testing on soil samples obtained from two locations within the Project Site during field exploration from a depth of approximately 1 to 4 feet below the ground surface. This testing was performed in accordance with the Institute of Electrical and Electronics Engineers standard.

In general, the borings found glaciolacustrine and glacial till deposits (mainly silt, sand, and clay soils) to an explored maximum depth of about 48.5 feet. According to data obtained from the NRCS, approximately 65% of the Project Area contains soils classified as having a high risk of the corrosion of steel (Table 10-1; NRCS 2019). Conversely, the risk of corrosion of concrete is low to medium throughout the Project Area (NRCS 2019). During geotechnical investigations, Terracon obtained samples for corrosion testing from five locations within the Project Site, at depths of approximately 1 to 4 feet below ground surface. The samples were tested for pH, water soluble sulfate, chloride content, sulfides, oxygen reduction potential, total salts and electrical resistivity.

Based on preliminary results of the geotechnical investigation, it is likely that the overburden soils encountered in the borings are frost susceptible. Project components will be designed to resist frost heave forces, and pile lengths will need to be long enough to counteract potential heave forces in the seasonal frost zone. Lightly loaded ancillary equipment should be underlain by 12 inches of non-frost susceptible material, or alternatively, the slabs could be designed to allow movement due to frost action.

Groundwater was observed at depths ranging from approximately 0 to 15 feet below the ground surface. See Table 10-2: *Summary of Borings and Test Pits Sampled During Geotechnical Study* below for a summary of groundwater levels observed during the preliminary geotechnical investigation. Accordingly, during excavations, such as when constructing trenches for electrical cables and conduits, groundwater could be encountered and could require dewatering. Any required dewatering would conform to the Project’s Dewatering Plan, prepared in accordance with the SWPPP (Appendix 13-C). Groundwater may also be encountered when excavating for shallow foundations, especially if construction is performed during periods of seasonally high groundwater. While precipitation is relatively constant throughout the year, groundwater levels are expected to be deepest during the late summer due to increased evaporation rates. Terracon recommends assuming groundwater levels to be shallow for design and construction.

Table 10-2: Summary of Borings and Test Pits Sampled During Geotechnical Study

Boring/Test Pit Number	Depth of Boring/ Test Pit (feet)	Depth to Groundwater (ft)[1]		Depth of Bedrock Encountered (feet)
		At the Completion of Drilling	After Pulling Equipment out of Test Pit	
CSB-1	20	--	14.5	N/A
CSB-2	18.9	--	8	N/A
CSB-3	20	8.5	2.5	N/A
CSB-4	20	--	13	N/A
CSB-5	18.4	0	N/A	N/A
CSB-6	20	10.5	8	N/A
CSB-7	20	0	0	N/A
CSB-8	20	0	0	N/A
CSB-9	20	--	--	N/A
CSB-10	20	--	--	N/A
CSB-11	20	--	--	N/A
CSB-12	19.3	14	8.5	N/A
CSB-13	20	--	3.5	N/A
CSB-14	20	15	N/A	N/A
CSB-15	20	--	--	N/A
CSB-16	19.3	--	14.5	N/A
CSB-17	19.3	--	--	N/A
CSB-18	18.6	--	--	N/A
CSB-19	19.8	14	12	N/A
CSB-20	20	--	--	N/A
CSB-21	20	0	12.5	N/A
CSB-22	20	--	--	N/A
CSB-23	20	--	--	N/A
CSB-24	20	--	--	N/A
CSSB-1	48.4	8	N/A	N/A
CSSB-2	45.2	7.5	4	40
CSTP-1	8	4	N/A	N/A
CSTP-2	8	5	N/A	N/A
CSTP-3	8	--	--	N/A
CSTP-4	8	--	--	N/A

Source: Terracon 2020

[1]Groundwater depths represented with an – indicate areas where no groundwater was encountered; N/A indicates water levels were not checked after removing equipment from test pit

Wet and loose/soft soil surface conditions due to rainwater could create access issues for vehicles, with the site generally being more accessible in the summer and early fall due to improved drying conditions. It is assumed that grading would be minimal, and on-site materials appear to be generally suitable for re-use as fill or backfill.

5) Preliminary Blasting Plan

No blasting is anticipated during Project construction. Shale bedrock was only encountered at one of the substation borings, CSSB-2, at a depth of 40 feet. CSSB-2 is associated with the site of the proposed substation, located on the west side of Graham Road, approximately 1,800 feet north of the intersection of Graham Road and Lockport Road. Any surficial exposed rock areas are generally avoided by the design. In the event that rock is encountered, it is anticipated that the material will consist of fractured and/or weathered shales or siltstones. The preliminary geotechnical investigation observations suggest that the shale bedrock will be generally drillable or rippable using an excavator bucket or conventional rock removal techniques and should not require blasting.

6) Potential Blasting Impacts

Blasting is not proposed for the Project due to the depth of bedrock and the rippability of any rock that may be encountered.

7) Mitigation Measures for Blasting Impacts

As detailed in Section (a)(5), blasting is not anticipated to be needed in the construction of the Project.

8) Regional Geology, Tectonic Setting, and Seismology

The Project Area is located within the Eastern Great Lakes Lowlands ecoregion (Bryce et al. 2010). Within New York State, this ecoregion abuts the Great Lakes and St. Lawrence Seaway to the west and north, and the Allegany Plateau to the south. The Eastern Great Lakes Lowlands includes much of the northern half of New York State, except for the highland ecoregions that it largely surrounds. The valleys and lowlands of this ecoregion are underlain by interbedded limestone, shale, and sandstone rocks that erode more readily compared to the more resistant rocks of the adjacent highlands. The Project Area occurs in the sub-ecoregion referred to as the Ontario Lowlands (Bryce et al. 2010). This sub-ecoregion is characterized by loamy soils derived from limestone and calcareous shale (Alfisols) that are deep and finely textured. These soils are well-suited for agriculture, and as a result, much of the region was cleared for agriculture and urban development.

Surficial geology underlying the Project Area is mapped primarily as till and lacustrine silt and clay sediments of Quaternary age deposited by glacial activity. Bedrock within the Project Area are of Upper Silurian age and consist of the Akron Dolostone and Salina Group (NYSM 1970). The Akron Dolostone is a formation of the Bertie Group, and it is composed of dolostone with some shale layers. The Salina Group underlays the Akron Dolostone and consists of Camillus, Syracuse and Vernon formations, which consist of shale, dolostone, salt, and gypsum layers (NYSM 1970).

The preliminary geotechnical investigation did not identify any karst features within the Project Area. The potential presence of karst topography can be a concern with ground disturbance because these systems are very vulnerable to groundwater pollution. Karst is a distinctive topography that develops in rock capable of being dissolved by surface water or groundwater. This landform is often associated with carbonate rocks (limestone and dolomite) although it can occur in the presence of other highly soluble rocks such as evaporates (gypsum and rock salt). Karst systems have relatively rapid rates of water flow and lack a natural filtration system, which makes them particularly susceptible to groundwater pollution. Ground subsidence (i.e., sinkholes) is a potential geologic hazard associated with karst terrain or where underground mining has occurred. Publicly available mapping from the USGS delineates an east-west band across New York State and Genesee County of such carbonate rocks with karst potential, upon which the Project Footprint lies (Kappel et al. 2020).

Soil type can influence the severity of an earthquake. In general, soft soils like fill and sand are more likely to amplify ground motion during an earthquake, while very hard rock would amplify ground motion the least. The National Earthquake Hazard Reduction Program (NEHRP) soil type for much of Genesee County are characterized as rock (i.e., Soil Type B), although some adjacent areas to the north of the Project Area are characterized as soft soil (i.e., Soil Type E) (Tetra Tech 2019). According to the 2014 USGS Seismic Hazards Maps, the Project Area is in an area of relatively low seismic activity. The 2% probability of exceedance in 50 years of Peak Ground Acceleration for this area is 10% to 14% of standard gravity (Petersen et al. 2014). The Clarendon-Linden Fault is a north-south trending fault system that that displays both strike-slip and dip-slip motion. It extends from Lake Ontario through Orleans, Genesee, Wyoming, and Allegany counties. The fault is seismically active, but it is of Devonian Age and the most recent seismic event was recorded on May 25, 1995 (Genesee County Soil and Water Conservation District 2020).

9) Potential Project Impacts on Regional Geology

The Project is not anticipated to result in any significant impacts to the regional geology. To the extent practical, Project components will be designed, sited, and constructed in a manner that avoids or minimizes temporary and permanent impacts to geology and soils. Only temporary, minor impacts to geology are expected as a result of construction activities. Construction activities such as excavation, HDD, post installation, have the potential to increase sediment discharge, create loose or unstable soils, open voids in soils, and lower the water table. When karst features and aquifers are present, construction activities may result in impacts to such features, including sedimentation within caves, water quality deterioration, landform destruction, sinkhole development or collapse, and decreasing the amount of available water. An assessment of the Project Area did not identify vulnerable karst features such as caves, sinkholes, and fractures. The closest primary aquifer is the Tonawanda Aquifer approximately 3.8 miles south of the Project Area and the closest principal aquifers sit to the north and south of the Project Area. Impacts to aquifers are not anticipated as a result of excavation, HDD operations, and other soil disturbance activities due to their relative location to the Project Area.

General risks to karst features and aquifers associated with HDD include creating loose, unstable soils and open voids along the drill path. More specifically, there may be a loss of drilling fluid to cave areas within a karst feature, creating fractures within the bedrock and possible sinkhole formation. These releases typically occur as a result of seeps that can form when pressure in the drill hole exceeds the capability of the overburden to contain it, or when fluids find a preexisting fault in the overburden. Bore depths for HDD will consider site-specific factors such as soil type and bedrock composition; however, a minimum depth of approximately 25 feet in sound soil should be sufficient to prevent an inadvertent release and impacts to karst areas and aquifers.

Because there were no karst features or evidence of karst features identified during the geotechnical study, risks to karst features from HDD are not anticipated. Refer to the Design Drawings in Appendix 5-A of the Application for additional information on the HDD crossing methods, and the Inadvertent Return Plan in Appendix 10-B, which outlines the operational procedures and responsibilities for the prevention, containment, and cleanup of an inadvertent release.

The risks and impacts of post installation as they pertain to the karst formations and aquifers are generally limited, based on the depths of the installed posts. The main risk associated with post installation is the potential for highly variable depths to rock, which was indicated in select areas in the borings. As there are no aquifers or karst formations in the Project Area, impacts to karst features and aquifers due to post installation are not anticipated.

10) Potential Impacts of Seismic Activity on Project Operation

According to the USGS Earthquake Hazard Program, the Project is not located near a young fault or a fault that has had displacement in Holocene time. The Clarendon-Linden fault bisects Genesee County from north to south, but it is of Devonian age, and the most recent documented seismic event occurred on May 25, 1995 (Jacobi and Smith 1999, Genesee County Soil and Water Conservation district). As noted in Section (a)(8) above, there were no reported damages from earthquakes in Genesee County between 1950 and 2017 (Tetra Tech 2019). Consequently, future impact of seismic activity to the Project Area is considered to be negligible.

However, to further minimize and mitigate potential impacts from seismic activity, components of the Project will be evaluated and designed to resist the effects of earthquake motions in accordance with New York State Uniform Code of American Society of Civil Engineers (ACSE 7). Current solar array technology also allows for emergency shut off in case of emergency, such as a large seismic event.

11) Soil Types Map

Figure 10-2: *Soil Types within the Project Area* depicts the soil types on and near the Project Area, including the Project Site, based upon the Natural Resources Conservation Service (NRCS) Soil Survey Geographic (SSURGO) and State Soil Geographic (STATSGO) digital soil survey data.

12) Soil Characteristics and Suitability for Construction

The preliminary geotechnical investigation report provides a general discussion of the suitability and limitations of existing soils for the proposed site development, including excavation stability, erosion hazard, corrosion potential, percent of organic matter, and foundation integrity (Appendix 10-A). Section (4) and Table 10-1, above, provides a summary of the drainage class, percent organic matter, and hydrologic soil group of all of the soil series in the Project Footprint. The preliminary geotechnical investigation report also provides some recommended Best Management Practices (BMPs) to help minimize potential risks/hazards.

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

13) Bedrock Analyses and Maps

Review of USGS bedrock geology mapping indicates that the primary rock unit within the Project Area is material of the Camillus, Syracuse, and Vernon Formations (Rickard, Isachsen, and Fisher 1971). These Formations are comprised of shale, dolostone, salt, and gypsum. The Geotechnical Investigation Report, provided as Appendix 10-A, includes vertical profiles of soil sample locations (Terracon 2020). Shale was encountered in all rock core runs and was identified as the primary bedrock material throughout the Project Area.

Bedrock throughout the Project is generally well below the anticipated depth of posts, the shallowest encountered at soil boring location CSSB-2, which was at a depth of approximately 40 feet below the existing surface.

Figure 13-1a: *Depth to Bedrock* in Exhibit 13: *Water Resources and Aquatic Ecology* of this Application shows depths to groundwater within the Project Area, based on data from the NRCS. Groundwater depth based upon NYSDEC water well records ranges from 11 to 79 feet below ground surface (NYSDEC 2014). During the geotechnical investigation, groundwater was observed at depths ranging from approximately 0 feet (at ground level) to 15 feet below the ground surface. See Table 10-2, above, for a summary of those test pits in which groundwater was observed during the geotechnical investigation.

b) Foundation Evaluation

1) Preliminary Engineering Assessment

Terracon performed site geotechnical investigation and provided recommendations and options for the design and construction of the Project as described below. The engineer of record for the Project will consider the Terracon recommendations and make final determinations in the final design.

As typical with solar farm construction, embedded W-piles are proposed to be implemented to support the proposed PV racks. Conventional shallow foundations, such as sonotubes, spread footings or similar systems, may be utilized to support the proposed equipment pads (e.g., inverter skids, medium voltage transformers) within the area covered by solar arrays, as well as the substation transformers and equipment. Alternatively, driven piles may be used for inverter skids.

A preliminary engineering assessment has been performed to determine the types and locations of foundations to be employed, as noted in Exhibit 5. The assessment utilized the latest version of the International Building Code (IBC) and standard industry accepted design standards.

Spread Footing and Mat/Slab Foundations:

As part of construction, some equipment may be supported on mat/slab foundations, which other structures and O&M building may be supported on shallow foundations. According to the Preliminary Geotechnical Report, loose to medium dense sands were encountered near the surface and may require improvement prior to foundation construction. Based on the anticipated types of structures and the expected magnitude of loading, surface compaction using a moderate to heavy vibratory roller will provide adequate improvement for shallow foundation support of these structures.

The base of all foundation excavations will be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care will be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations will be removed/reconditioned before foundation concrete is placed.

Slabs will be underlain by at least a 12-inch thickness of Non-Frost Susceptible (NFS) material or structural fill placed on either the native material or compacted fill placed for site grading, the surface of which should be proof-rolled. Crushed Stone wrapped in a geotextile separation fabric may be used in place of structural fill. Slab foundations will move due to freeze-thaw effects. NFS material will be placed at least 3 feet deep to significantly reduce the effects of freeze-thaw related movements. Alternately, the slab may be designed to allow movement due to frost action.

All grading within the equipment pads will incorporate the limits if the proposed structures plus a minimum lateral extent of 5 feet. Terracon recommends that concrete slabs have thickened edges, with a minimum embedment depth to bottom of edge of 18 inches below finished grade. The thickened edge may help in both confining the aggregate placed beneath the slab and minimizing the potential for erosion and foundation damage from storm runoff.

2) Pile Foundations and Potential Impacts

Tracker Foundations:

As is typical with solar farm construction, solar panels will be supported by steel W-section or H-section piles driven to a depth of approximately 6 to 12 feet below grade depending on final design. Terracon concluded that the site appears suitable for the use of driven steel W or H section steel piles for the support for the proposed solar arrays. Typical construction procedures will be implemented for the installation of piles and foundation elements associated with the solar farm construction. Installation of piles is typically completed using a pile driver (Vameer PD10 or similar). The Applicant does not anticipate any drilling, setting, or backfilling posts. The number of piled foundations is estimated to be up to approximately 235,000. It is anticipated that the piles can be installed in less than 125 days utilizing 10 pile installation crews.

Based on the relatively small pile cross-section, as discussed in Exhibit 5- Design Drawings of this Application, and the anticipated installation methods, ground-borne vibrations are expected to be minimal within the immediate work area and are not anticipated to create any risk with respect to surrounding properties and structures.

Equipment Foundations:

Equipment associated with the Project would be supported on spread footings, sonotubes, driven piles, or a combination thereof. Although installation depths of shallow foundations will be limited to within 5 feet of grade, and up to 12 feet for driven piles, actual foundations sizes and embedment depths would be apportioned based on recommended capacities provided in the Geotechnical Investigation Report.

Inverters would likely arrive on site 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.

3) Mitigation Measures for Potential Impacts from Pile Foundations

The Project will involve solar tracker pile installation using vibrating pile drivers with no off-site vibration effects anticipated. The expected pile driver type is the Vermeer PD10 vibratory hammer, or similar, and would exert a maximum centrifugal force of up to 145 kips while driving the pile to depth of 8 to 12 feet. The pile driver that may be required for the inverter skids and substation equipment would have similar specifications. As discussed in Exhibit 5 and Exhibit 7: *Noise and Vibration* of this Application, pile driving activities are not anticipated to impact surrounding properties or structures, from noise or vibration. Accordingly, there are no potential impacts for which mitigation is required.

Settlement and strength parameters were analyzed using soil compressibility properties derived from the SPT borings. Terracon encountered variable subsurface conditions during the borings, resulting in the Project Footprint being split into two zones, Zone 1 and Zone 2 (see Terracon 2020, Exhibit A-003). Zone 1 has medium dense to dense soil conditions, and based on the results, Terracon would not expect pre-drilling to be necessary. Zone 2 has more dense soil conditions with cobble/rock fragments, and pre-drilling would likely be required for piles to reach target depths. This characterization was based on borings and test pits completed at discrete locations and significant spacing; therefore, the limits of Zone 1 and Zone 2 as shown in the report are approximate. Terracon recommends that a supplemental pile driving and testing program be developed to confirm where pre-drilling may be necessary. In areas of driven pile refusal prior to reaching desired pile depth, it may be appropriate to pre-drill at those locations.

4) Vulnerability to Earthquake and Tsunami Events

There are no anticipated impacts of seismic activity or tsunami events on the Project. The Project is located in an area of relatively low seismic activity. Although the Clarendon-Linden Fault System bisects Genesee County, seismic events associated with the fault have not been documented since 1995. Three known earthquakes have impacted Genesee County since 1950, but they were of low intensity and no damages were reported. USGS Seismic Hazard Maps also depict relatively low activity; the 2% probability of exceedance in 50 years of Peak Ground Acceleration for this area is 10-14% of standard gravity.

Seismic design requirements for buildings and other structure are based on Seismic Design Category, from the IBC. Site Classification is required to determine the Seismic Design Category for a structure. Based on soil properties encountered during the geotechnical investigation, it is the professional opinion of Terracon that Seismic Site Classification of ‘D’ can be used for the site. Sites with a classification of ‘D’ are expected to experience severe and destructive ground shaking, but are not located close to a major fault, such as areas with poor soils (ISAT 2014). Subsurface explorations at the site were extended to a maximum of 48.5 feet; however, additional deeper borings or geophysical testing may be completed to confirm the conditions below the current boring depth.

In addition, because the nearest large body of water, Lake Ontario, is located approximately 17 miles away from the Project Footprint, there is no vulnerability associated with tsunami events.

References

Bryce, S.A., G.E. Griffith, J.M. Omernik, G. Edinger, S. Indrick, O. Vargas, and D. Carlson. 2010. Ecoregions of New York (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey, map scale 1:1,250,000.

Genesee County Soil and Water Conservation District. 2020. Unique Geologic Features of Genesee County. Pages 61-69. Clarendon-Linden Fault System. Available at: https://www.co.genesee.ny.us/departments/soilandwater/features7.php. Accessed October 16, 2020.

International Seismic Application Technologies (ISAT). 2014. Seismic Design Category Reference Information (ASCE 7-05). Available at: http://www.isatsb.com/Seismic-Design-Category.php. Accessed January 5, 2021.

Jacobi, R.D., and G.J. Smith. 1999, Structure and Upper Devonian stratigraphy in the Appalachian Plateau of Allegany County, New York State, including the Clarendon-Linden Fault System, NYSGA71st Annual Meeting Field Trip Guidebook, SUNY at Fredonia, p. Sat C1- Sat C44.

Kappel, William M., James E. Reddy, and Jonathan C. Root (Kappel et al. 2020). Statewide Assessment of Karst Aquifers in New York With an Inventory of Closed-Depression and Focused-Recharge Features. Prepared in cooperation with the New York State Department of Environmental Conservation. Available at: https://pubs.usgs.gov/sir/2020/5030/sir20205030.pdf. Accessed March 4, 2021.

Natural Resources Conservation Service (NRCS). 2019. Web Soil Survey. Available at https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm. Accessed January 2021.

New York State Department of Agriculture and Markets (NYS DAM). 2019. Guidelines for Solar Energy Project – Construction Mitigation for Agricultural Lands. Revised 10/18/2019.

New York State Department of Environmental Conservation (NYSDEC). 2014. Water Well Information. Available at: https://www.dec.ny.gov/cfmx/extapps/WaterWell/index.cfm. Accessed November 19, 2020.

New York Office of Information Technology Services (NYOITS). 2019. LIDAR collection (QL2) for Erie, Genesee, and Livingston Counties New York Lidar; Hydro Flattened Bare Earth DEM. Available at: https://gis.ny.gov/elevation/NYS-High-Res-DEM.htm. Accessed April 1, 2021.

New York State Museum (NYSM). 1970. Surficial Geology Shape Files and Bedrock Geology Shape Files. Available at: http://www.nysm.nysed.gov/research-collections/geology/gis. Accessed October 16, 2020.

Petersen, M.D., M.P. Moschetti, P.M. Powers, C.S. Mueller, K.M. Haller, A.D. Frankel, Yuehua Zeng, Sanaz Rezaeian, S.C. Harmsen, O.S. Boyd, Ned Field, Rui Chen, K.S. Rukstales, Nico Luco, R.L. Wheeler, R.A. Williams, and A.H. Olsen. 2014, Documentation for the 2014 update of the

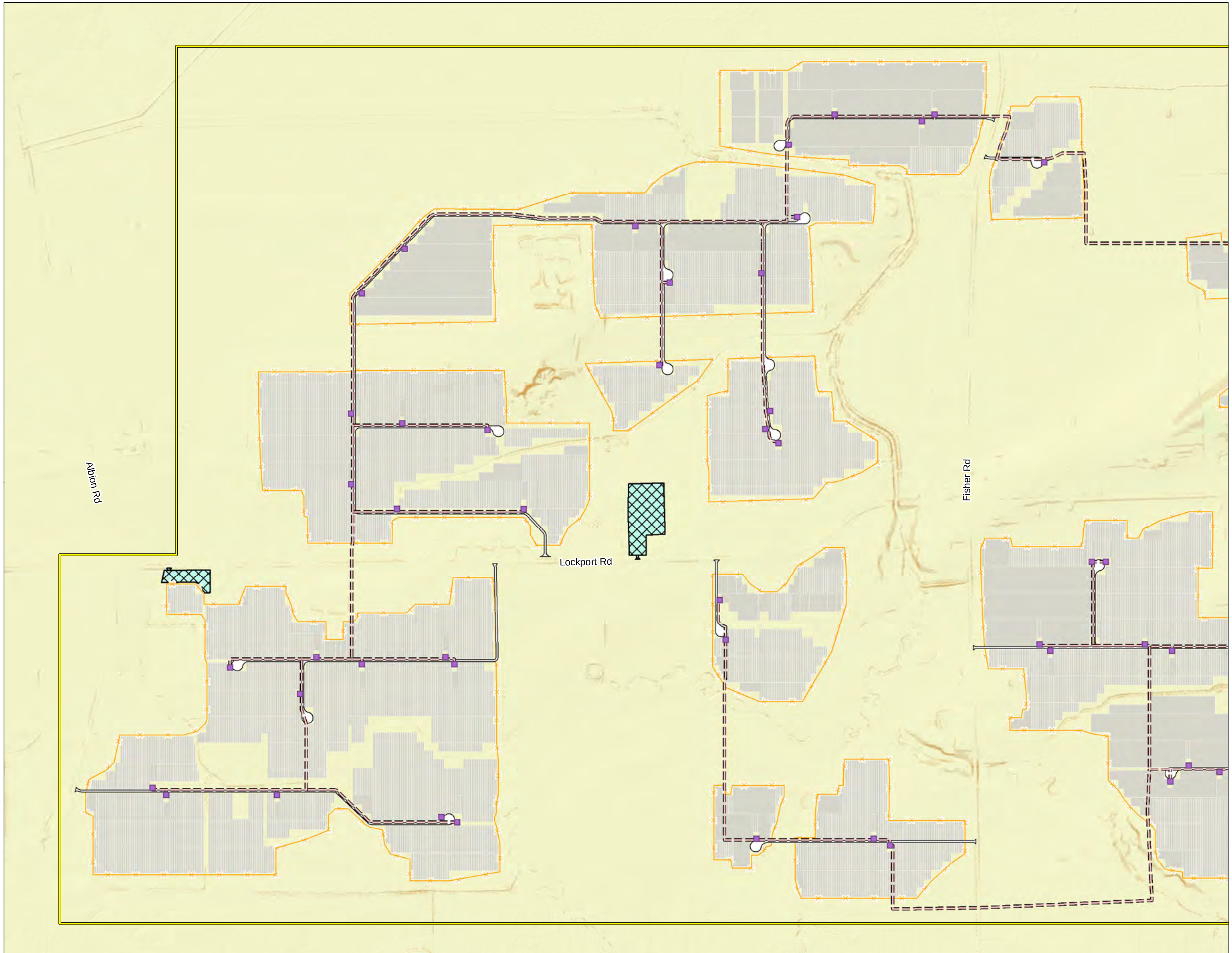
United States national seismic hazard maps: U.S. Geological Survey Open-File Report 2014–1091, 243 p. Available at: https://dx.doi.org/10.3133/ofr20141091. Accessed April 1, 2021.

Terracon Consultants-NY, Inc. (Terracon). 2020. Preliminary Geotechnical Engineering Report, Cider Solar Site, Genesee County, New York. Prepared December 24, 2020, for Stantec.

Tetra Tech. 2019. Genesee County Hazard Mitigation Plan. Available at: https://www.co.genesee.ny.us/departments/ems/genesee_county_hazard_mitigation_plan/index.php. Accessed October 16, 2020.

Rickard, L.V., Y.W. Isachsen, and D.W. Fisher. 1971. Geologic Map of New York. Published by New York State Museum and Science Service. Available at: https://ngmdb.usgs.gov/Prodesc/proddesc_98670.htm. Accessed November 3, 2020.

FIGURES



Stantec

Legend

Project Area

Proposed Project

Substation and Switchyard

Inverter

PV Panel Array

Collection Line

Fence Line

Access Road

Laydown Area

Existing Features

Municipal Boundary

Percent Slope

0-3%

3-8%

8-15%

15-25%

25-35%

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Notes

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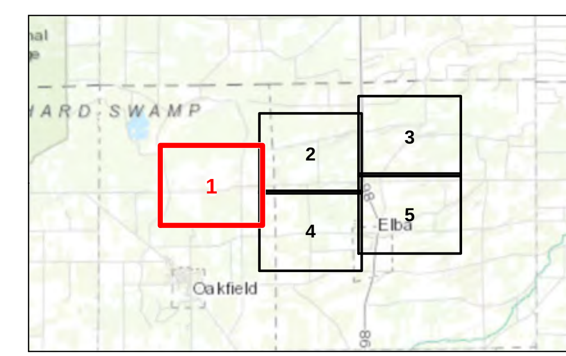
3. Background: NYSGPO 1-meter DEM
4. Percent Slope Calculated from NYSGPO 1-meter DEM.



Project Location
Town of Oakfield
Genesee County, NY

Prepared by AS on 2021-04-26
TR by EE on 2021-04-27
IR by AS on 2021-04-27

Client/Project
190502038 REVB

Hecate Energy Cider Solar LLC
Cider Solar Farm

Figure No.
10-1

Title
Slopes within the Project Area
Map 1 of 5

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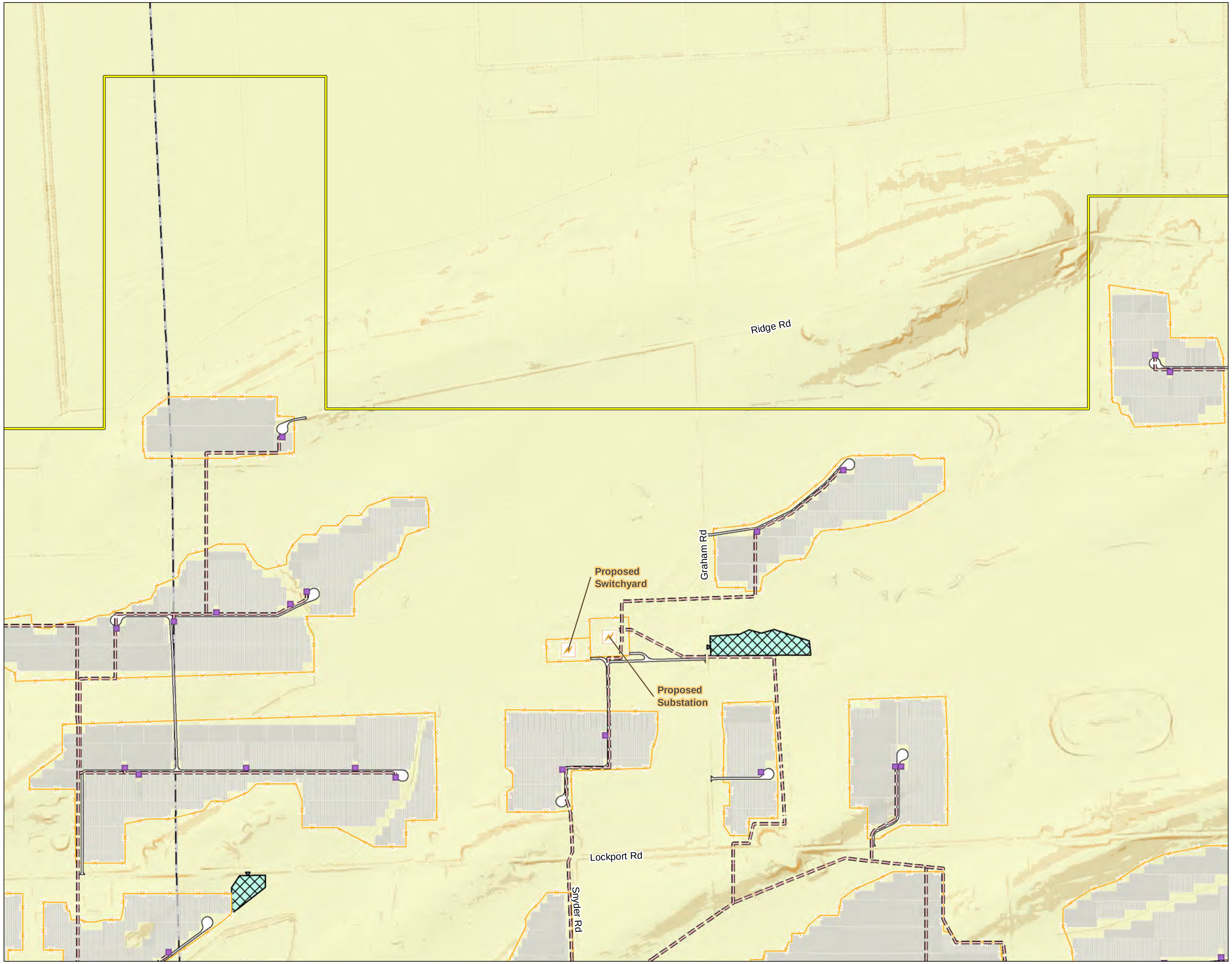

Stantec

Legend

Project Area

Proposed Project

Substation and Switchyard

Inverter

PV Panel Array

Collection Line

Fence Line

Access Road

Laydown Area

Existing Features

Municipal Boundary

Percent Slope

0-3%

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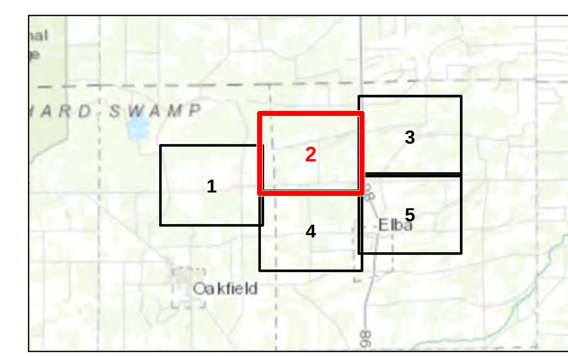
4. Percent Slope Calculated from NYSGPO 1-meter DEM.



Project Location
Towns of Oakfield & Elba
Genesee County, NY

Prepared by AS on 2021-04-26
TR by EE on 2021-04-27
IR by AS on 2021-04-27

Client/Project
190502038 REVB

Hecate Energy Cider Solar LLC
Cider Solar Farm

Figure No.

10-1

Title

Slopes within the Project Area
Map 2 of 5

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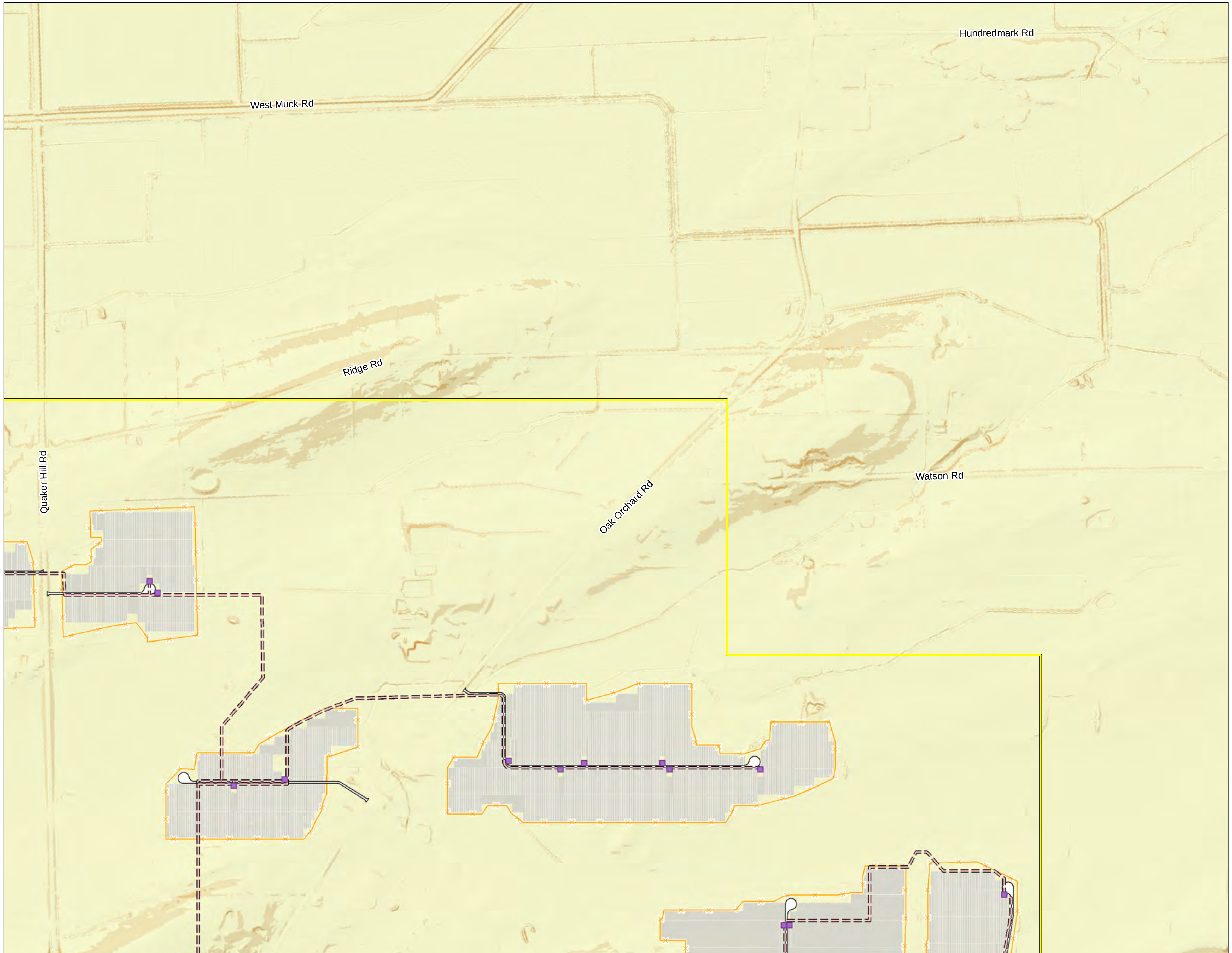

Stantec

Legend

Project Area

Proposed Project

Substation and Switchyard

Inverter

PV Panel Array

Collection Line

Fence Line

Access Road

Laydown Area

Existing Features

Municipal Boundary

Percent Slope

0-3%

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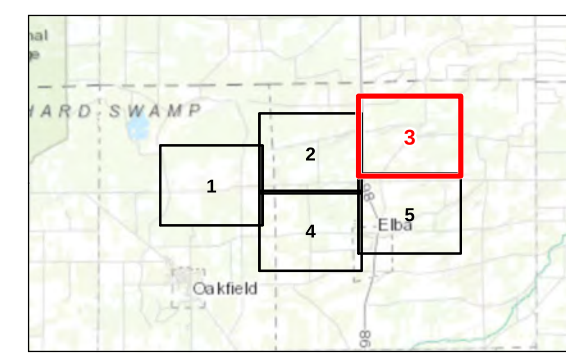
3. Background: NYSGPO 1-meter DEM

4. Percent Slope Calculated from NYSGPO 1-meter DEM.



Project Location
Town of Elba
Genesee County, NY

Prepared by AS on 2021-04-26
TR by EE on 2021-04-27
IR by AS on 2021-04-27

Client/Project 190502038 REVB

Hecate Energy Cider Solar LLC
Cider Solar Farm

Figure No.

10-1

Title

Slopes within the Project Area
Map 3 of 5

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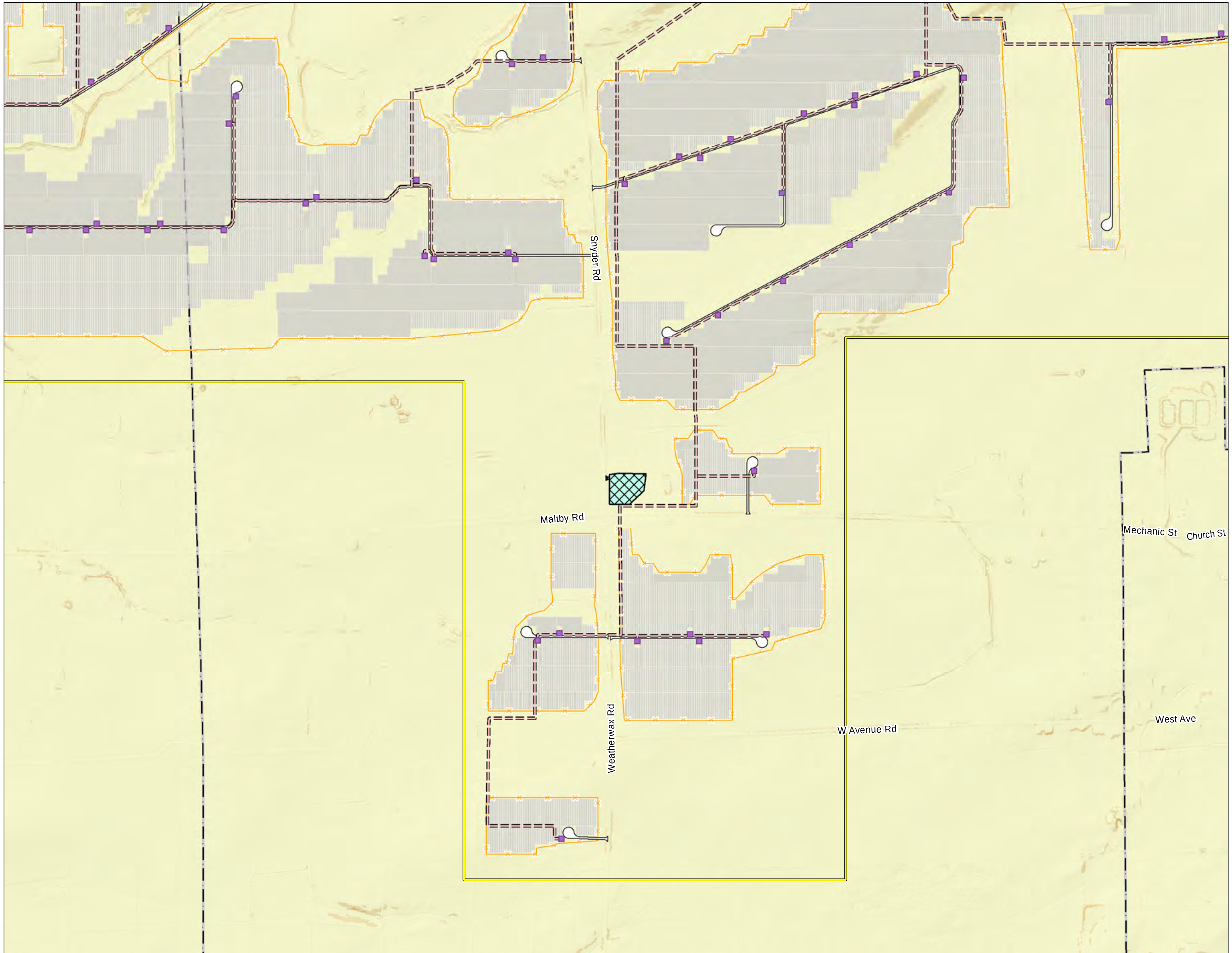

Stantec

Legend

Project Area

Proposed Project

Substation and Switchyard

Inverter

PV Panel Array

Collection Line

Fence Line

Access Road

Laydown Area

Existing Features

Municipal Boundary

Percent Slope

0-3%

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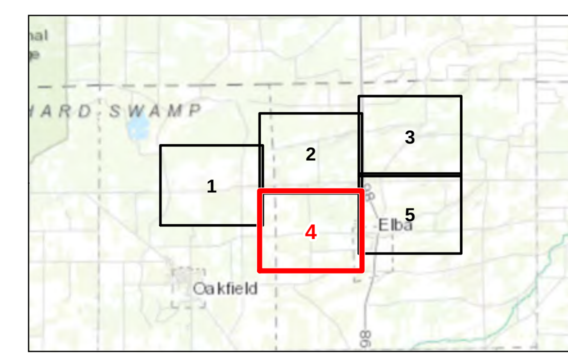

Project Location
Towns of Oakfield & Elba
Genesee County, NY

Prepared by AS on 2021-04-26
TR by EE on 2021-04-27
IR by AS on 2021-04-27

Client/Project
190502038 REVB

Hecate Energy Cider Solar LLC
Cider Solar Farm

Figure No.
10-1

Title
Slopes within the Project Area
Map 4 of 5

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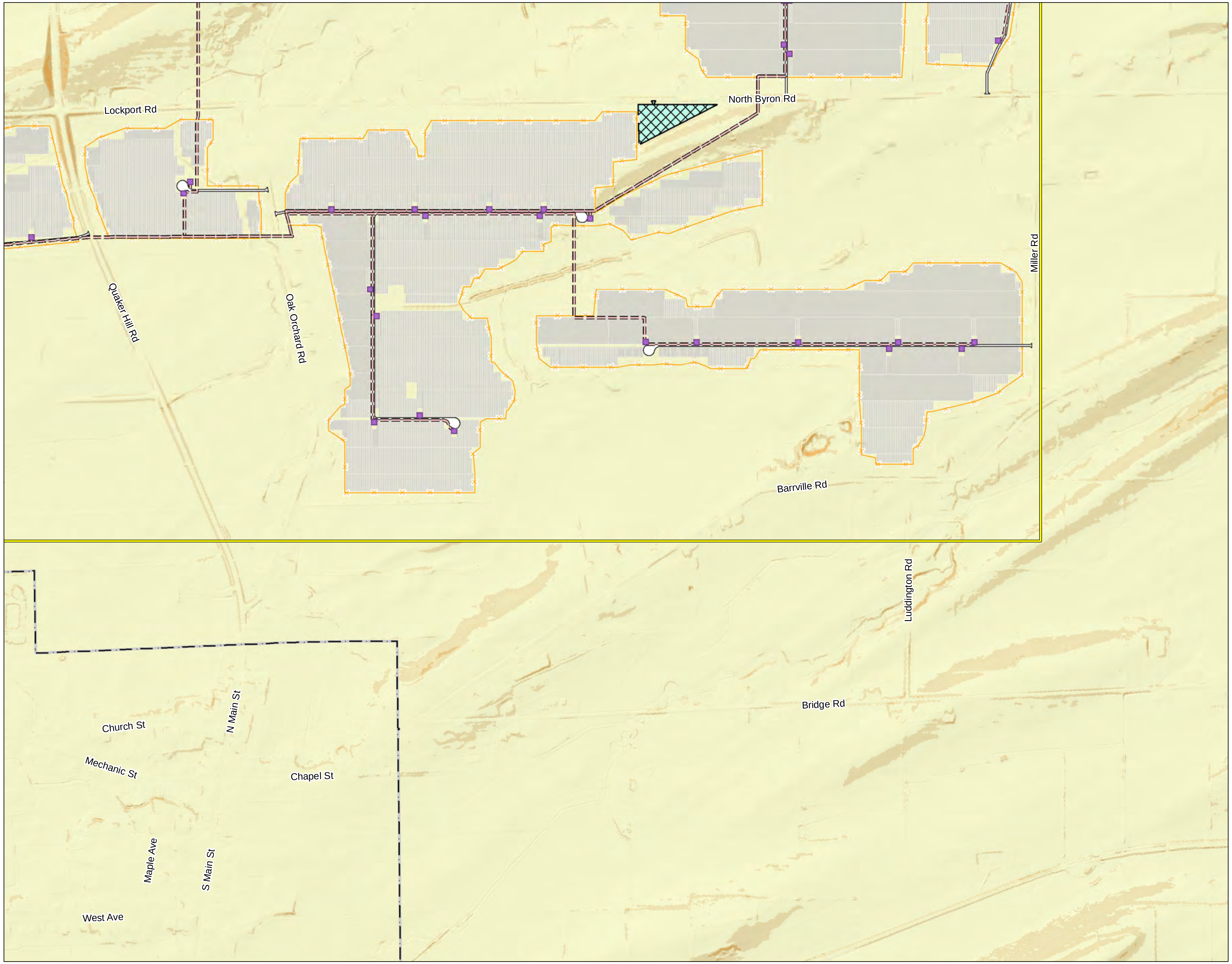

Stantec

Legend

- Project Area

Proposed Project

- Substation and Switchyard
- Inverter
- PV Panel Array
- Collection Line
- Fence Line
- Access Road
- Laydown Area

Existing Features

- Municipal Boundary

Percent Slope

- 0-3%
- 3-8%
- 8-15%
- 15-25%
- 25-35%
- >35%

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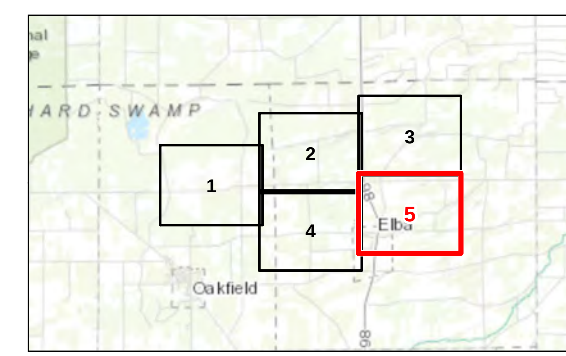
Notes

1. Coordinate System: NAD 1983 StatePlane New York West FIPS 3103 Feet
2. Data Sources: NYS GIS Clearinghouse (https://gis.ny.gov), USDA NRCS, (http://www.ncgc.nrcs.usda.gov/), NYS ITS GIS Program Office (NYSGPO) Bare-Earth Digital Elevation Models (DEM) Web Services
3. Background: NYSGPO 1-meter DEM
4. Percent Slope Calculated from NYSGPO 1-meter DEM.



Project Location
Town of Elba
Genesee County, NY

Prepared by AS on 2021-04-26
TR by EE on 2021-04-27
IR by AS on 2021-04-27

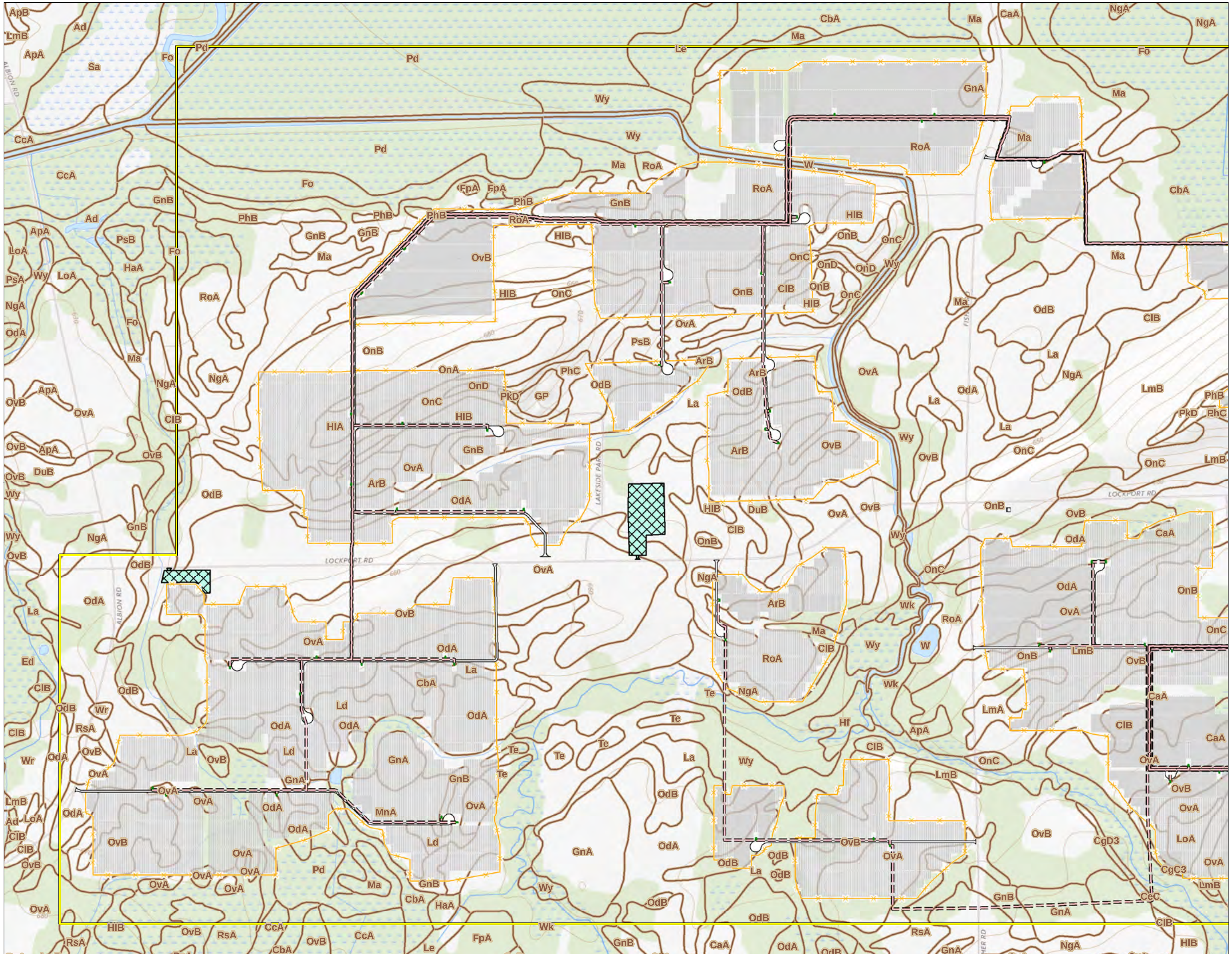
Client/Project
190502038 REVB

Hecate Energy Cider Solar LLC
Cider Solar Farm

Figure No.
10-1

Title
Slopes within the Project Area
Map 5 of 5

U:\190502038\03_data\gis\mxd\Application\Exhibit10\Fig_10-1_Slopes_Within_Project_Area_CSF.mxd Revised: 2021-05-21 By: astapleton



Stantec

Legend

Project Area

Proposed Project

Substation and Switchyard

Inverter

PV Panel Array

Collection Line

Fence Line

Access Road

Laydown Area

Existing Features

Soil Boundary

Municipal Boundary

* Bedrock material not shown on mapping due to the Project Area is composed of 100% Camillus Shale

N

0 1,000 2,000 Feet

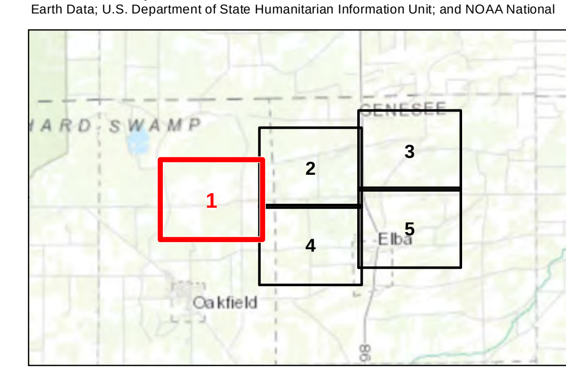
(At original document size of 11x17)
1:12,000

Notes

1. Coordinate System: NAD 1983 StatePlane New York West FIPS 3103 Feet

2. Data Sources: NYS GIS Clearinghouse (https://gis.ny.gov), USDA NRCS (http://www.ncgc.nrcs.usda.gov/)

3. Background: USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Global Ecosystems; U.S. Census Bureau TIGER/Line data; USFS Road Data; Natural Earth Data; U.S. Department of State Humanitarian Information Unit; and NOAA National



Project Location
Town of Oakfield
Genesee County, NY

Prepared by AS on 2021-04-26
TR by EE on 2021-04-27
IR by AS on 2021-04-27

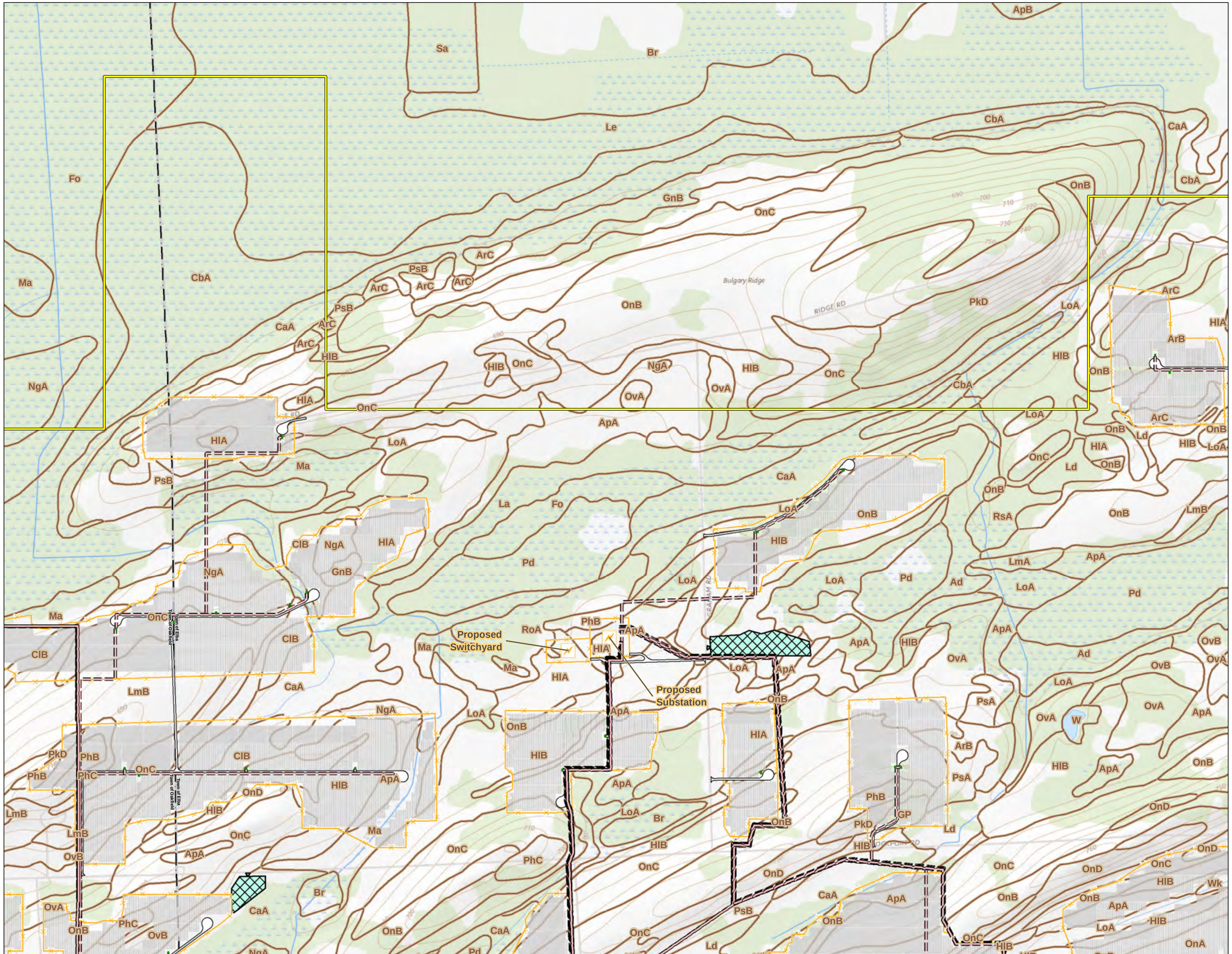
Client/Project 190502038 REVB

Hecate Energy Cider Solar LLC
Cider Solar Farm

Figure No.
10-2

Title
Soil Types within the Project Area
Map 1 of 5

U:\190502038\03_data\gis\mxd\ApplicationExhibit10\Fig_10-2_Soil_Types_Within_Project_Area_CSF.mxd Revised: 2021-04-28 By: astapleton



Legend

Project Area

Proposed Project

Substation and Switchyard

Inverter

PV Panel Array

Collection Line

Fence Line

Access Road

Laydown Area

Existing Features

Soil Boundary

Municipal Boundary

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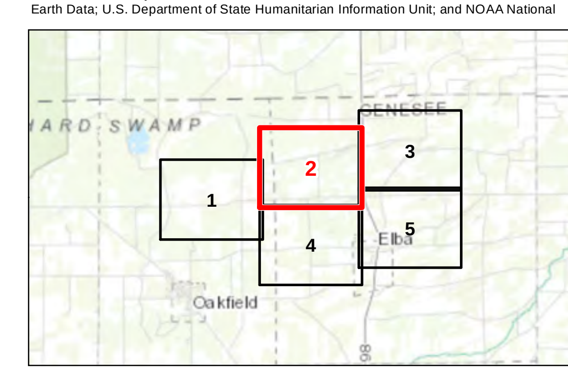

Project Location
Towns of Oakfield & Elba
Genesee County, NY

Prepared by AS on 2021-04-26
TR by EE on 2021-04-27
IR by AS on 2021-04-27

Client/Project

190502038 REVB

Hecate Energy Cider Solar LLC
Cider Solar Farm

Figure No.

10-2

Title

Soil Types within the Project Area
Map 2 of 5

U:\190502038\03_data\gis\mxd\ApplicationExhibit10\Fig_10-2_Soil_Types_Within_Project_Area_CSF.mxd Revised: 2021-04-28 By: astapleton

Stantec

Legend

Project Area

Proposed Project

- Substation and Switchyard
- Inverter
- PV Panel Array
- Collection Line
- Fence Line
- Access Road
- Laydown Area

Existing Features

- Soil Boundary
- Municipal Boundary

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N

0 1,000 2,000 Feet

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1:12,000

Notes

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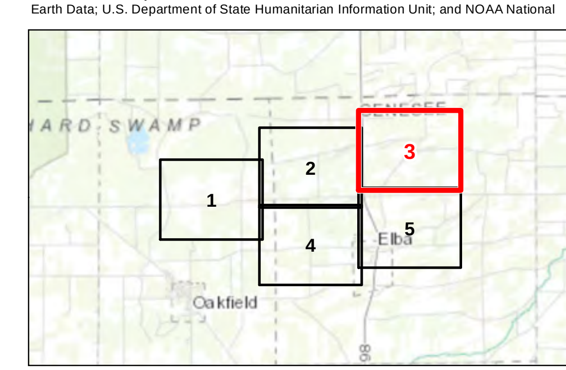


Project Location
Town of Elba
Genesee County, NY

Prepared by AS on 2021-04-26
TR by EE on 2021-04-27
IR by AS on 2021-04-27

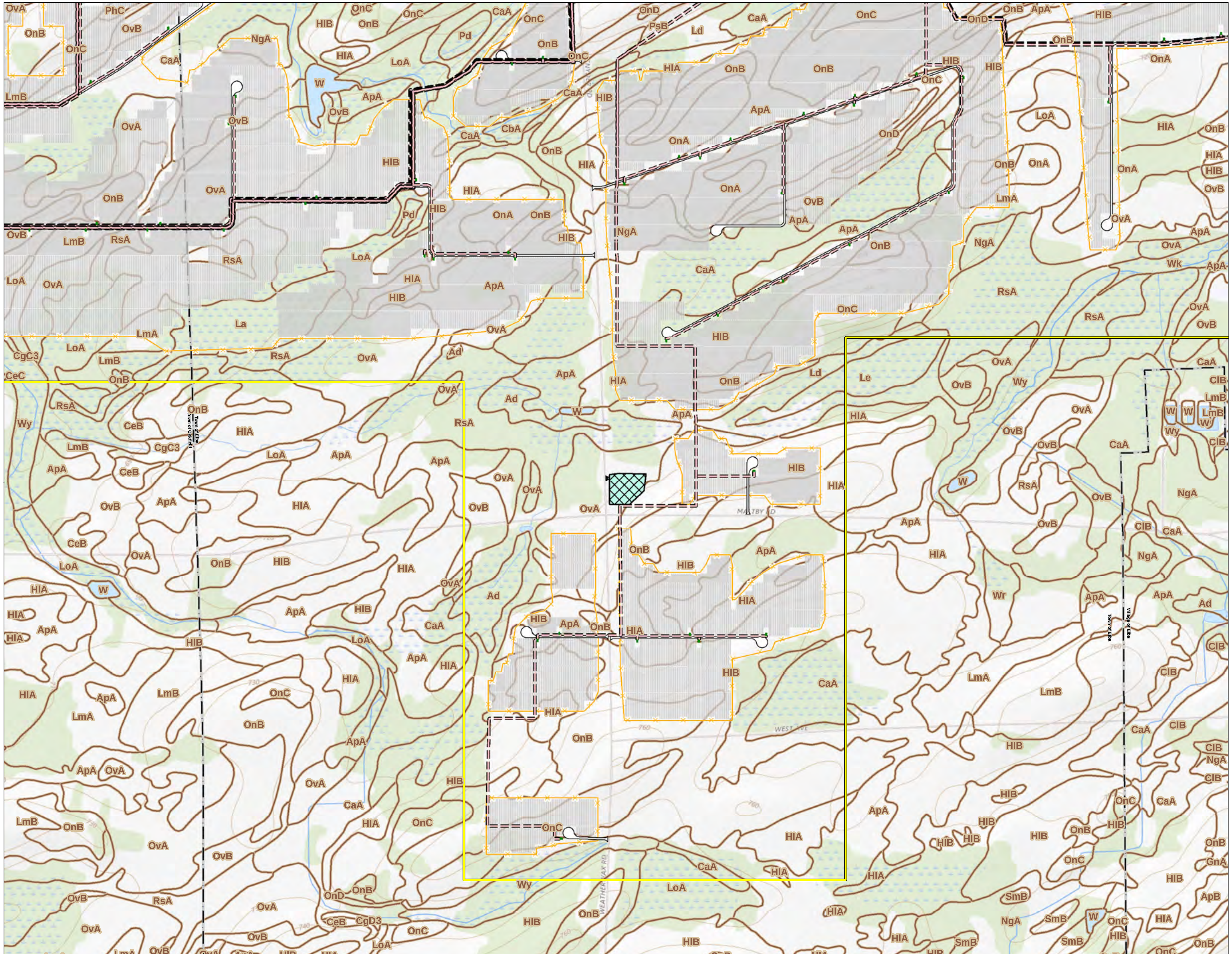
Client/Project
190502038 REVB

Hecate Energy Cider Solar LLC
Cider Solar Farm

Figure No.
10-2

Title
Soil Types within the Project Area
Map 3 of 5

U:\190502038\03_data\gis\mxd\ApplicationExhibit10\Fig_10-2_Soil_Types_Within_Project_Area_CSF.mxd Revised: 2021-04-28 By: astapleton



Stantec

Legend

- Project Area

Proposed Project

- Substation and Switchyard
- Inverter
- PV Panel Array
- Collection Line
- Fence Line
- Access Road
- Laydown Area

Existing Features

- Soil Boundary
- Municipal Boundary

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N

0 1,000 2,000 Feet

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Notes
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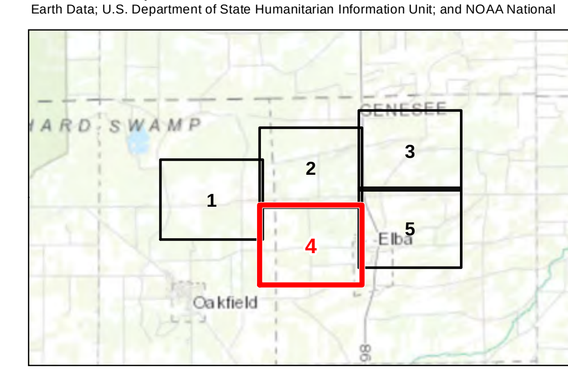


Project Location
Towns of Oakfield & Elba
Genesee County, NY

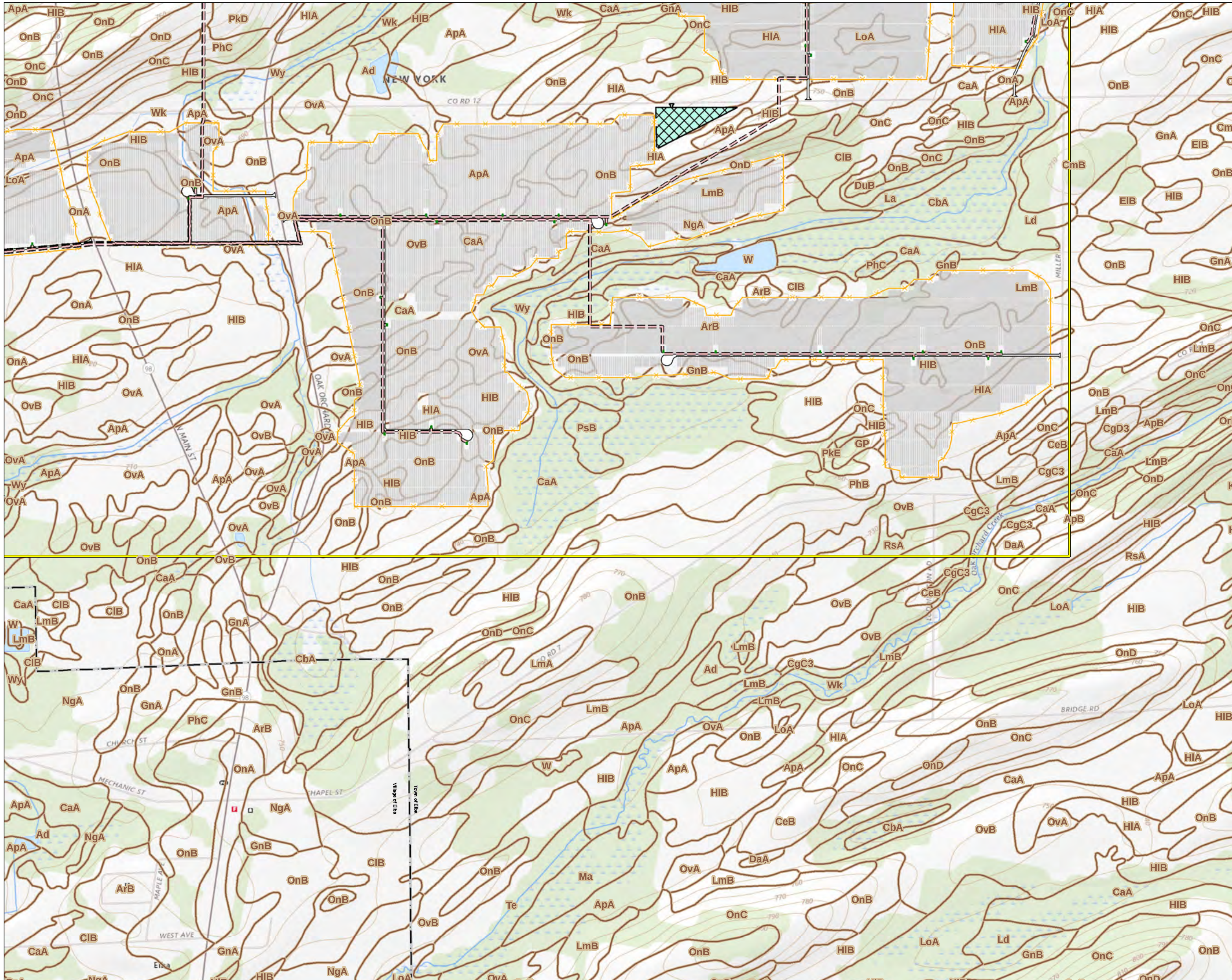
Prepared by AS on 2021-04-26
TR by EE on 2021-04-27
IR by AS on 2021-04-27

Client/Project 190502038 REVB

Hecate Energy Cider Solar LLC
Cider Solar Farm

Figure No.
10-2

Title
Soil Types within the Project Area
Map 4 of 5



Stantec

Legend

Project Area

Proposed Project

Substation and Switchyard

Inverter

PV Panel Array

Collection Line

Fence Line

Access Road

Laydown Area

Existing Features

Soil Boundary

Municipal Boundary

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Notes

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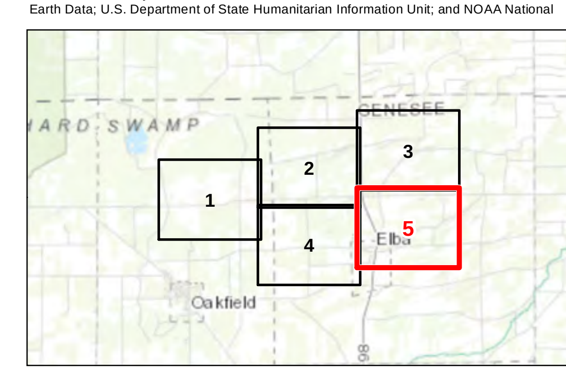


Project Location
Town of Elba
Genesee County, NY

Prepared by AS on 2021-04-26
TR by EE on 2021-04-27
IR by AS on 2021-04-27

Client/Project
190502038 REVB

Hecate Energy Cider Solar LLC
Cider Solar Farm

Figure No.
10-2

Title
Soil Types within the Project Area
Map 5 of 5

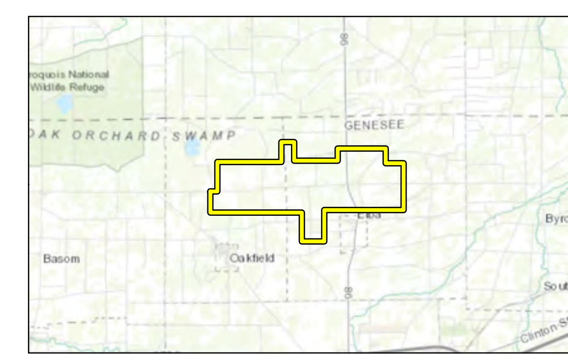
U:\190502038\03_data\gis\mxd\ApplicationExhibit10\Fig_10-2_Soil_Types_Within_Project_Area_CSF.mxd Revised: 2021-04-28 By: astapleton

Soil Types within the Project Site

Symbol	Soil Name	Symbol	Soil Name
Ad	Alden mucky silt loam	LmA	Lima silt loam, 0 to 3 percent slopes
ApA	Appleton silt loam, 0 to 3 percent slopes	LmB	Lima silt loam, 3 to 8 percent slopes
ApB	Appleton silt loam, 3 to 8 percent slopes	LoA	Lyons soils, 0 to 3 percent slopes
ArB	Arkport very fine sandy loam, 1 to 6 percent slopes	Ma	Madalin silty clay loam, 0 to 3 percent slopes
ArC	Arkport very fine sandy loam, 6 to 12 percent slopes	MnA	Minoa very fine sandy loam, 0 to 2 percent slopes
Br	Bergen muck	NgA	Niagara silt loam, 0 to 2 percent slopes
CaA	Canandaigua silt loam, 0 to 2 percent slopes	OdA	Odessa silt loam, 0 to 3 percent slopes
CbA	Canandiagua mucky silt loam, 0 to 2 percent slopes	OdB	Odessa silt loam, 3 to 8 percent slopes
CcA	Carlisle muck	OnA	Ontario loam, 0 to 3 percent slopes
CeB	Cazenovia silt loam, 3 to 8 percent slopes	OnB	Ontario loam, 3 to 8 percent slopes
CeC	Cazenovia silt loam, 8 to 15 percent slopes	OnC	Ontario loam, 8 to 15 percent slopes
CgC3	Cazenovia silty clay loam, 8 to 15 percent slopes, eroded	OnD	Ontario loam, 15 to 25 percent slopes
CgD3	Cazenovia silty clay loam, 15 to 25 percent slopes, eroded	OvA	Ovid silt loam, 0 to 3 percent slopes
ClB	Collamer silt loam, 2 to 6 percent slopes	OvB	Ovid silt loam, 3 to 8 percent slopes
CmB	Colonie loamy fine sand, 2 to 6 percent slopes	Pd	Palms muck
DaA	Darien silt loam, 0 to 3 percent slopes	PhB	Palmyra gravelly loam, 3 to 8 percent slopes
DuB	Dunkirk silt loam, 2 to 6 percent slopes	PhC	Palmyra gravelly loam, 8 to 15 percent slopes
Ed	Edwards muck	PkD	Palmyra and Arkport soils, 15 to 25 percent slopes
Fo	Fonda mucky silt loam	PkE	Palmyra and Arkport soils, 25 to 40 percent slopes
FpA	Fredon gravelly loam, 0 to 3 percent slopes	PsA	Phelps gravelly loam, 0 to 3 percent slopes
GnA	Galen very fine sandy loam, 0 to 2 percent slopes	PsB	Phelps gravelly loam, 3 to 8 percent slopes
GnB	Galen very fine sandy loam, 2 to 6 percent slopes	RoA	Rhinebeck silt loam, 0 to 3 percent slopes
GP	Gravel pits	RsA	Romulus silt loam, 0 to 3 percent slopes
HaA	Halsey silt loam, 0 to 4 percent slopes	Sa	Saprists and Aquents, ponded
Hf	Hamlin silt loam	Te	Teel silt loam
HlA	Hilton loam, 0 to 3 percent slopes	W	Water
HlB	Hilton loam, 3 to 8 percent slopes	Wk	Wakeville silt loam
La	Lakemont silty clay loam, 0 to 3 percent slopes	Wr	Warners mucky loam
Ld	Lamson very fine sandy loam	Wy	Wayland soils complex, 0 to 3 percent slopes, frequently flooded
Le	Lamson mucky very fine sandy loam		

Stantec

Notes
1. 1. Data Sources: USDA NRCS Gridded Soil Survey Geographic (gSSURGO) Database for NYS, 2020



Project Location
Towns of Elba and Oakfield
Genesee County, NY

Prepared by AS on 2021-04-26
TR by EE on 2021-04-27
IR by AS on 2021-04-27

Client/Project 190502038 REVB
Hecate Energy Cider Solar LLC
Cider Solar Farm

Figure No.
10-2

Title
NRCS Soils Key
Page 1 of 1

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