Visual Impact Assessment

February 2022

BR Benson Mines 20 MW Solar Project

Town of Clifton
St. Lawrence County, NY

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1.0 INTRODUCTION

On behalf of the New York State Energy Research and Development Authority (NYSERDA), TRC Companies, Inc. (TRC) has prepared a Visual Impact Assessment (VIA) for the proposed BR Benson Mines Solar Project (the Project). The 20-megawatt (MW) Project is located on approximately 179 acres (the Project Site), adjacent to New York State Route 3, near its intersection with the Benson Mines-Newton Falls Road (County Route 50) in the Town of Clifton, St. Lawrence County, New York. This assessment was completed to identify and address potential visual impacts within a five-mile radius around the Project Site (the "Study Area") per the Adirondack Park Agency (APA) *Application of Solar Generation Facility* (May 11, 2021).

2.0 PROJECT DESCRIPTION

NYSERDA is proposing a 20 MW ground mounted photovoltaic solar project that will comprise of commercial-scale solar arrays (or panels), and associated components such as an access road, inverters, electric collection lines, and electrical grid interconnection infrastructure.

The Project will consist of a series of bifacial photovoltaic modules (solar panels) mounted on steel piles. These piles are direct driven into the ground with the panel mounted on a torque tube which will rotate to follow the sun (referred to as a single-tracker system) in an east to west direction. The maximum height of 10 feet, at full tilt, will only be sustained for a relatively short period of time during daylight hours as it will make continuous angle adjustments to follow the sun. For example, it may lay flat near mid-day when the sun is directly overhead resulting in a panel height considerably lower than its maximum height for a substantial amount of time during the day.

Since the panels are ground mounted, they will generally follow the existing topography. However, minor grading will occur to remove undulations of the land, due to past mining operations, within the fence line (panel area) and along the proposed access drive. The panels will be surrounded by a seven-foot-high chain-link fence that will be made of galvanized steel (posts and fabric).

The site access road will be 20 feet wide, following an existing dirt road that extends southwest from New York State (NYS) Route 3. The new road will comprise of an aggregate surface material. Electrical equipment consisting of a transformer, inverters and controls will be pad mounted within the center of sections of the panel arrays.

It is anticipated that a 34.5 kilovolt (kV) electrical line will be undergrounded along a new 30-foot right-of-way (ROW), where it will cross NYS Route 3. After crossing Route 3, it is anticipated that the electrical line will become above ground and connect with the first utility pole 133.5 feet north of the corridor. Based on a typical interconnection design, six to eight poles are anticipated to be erected.

Upon completion, the Project will deliver renewable power to the existing electrical grid via an anticipated interconnection at the 34.5 kV lines north to the Star Lake Substation.

3.0 LANDSCAPE/CHARACTER SETTING

The Project Site is comprised of four parcels that consist of the tailings pile, vacant wooded land, and wetlands. The north and northeastern portion of the Site is bordered by the solid waste Star Lake Transfer Station, NYS Route 3, and the former J&L Steel iron and steel ore processing facility; this area also contains an abandoned single-story cinderblock shed, a one-story wooden shed used as a boat cleaning station, and the Star Lake Substation which is owned and operated by National Grid. To the east, the Project Site is bordered by NYS Route 3, the Saint Hubert's Cemetery, and the Little River. To the south, vacant land, a pond, and wooded land is visible.

The area of the proposed panels is a former tailings pile from an iron ore mine that closed in the 1970's; consisting primarily of sand pits and piles of mine tailings with bisecting earthen roads. In addition, there is scattered vegetation on the Project Site which can be characterized as undeveloped stands of forest. The topography is generally hilly, with sandy hills in the north-central area (highest points of the Site) and deep depressions towards the north side of the parcel. Towards the southern boundary the land is generally flat.

Character of the Study Area

Characteristics of the existing landscape may be broken down into basic features including landform, vegetation, water, and land use and development. Understanding the characteristics of the landscape is imperative to recognize how a proposed development may affect or change it.

The Study Area extends five miles around the proposed Project and traverses land within the Town of Clifton, which has a population of only 791[1]. Local land uses within the Study Area include a mix of industrial, utility, residential, transportation, and open space uses. Also, apart from the built areas (active or non), the Study Area includes a significant amount of forested land.

The most prominent roadway in the Study Area is NYS Route 3. This two-lane transportation corridor runs in an east-west direction spanning 246 miles connecting the community of Stirling with the City of Plattsburgh. Along its route it passes through the Cities of Fulton and Watertown, and the Villages of Tupper Lake and Saranac Lake. Specifically, NYS Route 3 runs adjacent to the Project Site, where it has an annual average daily traffic (AADT) volume of between 1,274 (east of County Route 60) and 1,891 (west of County Route 60) vehicles, approximately 14% of which are trucks[2].

[1] https://stlawco.org/CountyFriends/CFTowns

[2] https://www.dot.ny.gov/tdv. AADT data is based on 2019 estimates.

The intersection of NYS Route 3 and County Route 60 has an industrial appearance as there is an existing substation, an increased amount of asphalt associated with roads, driveways and former land-uses, security fencing, dilapidated buildings from previous mining and steel operations, and a boat wash facility.

Overall, there is a limited amount of residential development found within the Study Area. Most residential dwellings can be found in, or adjacent to, the hamlets of Newton Falls, Star Lake, and Wanakena. The dwellings are generally single family one to two-story structures that may be for seasonal or year-round use. The State University of New York College of Environmental Science and Forestry Ranger School is also located in Wanakena. The 2,800-acre campus contains multiple buildings of varying sizes that provide students with classroom, residential dorms, and support buildings.

Physiographic Characteristics of the Study area

The Study Area lies in the Adirondack Mountain physiological zone, characterized by deciduous and evergreen species such as beech, maple, birch, red spruce, and balsam fir. Mature vegetation is found in large stands throughout the Study Area. The Study Area contains little flat land as the visible rolling to steep terrain reaches a high elevation of 2,070 feet and a low of 1,080 feet; located at 2.88 miles and 4.29 miles from the Project Site, respectively. These slopes and hilltops are generally well vegetated with a mix of mature vegetation. With a few exceptions, long distant views within the Study Area are limited.

Water features are part of the landscape and can be a component of the Study Area, depending on the specific location. Those publicly accessible water resources that are prominent features include (but are not limited to) Star Lake, Chaumont Pond, Little River, and the Oswegatchie River. Additionally, ponds, streams, small lakes, bogs, as well as wetlands, are scattered throughout the Study Area.

4.0 DISTANCE ZONES

Three zones represent the distance between the Project and observer: the foreground, middleground, and background. These distance zones are based on definitions contained in The U.S. Forest Service Landscape Aesthetics – A Handbook for Scenery Management (U.S. Forest Service Handbook) (1995). Although the effects of distance are dependent on the characteristics of the landscape (topography, vegetation, etc.), each zone provides guidance to the level of visual detail and acuity of objects. Distance zones have been reasonably modified from the U.S. Forest Service Handbook to accommodate the required Study Area, as well as considerations such as the size (height) of the Project, and the level of potential visibility.

As it is expected that far-reaching vistas will likely be limited due to the surrounding landform and vegetation, the following distance zones are defined as:

- Foreground (up to 0.5 miles from the viewer): This is the closest distance at which details, such as textures and color, of the landscape and the Project may potentially be seen depending on the circumstances of the specific project. Individual landscape forms are typically dominant, and individual project components may be seen. Scale of the proposed facility when compared to the immediately surrounding landscape is at its highest.

- Middleground (0.5 to 3 miles from the viewer): At this distance, individual tree forms and buildings can still be distinguished. However, the middleground is defined as the point where the texture and form of individual plants are no longer visibly acute in the landscape. In some areas, atmospheric conditions can reduce visibility and shorten the distance normally covered by each zone. Project components, where visible, will lose their level of detail. Contrasts of color and texture lessen as colors take on a bluish hue and details begin to merge.

- Background (3 to 5 miles from the viewer to the horizon): At the extent of background distances, texture disappears, and color flattens but large light and dark patterns of vegetation or open land due to shape or color are distinguishable and ridgelines and horizon lines are the dominant visual characteristics. Landscapes are simplified and are viewed in groups or patterns. Project components, where visible, can be detected as a distant form and color change but are not as discernible.

5.0 VIEWSHED MAP AND ANALYSIS

To identify where the Project would be visible from within the five-mile study area, a viewshed map and associated analysis was undertaken by TRC. A viewshed map is a computerized GIS analytical technique that illustrates the predicted potential visibility expected for a proposed action and allows one to determine if and where a project can geographically be seen. The results of the viewshed map are combined with other sensitive location information such as historic places, national forests, or state parks, etc. to understand potential visibility at sensitive receptors and may be used as part of an analysis of the potential amount of visibility.

5.1 VIEWSHED METHODOLOGY

In completing the necessary viewsheds, Light Detection and Ranging (LiDAR) point cloud data from the FEMA Franklin and St. Lawrence Counties LiDAR dataset dated 2016-2017 and obtained from the NYS GIS Clearinghouse. LiDAR data is the best available elevation data as it contains high resolution accurate ground elevations in addition to equipment and tree heights that offer realistic physical visual impediments as they occur in the landscape.

Control points at a height of 10 feet (representing the panel height), were placed in a 100-foot grid pattern throughout where the panels are being proposed. In addition, one pole at a height of 45 feet was used to represent the point of interconnect (POI). For each of the specified control points, GIS software (ESRI Spatial and 3D Analyst) identified where there would be an unobstructed line of sight, or view, between that point and an observer at 6 feet in height. This process was run twice, once based on the topography only, and once to include vegetation and structures (referred to as a “screened” viewshed); all of which are contained in the LiDAR dataset. The final resulting output identified those areas from which viewers would potentially see some part of the Project.

The topography-only viewshed (see Appendix B, Figure 1) does not reflect a realistic presentation of visibility; this viewshed serves as one component of the baseline information for preparing the viewshed analysis. For the purpose of this assessment, the screened viewshed analysis was used to detect potential visibility, as it incorporates screening caused by topography, vegetation, and buildings (see Appendix B, Figure 2). The results provide the reader with a more reasonable and realistic depiction of potential visibility.

5.2 ASSUMPTIONS AND LIMITATIONS OF THE VIEWSHED MAP AND ANALYSIS

The viewshed map identifies geographic areas where control points are visible by an observer. Certain factors in the interpretation of map and associated analysis need to be considered:

1. The viewshed map, and associated analysis, because of its computerized aspect, is conservative in identifying visibility as it 1) assumes that the observer has perfect vision at all distances, and 2) identifies potential visibility where only a glimpse of a portion of the facility may be seen from a distance (as discussed below). Therefore, it is important to be cognizant of the fact that there may be limitations of human vision at greater distances; atmospheric/meteorological conditions, such as haze or other inclement weather conditions, may impair visibility. Additionally, an object will appear smaller and less detailed with increased distance, thus having less potential for perceived visual impact in most instances.

2. Just because an area, or specific point, may be identified as having visibility, it is important to understand that the entire Project may not be seen. The existing tree stands, hedgerows, and landforms seen in the area provide visual impediments for all or a portion of the facility. Additionally, the viewshed map uses one color to identify visibility of the solar panels, one representing the POI transmission pole, and a third color to represent where both the solar panels and pole may be visible.

3. The viewshed map and associated analysis does not illustrate how much of each piece of equipment is visible. For example, certain visibility may only be a result of glimpsing a portion of the Project over treetops or between gaps of trees.

4. A viewer would not see the Project if standing amongst trees in forested areas as the tree canopy would preclude outward-looking views.

5.3 VIEWSHED ANALYSIS RESULTS

To put the limited amount of visibility into perspective, based on the completed screened viewshed map and Table 1, the analysis demonstrates that only 0.51% of the land within the Study Area will have a full or partial view of the Project. Of this, only 10.64% of the visibility occurs within the Foreground distance zone and 0.55% occurs within the Middleground distance zone.

Table 1. Percent Visibility Within Each Distance Zone*

Distance Zone	Total Area Comprising Distance Zone Square Miles	Visibility Within Distance Zone Square Miles	Percent of Square Miles With Visibility in Each Distance Zone	Percent of Visibility Within the Five Mile SA
Foreground (0-0.5 Miles)	2.63	0.28	**10.64%**	**0.30%**
Middleground (0.5-3.0 Miles)	34.41	0.19	**0.55%**	**0.21%**
Background (3-5 Miles to Horizon)	55.72	0.00	**0.00%**	**0.00%**
Total	**92.76**	**0.47**	**N/A**	**N/A**

* The screened viewshed analysis was used to detect visibility, as it incorporates screening caused by topography, vegetation, and buildings. The results provide the reader with the most reasonable and realistic depiction of Project visibility.

The screened viewshed map (considered to be the most realistic scenario) shows that most of the visibility is limited to within 0.5 miles of the Project (see appendix B, Figure 2). Visibility is primarily contained within the Project Site itself, to the southwest, or from within the Star Lake Transfer Station. When reviewing the amount of visibility, it is important to recognize that 71%, or 0.2 square miles, of the visibility is contained within the Project Site, while the remaining is generally found on either private land or in areas of limited visitation by the general public.

Outside of the Foreground distance zone, only 0.21% (0.19 out of 90.13 square miles) of the land may have some type of view. Much, if not all, of this visibility is seen within properties privately held by Benson Mines or J&L Steel.

In addition to the screened viewshed analysis, a topographic or “bare-earth" viewshed was also developed. The viewshed and associated analysis identified that 36.60% (24.68 square miles) of the Study Area (see Appendix B, Figure 1) will have visibility of some portion of the Project. While the bare-earth viewshed should not be perceived as a realistic representation of visibility and is not the focus of this report, it is still a useful tool in understanding the influence of the terrain and its screening potential.

Despite its limitations, the bare-earth viewshed illustrates that the varied topography seen throughout the Study Area will result in a significant amount of screening. This map shows that visibility is found to the north, northeast, southwest and west of the Project Site, with a heavier concentration of visibility within two- and one-half miles.

6.0 VISUAL RESOURCE INVENTORY

This section includes a resource inventory and evaluation in accordance with the New York State Department of Environmental Conservation (NYSDEC) Program Policy DEP-00-2 entitled *Assessing and Mitigating Visual Impacts* (NYSDEC Policy)[3]. The policy states that the State’s interest with respect to aesthetic resources is to protect those resources whose scenic character has been recognized through national or state designations.

Aesthetic resources are places that have been established by the federal or state government pursuant to statutory authority; they are determined by public record and are not arbitrarily or subjectively identified. The NYSDEC Visual Policy contains specific criteria defining places considered to be aesthetically significant resources of statewide interest (also referred to as “statewide significant”). As defined by the NYSDEC Visual Policy, presence, or lack thereof, of resources were determined using GIS databases and federal and state agency information resources.[4]

> *1) A historic resource listed or eligible for inclusion in the State or National registers of historic places; 2) State Parks [Parks, Recreation and Historic Preservation Law Section 3.09]; 3) NYS Heritage Areas (formerly Urban Cultural Parks [Parks, Recreation and Historic Preservation Law Section 35.15]; 4) The State Forest Preserve [NYS Constitution Article XIV]; 5) National Wildlife Refuges [16 U.S.C. 668dd], and State Game Refuges[5] [ECL 11-2105]; 6) National Landmarks [36 CFR Part 62]; 7) The National Park System, Recreation Areas, Seashores, Forests [16 U.S.C. 1c]; 8) Rivers designated as National or State Wild, Scenic or Recreational [16 U.S.C. Chapter 28, ECL 15-2701 et seq.]; 9) A site, area, lake, reservoir or highway designated or eligible for designation as scenic, including*

[3] https://www.dec.ny.gov/docs/permits_ej_operations_pdf/visualpolicydep002.pdf

[4] Per the policy, only those designated to be of aesthetic value or quality should be considered and “not mere presence within a viewshed.”

[5] Please note that this also includes State Wildlife Management Areas.

NYS Scenic Byways [ECL Article 49 Title 1] or DOT equivalent; 10) Scenic Areas of Statewide Significance [Article 42 of Executive Law]; 11) A State or federally designated trail, or one proposed for designation [16 U.S.C. Chapter 27 or equivalent]; 12) Adirondack Park Scenic Vistas [Adirondack Park Land Use and Development Map]; 13) State Nature and Historic Preserve Areas [Section 4 of Article XIV of the State Constitution]; 14) Palisades Park [Palisades Interstate Park Commission]; 15) Bond Act Properties purchased under Exceptional Scenic Beauty or Open Space category [ECL Article 51, 52 and 56).

Locations of Potential Local Interest

The NYSDEC Policy also identifies that aesthetic resources of local importance should be considered. These places are to be publicly accessible, and recognized and enjoyed for their aesthetic value, by the community and visitors alike. Resources of local importance are established in part, by the local government through the adoption of their comprehensive plan, zoning, etc., and are not arbitrarily or subjectively selected. Resources that are of local importance commonly consist of municipal parks, trails, bikeways, conservation lands, and open space preserves.

Because the Study Area is rural in nature, this report is overly comprehensive and also identifies *representative* locations that may not fit into the above identified categories. These supplemental locations may strictly be of interest to the local community (e.g., Clifton-Fine School and Hospital, Star Lake Fire Department, Cathedral Rock Fire Tower, etc.), or a municipal setting (e.g., hamlet). The locations must be publicly accessible and are not aesthetic in nature. They were chosen based on field investigations and aerial imagery/mapping interpretation to ensure a conservative approach to assessing visibility. In addition, it was identified that the Star Lake Fire Department is used for community events and therefore was included as a resource of community interest.

All resources within the five-mile Study Area were identified through a desktop study (review of GIS databases, various on-line maps and documents, and websites [e.g., NYSDEC], and any applicable on-line research), as well as site reconnaissance. Although all identified resources are listed in Table 1, some of the more prominent resources are described below.

National Register Sites – There are two resources noted as listed historic structures contained within the Study Area. These include the Wanakena Footbridge and Wanakena Presbyterian Church. The Footbridge, while still identified as a historical structure, was destroyed by an ice jam in 2014 and since rebuilt. It has been reported that the bridge was taken off the historic register, however it is still listed on the NYS CRIS system therefore contained in this study.

State Fishing and Waterway Access Sites – There are three noted water access locations within the study area. These include access to Star Lake, the Oswegatchie River, and Little River.

Oswegatchie River – The Oswegatchie River is a 137-mile-long waterway that originates within the Adirondack Mountains and flows north to the St. Lawrence River. A 21-mile section of the River, 6.83 miles of which is within the Study Area, is listed on the Nationwide Rivers Inventory[6]. Per the National Park Service, this portion of the Oswegatchie River is "largely inaccessible and virtually undeveloped or wild in character". It is noted that the River is being included on this list as it exhibits a "remarkable value" in culture, fishery, and scenic values.

NYS Route 3/Olympic Trail Scenic Byway/NYS Bike Route – The Olympic Trail Scenic Byway coincides with NYS Route 3, bisecting the Study Area in an east-west direction, running adjacent to the Project Site. In addition, this corridor is also designated as a bikeway making it suitable for vehicular users and cyclists. The Scenic Byway is a 170-mile scenic route stretches from Sacketts Harbor (Lake on Ontario) to Keesville Lake (Lake Champlain), passing through various communities, including the City of Watertown and the Village of Lake Placid.

The Adirondack Park – The Park was created in 1892 and was one of the first Forever Wild Forest Preserves in the United States and is also the largest National Historic Landmark. It contains six million acres of land and is the largest protected area in the nation. The Park contains 105 small towns and villages, it has over 3,000 lakes and 30,000 miles of waterways, and is provides a diversity of open space, recreation lands, wildlife, mountains and meadows, and areas of wilderness[7]. *The Project and Study Area is located in their entirety within the Adirondack Park; the Park is not designated as one specific resource – however, each identified resource in Table 2 addresses potential visibility.*

Aldrich Pond Wild Forest, Five Ponds Wilderness, and Cranberry Lake Wild Forest – The three identified wilderness areas (or units) make up a large portion of the Study Area and although not specifically identified as a resource, they do represent portion of the Adirondack Park and contain recreational opportunities, which are individually listed as resources. These units contain a significant amount of hardwood forests, coniferous swamps, and wetlands. The terrain varies from relatively flat to hilly, with some of the land being more remote than others. Within these wilderness areas there are a variety of recreational opportunities including hiking, snowmobiling, horse riding, primitive camping, biking, and cross-country skiing. The major trails where these opportunities may occur include the following:

- Tamarack Trail (Aldrich Pond Wild Forest),

[6] https://www.nps.gov/subjects/rivers/nationwide-rivers-inventory.htm. Last accessed November 2021.

[7] https://apa.ny.gov/about_park/index.html

- Alice Brook Trail (Five Ponds Wilderness),
- High Falls Trail (Five Ponds Wilderness), and
- Peavine Swamp Ski Trail (Cranberry Lake Wild Forest).

Table 2, below, identifies those resources and associated categories identified in the NYSDEC Visual Policy and select locations deemed as representative locations of potential local interest.

Table 2. Inventory of Aesthetic Resources Within the Five-Mile Study Area

Map ID	Resource/Location Name	Approximate Distance to Project Site (miles)	Potential Visibility [1]
Historic Sites			
Historic Districts – Listed			
17	Wanakena Footbridge (98NR01340)	3.96	No
22	Wanakena Presbyterian Church (05NR05552)	3.87	No
A Site, Area, Lake, Reservoir or Highway Designated or Eligible for Designation as Scenic			
12	NYS Route 3/Olympic Trail Scenic Byway/NYS Bike Route	133 Feet	Yes
State or Federally Designated Trail, or One Proposed for Designation			
7	Tamarack Trail	1.90	No
8	Buck Pond Trail	1.87	No
14	Peavine Swamp Ski Trail	4.65	No
18	Dead Creek Trail	4.20	No
19	Moore Trail	2.75	No
21	High Trails Falls	3.91	No
9	Alice Brook Trail	1.28	No
Nationwide Rivers Inventory – Supplemental Recreation Resource			
16	Oswegatchie River	2.75	No

Table 2. Inventory of Aesthetic Resources Within the Five-Mile Study Area

Map ID	Resource/Location Name	Approximate Distance to Project Site (miles)	Potential Visibility [1]
State Land – Supplemental Recreation Resources			
State Fishing and Waterway Access Sites			
5	NYSDEC Boat Launch and Fishing Access	1.52	No
6	LWRP Water Access Point (DEC/DOS)	1.76	No
20	NYSDEC Boat Launch	2.90	No
Local and Community Resources			
1	Clifton-Fine School District	2.10	No
2	Clifton-Fine Hospital	2.61	No
3	Saint Huberts Church	2.50	No
4	Star Lake Fire Department	1.65	No
10	Hamlet of Star Lake	1.36	No
11	Clifton-Fine Municipal Golf Course	1.28	No
13	Hamlet of Newton Falls	3.03	No
15	Cathedral Rock Firetower	3.84	No
23	Wanakena Playground	3.95	No
24	Saint Hubert's Cemetery	755 Feet	Yes
25	Hamlet of Wanakena	3.86	No
26	County Route 60	370 Feet	Yes

[1] *Potential visibility is based on LiDAR-based viewshed analysis results that include topography, trees, and buildings, as it is a more reasonable and accurate depiction of landscape conditions. Potential visibility may only be a result of glimpsing a portion of the facility over treetops or between gaps of trees, etc.*

7.0 SITE RECONNAISSANCE

On April 19, 2021 and October 19, 2021, TRC staff with experience in visual assessments drove public roads and photographed views from representative locations. Attempts were made to take photographs that provided the most unobstructed views possible where the screened viewshed map identified the potential for visibility of the Project.

All photographs documenting the existing visibility (or view) were taken using a Canon EOS 6D Mark II digital single lens reflex ("DSLR") 26-mega pixel camera with a lens setting of 50mm. The coordinates of each photo location were recorded using a handheld global positioning system (GPS) unit.

In addition to obtaining photographs, the site reconnaissance was also an opportunity to review the completed viewshed mapping, from publicly accessible locations. The October 19th site visit included discussions regarding visibility and photo locations with staff from NYSERDA and the APA.

8.0 PHOTOGRAPHIC SIMULATIONS

An analysis of existing and anticipated future views of the Project Site from two locations, selected in consultation with APA, within the Study Area was conducted to further identify and evaluate any potential visual impacts. Simulations were prepared to illustrate how the Project will appear from the locations identified in Table 3.

Table 3. Photographic Simulation Locations

Viewpoint ID	Simulation Location	Approximate Distance to Project	Camera Orientation
2	Saint Hubert's Cemetery	893	West
22	New York State Route 3/Olympic Trail Scenic Byway	307 Feet	Northwest

8.1 METHODOLOGY

To create the photographic simulations of the Project, Autodesk Civil 3D 2020 (CAD) was used to extract the proposed solar layout (site plan and grading) that was prepared by TRC, the Project design engineers. This data was interfaced with Autodesk 3DS Max 2020 (MAX) visualization software to construct a three-dimensional (3D) model of the Project at the precise coordinate (x, y, z) location at which equipment is physically proposed.

To appropriately position the facility on the terrain or the ground surface, a 3D topographic surface was generated from LiDAR data used to complete the engineering drawings of the Project.

The 3D model was further developed to position a 3D camera at coordinates of each simulated viewpoint location, extracted from GPS data recorded during the site visit. A photograph is then overlaid into the 3D camera's perspective and a 3D environment is constructed from existing conditions using LiDAR data. Each 3D camera is then adjusted to match the identical settings of the camera used during the field effort, along with minor adjustments to the camera's target and roll, which results in the 3D environment mirroring the photograph's environment.

Example of 3D Model from the Saint Hubert's Cemetery

At this point, the recorded date and time of the photograph is entered into a physical daylight system, which calculates and renders a Computer-Generated Image (CGI) with accurate placement of shadows, materials and highlights casted from the facility of true lighting conditions seen in the photograph.

The CGI is superimposed within the photograph using Adobe Photoshop. Any final editing is completed to demonstrate any proposed actions, such as removal of vegetation, in addition to the removal of Project components that fall behind existing features (e.g., removing the portion of the Project that may fall behind structures, vegetation, topography, etc.).

Each completed simulation is contained in Appendix C.

8.2 DISCUSSION OF SIMULATIONS

Two photographic simulations have been completed to illustrate how the Project will likely be seen from a specific location. Descriptions of the existing and proposed views are described below:

Viewpoint 2 – Saint Hubert's Cemetery: This west facing view is generally contained to the immediate foreground due to the layers of vegetation and topography obstructing long distant vistas. There appears to be limited opportunities for views to the immediately adjacent landform found through gaps in the tree stand that consists mostly of deciduous trees. This vegetation borders the small, maintained cemetery; a series of grave markers and defined yet informal pathway/roadway are in view.

With the Project in place, it is largely screened by the existing vegetation and topography; the landform screens the majority of the Project from this location. However, it may be possible to see a very minor portion of the Project (fence and top of a panel) through a small gap of the vegetation; this view is not comprehensible.

Viewpoint 22 – New York State Route 3/Olympic Trail Scenic Byway: This northeast facing view, looking across Route 3, is generally contained to the immediate foreground with limited opportunities for a long distant vista. The view contains a series of wooden utility poles and associated conductors, fencing, shed, signage, dilapidated asphalt, and the Star Lake Substation which is partially obscured from view by adjacent evergreen plantings. This cluttered view takes on more of a commercial/industrial feel. The northern portion of the Project Site is bordered by a tree stand that consists of deciduous, with scattered evergreen trees.

With the Project in place, eight wooden poles with associated conductors and equipment are now visible. The upper portions of these new vertical elements are seen against the sky while the lower sections are either screened or seen against the existing vegetation. These elements are seen within the context of the current energy infrastructure, as such the Project appears to be consistent with what is presently in place, therefore in keeping with the existing land uses.

It is anticipated that views of the POI, while passing through this section of NYS Route 3, will be limited and fleeting; the time available for such a transient angled view will be short as the posted speed limit is 55 miles per hour. Further limiting time to view the Project and surrounding landscape is the tendency of drivers (and possibly other occupants) to navigate the road (this section of the roadway is on a bend), as well as the other vehicles (including large trucks) that may be encountered.

9.0 RESOURCE SUMMARY

The Project will not have an adverse impact on designated natural, scenic, or historic resources.

State Designated Resources

It is anticipated that the Project may be visible from one of the State Designated resources identified in Table 2. It is likely that the Project will be visible from the NYS Route 3/Olympic Trail Scenic Byway corridor. Specifically, it is most likely that the POI will be visible. With any visibility of the proposed Project, observers will view the Project in conjunction with views of the existing utility infrastructure (transmission lines, Star Lake Substation) and former J&L Steel structures. The view may vary between open and limited (e.g., caused by roadside or on-site vegetation), fleeting and transient in nature, and limited by the angle of such view. Potential visibility of the Project from the NYS Route 3/Olympic Trail Scenic Byway is depicted in the completed simulation and further described in Section 8.2.

In addition, although not a specifically identified resource, the Adirondack Park (including the Aldrich Pond Wild Forest, Five Ponds Wilderness, and Cranberry Lake Wild Forest) encompasses the entire Study Area and is represented by each identified resource contained within this assessment. The Project will not impact the overall importance or character of the Park.

Locations of Potential Local Interest

Two locations that may be of interest to the local community have the potential for limited visibility of the Project. From within the Saint Hubert's Cemetery, there is an extremely small gap in the vegetation allowing visibility of the top portion of the fence and panel. Based on the simulation, an observer may not comprehend such visibility. If additional views (e.g., filtered or framed) become available due to unexpected openings in the trees, it is expected to be minor. Any such visibility may be unnoticeable or non-distracting as a result of user activity and siting of the panels.

There is a small section of County Route 60, near its intersection with NYS Route 3, where there may be sporadic views of the Project's POI. This portion of the road currently has views of existing utility infrastructure, the Star Lake Substation, and former industrial uses. Any view will likely be limited due to roadside vegetation, fleeting and transient in nature, and limited by the angle of such view. In addition, potential views may be more noticeable during leaf-off conditions.

10.0 DESIGN CONSIDERATIONS

Design considerations were implemented during the development of the Project to help mitigate visibility. Notable design features included as part of the Project include:

Design

- The proposed access road utilizes an existing dirt roadway. Although there will be minor grading and a new gravel surface installed, an existing corridor is being utilized. Thus tree clearing is minimized and the need for an additional element visible along NYS Route 3 is eliminated.
- Although the interconnect will require a new 30-foot-wide corridor cut through existing vegetation, the proposed 34.5 kV line will be buried, therefore eliminated the need for additional utility poles. In addition, this new line will not daylight until the riser pole located 133.5 feet north of NYS Route 3, removing the need to cross this scenic byway above ground.
- Placement of the solar panels within a former mine is utilizing a likely undevelopable parcel of land. In addition, due to the vegetation and topography it is likely to have minimal or no visibility of the Project from the NYS Route 3 corridor.
- The location of the POI is adjacent to the existing Star Lake Substation. There, these eight new wooden poles will be in a setting that already sees such infrastructure.

Maintenance

- General maintenance and cleanliness of the Project Site should be a focus of ongoing operations.

Lighting

- No new lighting will be proposed at the Star Lake Substation, access road, or within the Project Site. Should any lights be needed, they should not be utilized during nighttime hours, under normal operations, unless required for safety and security purposes, or required maintenance visits. All lights should be task oriented with full cut-off shields.

11.0 PROJECT SUMMARY AND CONCLUSION

Assessment Summary:

The Study Area contains a significant amount of topographic relief and vegetation. The Project is located on property consisting of sand pits and piles of tailings, with bisecting earthen roads. Steep slopes and hilltops are found throughout the Study Area and when combined with the existing vegetation significantly limits overall visibility and long distant views of the Project.

The Project is consistent with the historical industrial nature that has defined this portion of the Study Area and Project Site – in addition there is also an existing substation and associated utility infrastructure adjacent to the Project Site that will be used for the POI. The screened viewshed map, considered to be the most realistic scenario, illustrates that only 0.51% of the five-mile Study Area will theoretically contain a view of the proposed Project. Where views may be possible, it should be recognized that they may from areas that are inaccessible to the public (e.g., private land).

One of the largest areas of continuous visibility occur on lands identified as the Project Site. In fact, 71%, or 0.2 square miles of the visibility found within the Foreground distance zone is contain on Site. Outside of the Foreground distance zone, only 0.21% (0.19 out of 90.13 square miles) of the land may have some type of view. Much, if not all, of this visibility is seen within properties privately held by Benson Mines or J&L Steel.

Assessment Conclusion

The Project will not have an adverse impact on designated natural, scenic, or historic resources, or locations of potential local interest. The Project is located in a manner to take advantage of onsite screening opportunities (limited clearing of existing vegetation, minimizing panel height, and co-locating the POI adjacent to an existing substation); and located on a suitable Site that is consistent with the surrounding area.

As described in the NYSDEC Visual Policy a "significant adverse visual impacts are those that cause a diminishment of the public enjoyment and appreciation of an inventoried resource, or one that impairs the character or quality of such a place"[8]. This assessment demonstrates that the Project will not cause such diminishment or impairment and will not cause an adverse visual impact.

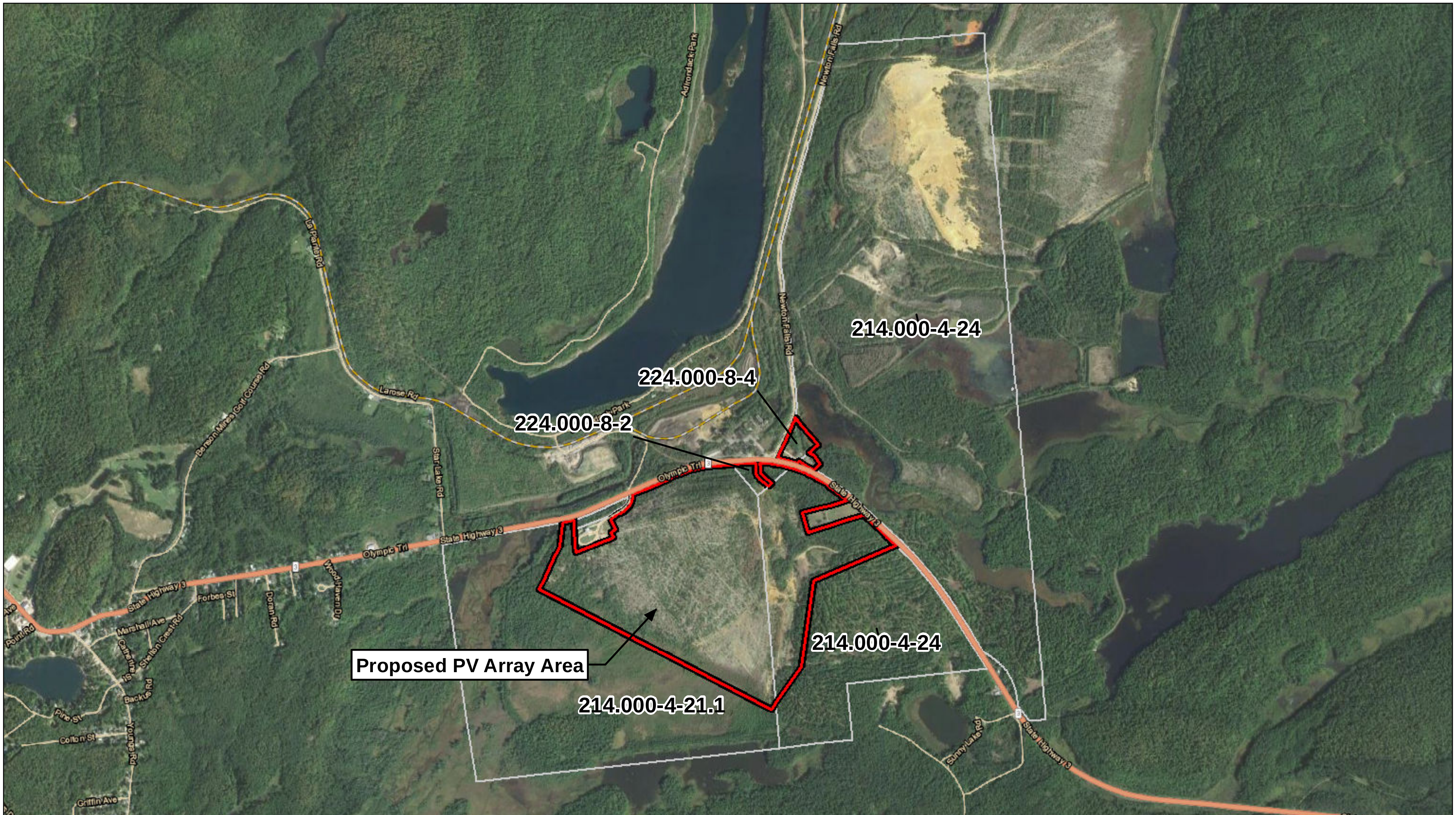
As identified in the NYSDEC Visual Policy, visibility of a project is not to be considered an impact unless it clearly interferes or reduces public enjoyment or appreciation of the resource. The Visual Policy further summarizes that not all visibility rises to the level of an Aesthetic Impact, or one that reduces the enjoyment the public may find at a particular resource.

As a result of viewshed mapping and associated analysis, photographic simulations, site reconnaissance, and the data provided above, the overall visibility of the Project will be minimal. While there are limited areas that will have some sort of visibility of the Project, it appears to be generally confined to the immediate area of the Project Site or on lands that may not be publicly or easily accessible.

[8] Page 9 of the NYSDEC Visual Policy.

Appendix A

Project Site Location



PROJECT AREA

APPROXIMATE PARCEL BOUNDARY

N

Data: TRC

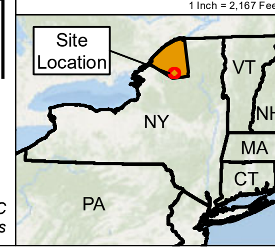
Base Map: Google Maps; Esri and its contributors

0 400 800

Feet

1:26,000

1 Inch = 2,167 Feet



PROJECT:

BR BENSON MINES SOLAR PROJECT
TOWN OF CLIFTON
ST. LAWRENCE COUNTY, NY

TITLE:

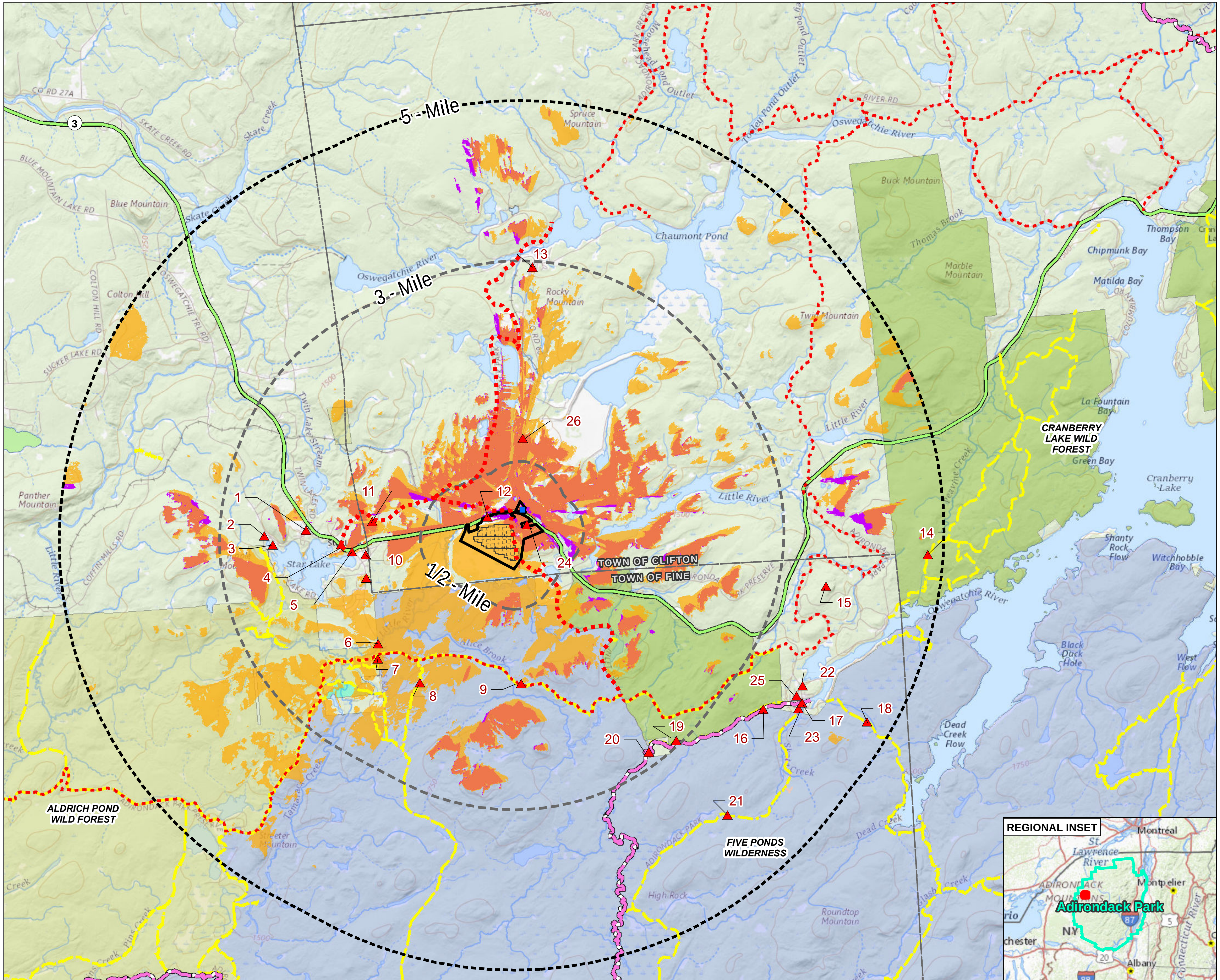
PROJECT SITE LOCATION MAP

DRAWN BY:	J. FREDENBURG	PROJECT NO:	416121
CHECKED BY:	R. BARBER	**VIA Appendix A**	
APPROVED BY:	N. VLAHOS		
DATE:	JANUARY 2022		

TRC

10 MAXWELL DRIVE
CLIFTON PARK, NY 12065

Appendix B
Viewshed Maps



LEGEND

- PROJECT AREA
- PROPOSED SOLAR ARRAY
- POI
- 1/2-MILE STUDY AREA
- 3-MILE STUDY AREA
- 5-MILE STUDY AREA
- AESTHETIC RESOURCE
- NYS DEC TRAILS
- NATIONWIDE RIVERS INVENTORY
- OLYMPIC TRAIL SCENIC ROADWAY
- SNOWMOBILE TRAILS
- TOWN BOUNDARY

BARE EARTH VIEWSHED

- SOLAR ARRAY AND POI VISIBILITY
- SOLAR ARRAY VISIBILITY ONLY
- POI VISIBILITY ONLY

NOTES

1. THIS FIGURE SHOWS SOLAR ARRAY AND POI VISIBILITY ONLY BASED ON BARE EARTH TOPOGRAPHY.
2. TOPOGRAPHIC INFORMATION FROM LIDAR LAS DATA PROVIDED BY NYS GIS CLEARING HOUSE, NEW YORK STATE LIDAR SURVEY – FEMA-FRANKLIN-STLAWRENCE, 2016-2017.
3. SOLAR ARRAYS ASSUMED TO BE – 10' TALL, POI ASSUMED TO BE 45' AND AN OBSERVER HEIGHT OF 6 FOR VIEWSHED ANALYSIS.
4. VISIBILITY DOES NOT MEAN THE ENTIRETY OF SOLAR ARRAY POI WILL BE SEEN. THE MODEL DOES NOT ACCOUNT FOR THE LIMITATIONS OF HUMAN VISION AT A GREATER DISTANCE OR ATMOSPHERIC CONDITIONS THAT MAY CAUSE REDUCED VISIBILITY.
5. INFORMATION PRESENTED HERE IS THE RESULTS OF A DESKTOP ANALYSIS AND HAS NOT BEEN GROUND-TRUTHED.
6. THE WHOLE MAP EXTENT IS WITHIN ADIRONDACK PARK.

0 0.6 1.2 Miles

1 " = 1.2 MILES

1:76,032

N

PROJECT:

NYSERDA BR BENSON MINES
TOWN OF CLIFTON, NY

TITLE:

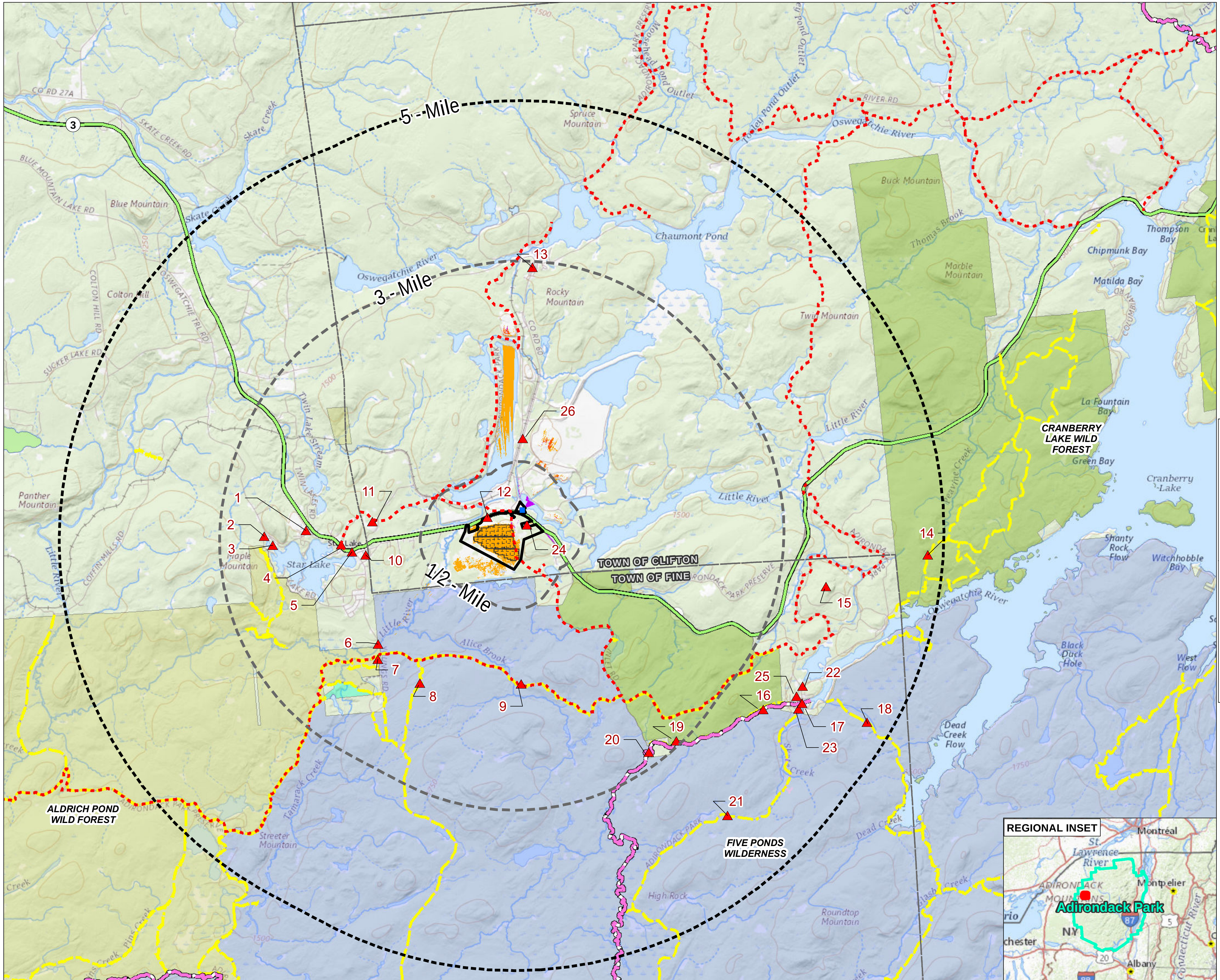
PROPOSED SOLAR ARRAY AND POI BARE EARTH VIEWSHED ANALYSIS WITHIN 5 MILES OF PROJECT SITE

DRAWN BY:	S. MOTURI	PROJ NO.:	416121
CHECKED BY:	A. THOMPSON		
APPROVED BY:	J. GUARIGLIA		FIGURE 1
DATE:	DECEMBER 2021		

TRC
10 Maxwell Drive
Clifton Park, NY 12065

FILE NO.: Figure1_BensonMines_Arrays_POI_VS_BareEarth_11X17_2021-08-24.mxd

TRC - GIS
Coordinate System: NAD 1983 StatePlane New York East FIPS 3101 Feet (Foot US)
Map Rotation: 0
Plot Date: 12/2/2021, 10:15:30 AM by SMOTURI -- LAYOUT: ANSI B(11"x17")
Path: S:\1-PROJECTS\NYSERDA\394233_NYSERDA_Siting\9-VISUAL\BensonMines\Figure1_BensonMines_Arrays_POI_VS_BareEarth_11X17_2021-08-24.mxd



LEGEND

- PROJECT AREA
- PROPOSED SOLAR ARRAY
- POI
- 1/2-MILE STUDY AREA
- 3-MILE STUDY AREA
- 5-MILE STUDY AREA
- AESTHETIC RESOURCE
- NYS DEC TRAILS
- NATIONWIDE RIVERS INVENTORY
- OLYMPIC TRAIL SCENIC ROADWAY
- SNOWMOBILE TRAILS
- TOWN BOUNDARY

SCREENED VIEWSHED

- SOLAR ARRAY AND POI VISIBILITY
- SOLAR ARRAY VISIBILITY ONLY
- POI VISIBILITY ONLY

NOTES

1. THIS FIGURE SHOWS SOLAR ARRAY AND POI VISIBILITY ONLY BASED ON SCREENED TOPOGRAPHY.
2. TOPOGRAPHIC INFORMATION FROM LIDAR LAS DATA PROVIDED BY NYS GIS CLEARING HOUSE, NEW YORK STATE LIDAR SURVEY – FEMA-FRANKLIN-STLAWRENCE, 2016-2017.
3. SOLAR ARRAYS ASSUMED TO BE – 10' TALL, POI ASSUMED TO BE 45' AND AN OBSERVER HEIGHT OF 6 FOR VIEWSHED ANALYSIS.
4. VISIBILITY DOES NOT MEAN THE ENTIRETY OF SOLAR ARRAY POI WILL BE SEEN. THE MODEL DOES NOT ACCOUNT FOR THE LIMITATIONS OF HUMAN VISION AT A GREATER DISTANCE OR ATMOSPHERIC CONDITIONS THAT MAY CAUSE REDUCED VISIBILITY.
5. INFORMATION PRESENTED HERE IS THE RESULTS OF A DESKTOP ANALYSIS AND HAS NOT BEEN GROUND-TRUTHED.
6. THE WHOLE MAP EXTENT IS WITHIN ADIRONDACK PARK.

0 0.6 1.2 Miles

1 " = 1.2 MILES

1:76,032

N

PROJECT:

NYSERDA BR BENSON MINES
TOWN OF CLIFTON, NY

TITLE:

PROPOSED SOLAR ARRAY AND POI SCREENED VIEWSHED ANALYSIS WITHIN 5 MILES OF PROJECT SITE

DRAWN BY:	S. MOTURI	PROJ NO.:	416121
CHECKED BY:	A. THOMPSON		FIGURE 2
APPROVED BY:	J. GUARIGLIA		
DATE:	NOVEMBER 2021		

TRC

10 Maxwell Drive
Clifton Park, NY 12065

FILE NO.: Figure2_BensonMines_Arrays_POI_VS_Screened_11X17_2021-11-16.mxd

TRC - GIS

Coordinate System: NAD 1983 StatePlane New York East FIPS 3101 Feet (Foot US)
Map Rotation: 0

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Appendix C

Photographic Simulations

Viewpoint 2 - View From Saint Hubert's Cemetery

View Distance: 893 Feet

<u>Technical Viewpoint Information</u>

Viewpoint Location..44.16494, -74.99100
Camera Model...Cannon EOS 5D Mark II

Lens Setting.............................Full Frame (50 mm)
Time & Date............................4-19-2021 11:01 AM

Existing Photograph

Viewpoint Location


Existing Conditions

TRC

Visual Simulations
NYSERDA - BR Benson Mines
Town of Clifton, NY

Viewpoint 22 - View From New York State Route 3/Olympic Trail Scenic Byway
View Distance: 307 Feet

Technical Viewpoint Information

Viewpoint Location..44.16644, -74.99108	Lens Setting............................Full Frame (50 mm)
Camera Model...Cannon EOS 6D Mark II	Time & Date...........................10-19-2021 3:03 PM

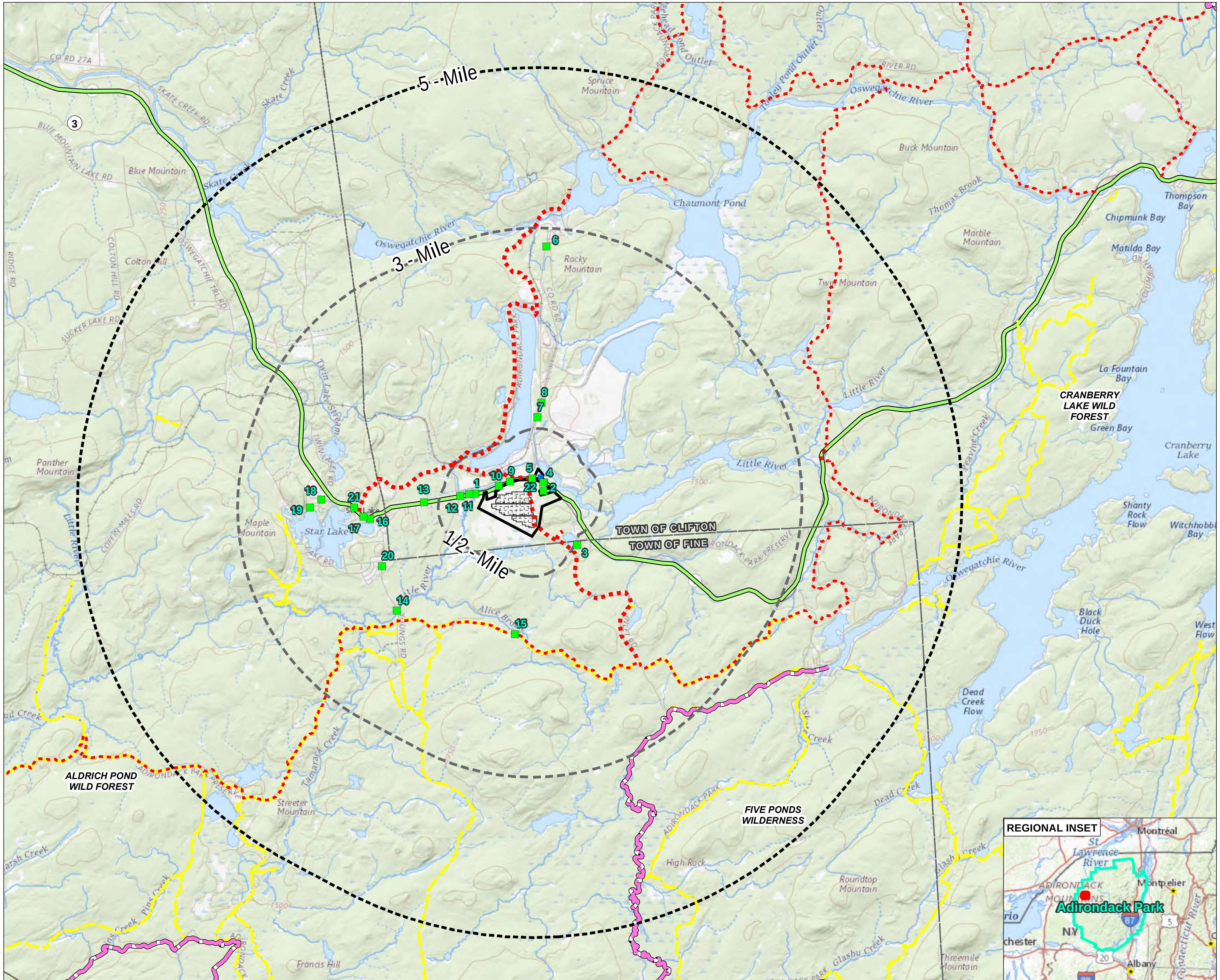
Existing Photograph

Viewpoint Location

Visual Simulations
NYSERDA - BR Benson Mines
Town of Clifton, NY

Visual Simulations
NYSERDA - BR Benson Mines
Town of Clifton, NY

Appendix D
Photolog



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Coordinate System: NAD 1983 StatePlane New York East FIPS 3101 Feet (Foot US)
Map Rotation: 0
TRC - GIS

LEGEND

- PROJECT AREA
- PROPOSED SOLAR ARRAY
- POI
- PHOTO LOCATION
- 1/2-MILE STUDY AREA
- 3-MILE STUDY AREA
- 5-MILE STUDY AREA
- NYS DEC TRAILS
- NATIONWIDE RIVERS INVENTORY
- OLYMPIC TRAIL SCENIC ROADWAY
- SNOWMOBILE TRAILS
- TOWN BOUNDARY

0 0.6 1.2 Miles

1 " = 1.2 MILES

1:76,032

N

PROJECT:

NYSERDA BR BENSON MINES TOWN OF CLIFTON, NY

TITLE:

PHOTO LOCATIONS WITHIN 5 MILES OF PROJECT SITE

DRAWN BY:	S. MOTURI	PROJ NO.:	416121
CHECKED BY:	A. THOMPSON	FIGURE 1	
APPROVED BY:	J. GUARIGLIA		
DATE:	NOVEMBER 2021		

TRC

10 Maxwell Drive
Clifton Park, NY 12065

FILE NO.: Figure1_BensonMines_Photopoints_11X17_2021-11-22.mxd

1

VIEWPOINT 1 - Facing East

2

VIEWPOINT 2 - Facing West

3

VIEWPOINT 3 - Facing Northwest

4

VIEWPOINT 4 - Facing Northwest

5

VIEWPOINT 5 - Facing South

6

VIEWPOINT 6 - Facing South

7

VIEWPOINT 7 - Facing South

8

VIEWPOINT 8 - Facing South

9

VIEWPOINT 9 - Facing Southwest

10

VIEWPOINT 10 - Facing Southeast

11

VIEWPOINT 11 - Facing Southeast

12

VIEWPOINT 12 - Facing East

13

VIEWPOINT 13 - Facing East

14

VIEWPOINT 14 - Facing Northeast

15

VIEWPOINT 15 - Facing North

16

VIEWPOINT 16 - Facing East

17

VIEWPOINT 17 - Facing East

18

VIEWPOINT 18 - Facing East

19

VIEWPOINT 19 - Facing East

20

VIEWPOINT 20 - Facing Northeast

21

VIEWPOINT 21 - Facing East

22

VIEWPOINT 22 - Facing Northwest

Appendix E

Glare Analysis

TRC
708 Heartland Trl, Suite 3000
Madison, WI 53717

Technical Memorandum

Date:	November 22, 2021
To:	NYSERDA
From:	TRC
Cc:	Nancy Vlahos – Project Manager
Reference No.:	TRC Project No. 430156.0PPL
Subject:	BR Benson Mines Glare Study – Solar Glare Hazard Analysis

Introduction

The New York State Energy Research and Development Authority (NYSERDA) is proposing to develop an approximately 179-acre solar photovoltaic (PV) project identified as the BR Benson Mines Solar Project (the Project). The Project is located in the Town of Clifton, Saint Lawrence County, New York. Figure 1 demonstrates the proposed PV array location for the Project.

Solar Glare Analysis Methodology

TRC conducted a solar glare analysis using methodology developed by Sandia National Laboratories and described in the Solar Glare Hazard Analysis Tool (SGHAT) User's Manual (Ho et al, 2013). The SGHAT-compliant software used in this analysis is under license to TRC by ForgeSolar.

Under certain conditions, solar panel surfaces reflect sunlight and produce glint (a momentary flash of bright light) or glare (a continuous source of bright light). The magnitude of glint and glare depends on several factors such as sun position, location of observer, and characteristics of the solar PV array including the tilt, orientation, location, and optical properties of the modules.

Glare visibility from the observer's location is analyzed once glare characteristics are determined. Ocular hazard potential is estimated based on retinal irradiance and subtended angle (size/distance) of the glare (Ho et al., 2010). Potential ocular hazards range from temporary after-image to retinal burn depending on the retinal irradiance and subtended angle as shown in Figure 2. The SGHAT classifies solar glare into three categories, denoted as either 'green', 'yellow', or 'red' glare.

- Green glare is the mildest of the three glare classifications and refers to a level of glare that has a low potential to cause after-image and no potential to cause retinal burn.
- Yellow glare is a moderate level of glare with some potential to cause temporary after-image and no potential to cause retinal burn.
- Red glare is a serious and significant form of glare with potential to cause retinal burn and/or permanent eye damage.

Limitations of the SGHAT applicable to this Project are as follows:

- The SGHAT does not rigorously represent the detailed geometry of a solar panel array; detailed features such as gaps between modules, variable height of the PV array, and support structures may impact actual glare results. However, accuracy of the current approach is validated by several test cases.
- The model does not consider obstacles (either man-made or natural, existing, or proposed) and mitigation measures between the observation points and prescribed solar installation that may obstruct predicted glare, such as vegetation.
- The ocular hazard predicted by the tool depends on a number of environmental, optical, and human factors, which can be uncertain.

In general, default values given by the SGHAT in this analysis reflect the worst-case scenario. As such, the actual glare created by the proposed Project will likely be less than that predicted by this model.

Project Description

NYSERDA is seeking Adirondack Park Agency (APA) approvals for the BR Benson Mines Solar Project located in the Town of Clifton, St. Lawrence County, New York (Figure 1). The proposed Project will consist of an approximately 20-MW solar photovoltaic (PV) array system near the intersection of New York State Route 3 (Olympic Trail) and Newton Falls Road in the Town of Clifton, New York. The Project is to be sited on a former tailings pile from the prior iron ore mine north of Route 3 that was closed in the 1970s.

The Project will include commercial-scale solar arrays, access roads, inverters, buried collection lines, a generation tie line and point of interconnection (POI), fencing, and laydown area. The Project will interconnect on-site to the electric power grid via a line tap to the transmission lines north of the Star Lake Substation, which is north of State Route 3 and adjacent to the Project.

The Project was modelled as one distinct array area for this analysis.

Figure 1 depicts the proposed arrays, observation points (OPs), and route receptors evaluated. The same receptor parameters were used for each grouping of arrays analyzed.

Project Specifications

The PV panels for the Project are proposed to be mounted on a single axis tracking racking system with axes that are oriented to the 180° azimuth, and an east-west tilt angle of -60° to 60°. The resting angle, which is defined as the angle of rotation of the panels when the sun is outside the panels' tracking range, is proposed to be 60°.

Single-axis tracking systems are programmed for the panels to remain perpendicular to the sun's location as the sun moves across the sky throughout the day via solar data from ephemeris tables, which predict the sun's path across the sky. The tracking system begins when the sun's location is perpendicular with the maximum tracking angle (60°) of the system and continues until the sun enters a range where the panel can no longer remain perpendicular with the sun. When the sun is outside the tracking range of the system (when the panels no longer can remain perpendicular with the sun), the trackers remain at their resting angle until the sun sets below the horizon.

The panels are proposed to be mounted to the racking at approximately 6 feet above ground level (AGL). The glare analysis will be evaluated at the mounting height. The tilt of the tracking axis angle ranges from 0 to 3 degrees. The panels are designed to absorb sunlight. The panels were modeled as smooth glass. The panels will be treated with anti-reflective coatings (ARC), which assists to absorb and transmit light rather than reflecting it.

Observation Point Parameters

Solar glare hazard analyses were conducted for outdoor observers located in vicinity of the Project using ForgeSolar's OP tool to estimate potential glare. Unoccupied structures, such as garages, sheds, barns, etc., were not analyzed.

The Observation Points (OPs) analyzed were selected by TRC. A height of 5.5 feet was used to represent outdoor observers. Table 1 summarizes the modelled characteristics of the selected OPs and their corresponding labels. Figure 1 shows the locations of the selected OPs in relation to the Project.

Table 1: Observation Points

Observation Point Label	Number of Floors in Residence	Height (ft)
OP1	Observer located at nearby solid waste station	5.5
OP2	Observer at nearby cemetery	5.5

Route Receptors

TRC also analyzed the adjacent roadway, NY Highway 3, and the proposed snowmobile trail, utilizing the Route Receptor in ForgeSolar (Figure 1). The Route Receptor provides a multi-line representation that simulates observers traveling along continuous paths such as roads, railways, helicopter paths, and multi-segment flight tracks. The viewing angle for observers traveling along the NY Highway 3 was presumed to be a 180° field of view, which represents that the observer can view glare in all directions. The height for observers traveling along the NY Highway 3 was assumed to be 5 and 11 feet AGL to account for personal vehicles and semi-trucks. The viewing angle for observers using the snowmobile paths was 180 degrees to account for reflections off of side-view mirrors of the snowmobile. Because snowmobiles are located closer to the ground, an observer height of 4.5 feet AGL was used.

Additional Assumptions

The following assumptions have been utilized for the analyses:

- Time zone for the Project was set at UTC – 5 hours (Eastern Standard Time).
- Subtended angle of the sun of 9.3 milliradian (mrad) is assumed as recommended by SGHAT. This is the average angle of the sun as viewed from earth as it moves throughout the day.
- The time interval for the analysis was set to run at 1-minute increments.

Inputs, outputs, and other assumptions used in the analysis are documented in the solar glare hazard analysis reports.

Results, Recommendations, and Conclusions

TRC conducted the solar glare hazard analysis using the FAA-approved SGHAT tool to evaluate potential impact of the Project on the evaluated OPs and Route Receptors. TRC evaluated the potential solar glare impact of the PV panels using the project specifications detailed above.

Tables 2 and 3 provide the estimated total number of minutes per year that glare may be visible from the proposed Project at each OP and Route Receptor evaluated. These results are detailed in Attachments 1 and 2.

Table 2: Annual Glare Results with a 0 degree Tracking Axis Tilt

Receptor	Green Glare (min/yr)	Yellow Glare (min/yr)	Red Glare (min/yr)
Observation Point 1 – Nearby Maintenance Area	0	0	0
Observation Point 2 – Nearby Cemetery	0	0	0
Highway 3 – 5 feet	0	0	0
Highway 3 – 11 feet	0	0	0
Snowmobile Path – 4.5 feet	0	0	0

Table 3: Annual Glare Results with a 3 degree Tracking Axis Tilt

Receptor	Green Glare (min/yr)	Yellow Glare (min/yr)	Red Glare (min/yr)
Observation Point 1 – Nearby Maintenance Area	0	0	0
Observation Point 2 – Cemetery	0	0	0
Highway 3 – 5 feet	0	0	0
Highway 3 – 11 feet	0	0	0
Snowmobile Path – 4.5 feet	0	0	0

Based on the glare hazard analysis performed for the Project with the project specifications provided above, no green, yellow, or red glare is expected to be visible at the OPs and along the Route Receptors evaluated.

The lack of glare predicted to be visible is primarily attributed to the proposed resting angle of the PV panel system. The resting angle of a tracking system can have a large impact on glare produced near sunrise and sunset. This is because when the sun is low on the horizon and panels are at a low angle, light is more likely to be reflected to observers close to the ground, such as nearby residences or vehicles. For example, if the resting angle is 0 degrees, the panels will be flat until the sun is within the range, at which point the panel is able to rotate perpendicular to the sun; therefore, at sunrise and sunset, light will reflect at a low angle and high reflectance off of the panels, causing glare. Steeper resting angle ensures that light is reflected in a more upward trajectory, mitigating observable glare.

Because the Project is proposed to use a resting angle of 60 degrees, the estimated glare impacts from the panel are minimized. During times of the day when glare would be the most prevalent (sunrise and sunset), the higher resting angle would reflect light in an upward trajectory, away from OPs and Route Receptors.

It should be noted that changes to the Project specifications may affect the results of this analysis. In addition, vegetative screening may further mitigate visual impacts from the Project arrays.

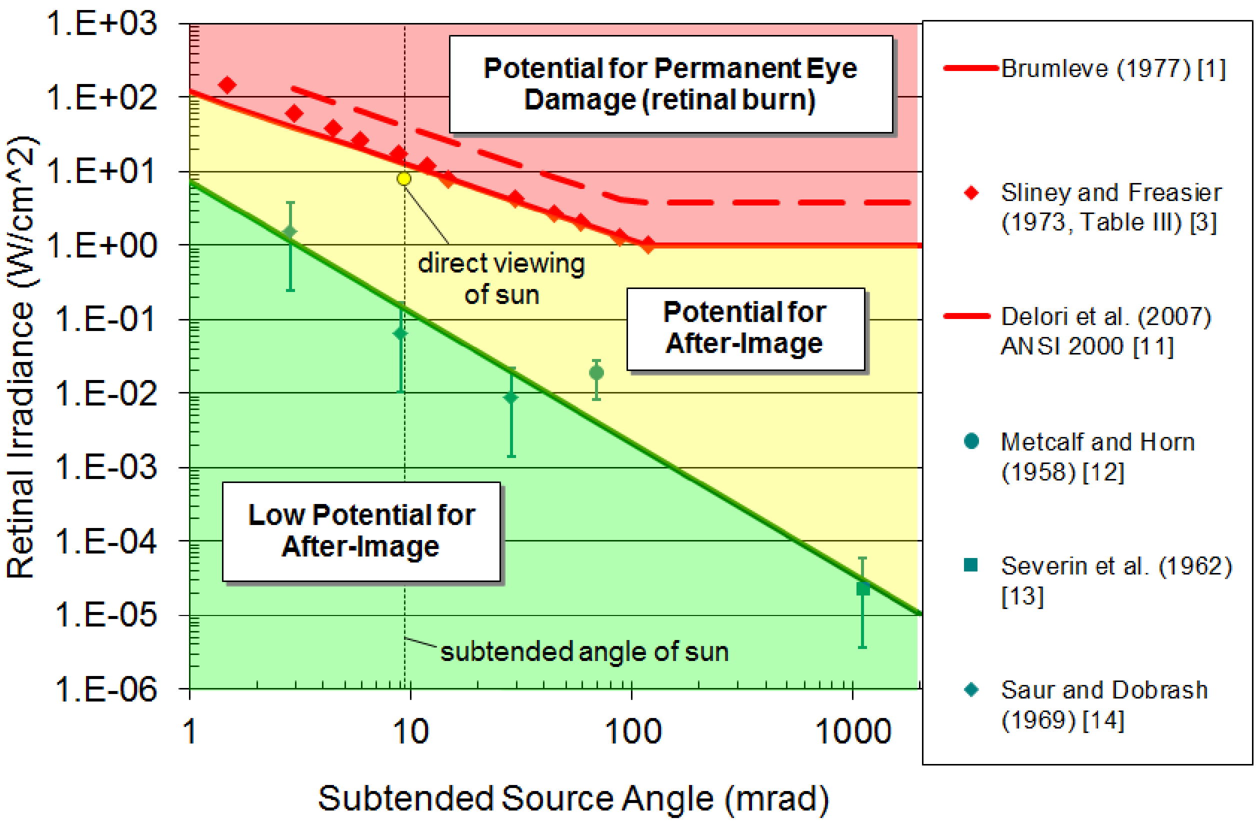
References

Ho, C.K., C.M. Ghanbari, and R.B. Driver. 2010. Methodology to Assess Potential Glare Hazards from Concentrating Solar Power Plants: Analytical Models and Experimental Validation, SAND2010-2581C, in proceedings of the 4th International Conference on Energy Sustainability, Phoenix, AZ, May 17-22.

Ho, C.K. and C.A. Sims. 2013. Solar Glare Hazard Analysis Tool (SGHAT) User's Manual v 3.0.

Figures

Figure 1. BR Benson Mines Site with Route Receptor Locations



Airport Feature	FAA Acceptable Glare Limit	Color Code
Runways	No Glare	None
	Low potential for after image	Green
ATCT	No Glare	None

Note:
After image (flash blindness) is an internal picture that appears on the retina after looking at an object reflecting light or at a source of light itself.

Figure 2. Glare Hazard Analysis Plot and FAA Acceptable Glare Limits (Ho et al., 2011 and FAA, 2013)

Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions.

Several calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare.

The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)

Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.

Glare vector plots are simplified representations of analysis data. Actual glare emanations and results may differ.

The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual results and glare occurrence may differ.

Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.

Attachment 1

BR Benson Mines Solar Project – 0 Degree Tracking Axis Tilt Solar Glare Hazard Analysis Reports

FORGESOLAR GLARE ANALYSIS

Project: **Benson Mines**
Site configuration: **Benson Mines**
Analysis conducted by BreAnne Kahnk (bkahnk@trccompanies.com) at 21:02 on 26 Oct, 2021.

U.S. FAA 2013 Policy Adherence

The following table summarizes the policy adherence of the glare analysis based on the 2013 U.S. Federal Aviation Administration Interim Policy 78 FR 63276. This policy requires the following criteria be met for solar energy systems on airport property:

- No "yellow" glare (potential for after-image) for any flight path from threshold to 2 miles
- No glare of any kind for Air Traffic Control Tower(s) ("ATCT") at cab height.
- Default analysis and observer characteristics (see list below)

ForgeSolar does not represent or speak officially for the FAA and cannot approve or deny projects. Results are informational only.

COMPONENT	STATUS	DESCRIPTION
Analysis parameters	PASS	Analysis time interval and eye characteristics used are acceptable
2-mile flight path(s)	N/A	No flight paths analyzed
ATCT(s)	N/A	No ATCT receptors designated

Default glare analysis parameters and observer eye characteristics (for reference only):

- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

FAA Policy 78 FR 63276 can be read at https://www.federalregister.gov/d/2013-24729

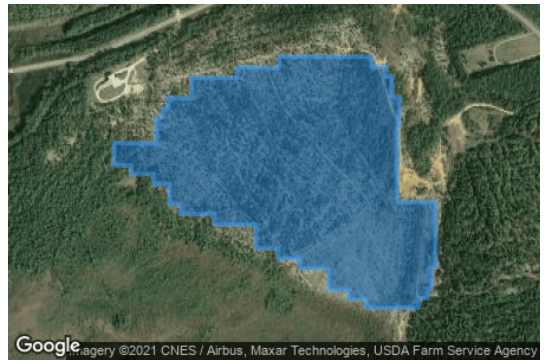
SITE CONFIGURATION

Analysis Parameters

DNI: peaks at 1,000.0 W/m^2
Time interval: 1 min
Ocular transmission coefficient: 0.5
Pupil diameter: 0.002 m
Eye focal length: 0.017 m
Sun subtended angle: 9.3 mrad
Site Config ID: 59192.10533

PV Array(s)

Name: PV Array - Benson Mines
Axis tracking: Single-axis rotation
Tracking axis orientation: 180.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Resting angle: 60.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	44.164792	-74.998392	1505.40	6.00	1511.40
2	44.164794	-74.995037	1532.59	6.00	1538.59
3	44.164528	-74.995040	1533.79	6.00	1539.79
4	44.164533	-74.994510	1527.39	6.00	1533.39
5	44.164273	-74.994529	1526.88	6.00	1532.88
6	44.164272	-74.994302	1526.46	6.00	1532.46
7	44.163736	-74.994303	1513.41	6.00	1519.41
8	44.163730	-74.994023	1517.33	6.00	1523.33
9	44.162947	-74.994041	1497.95	6.00	1503.96
10	44.162951	-74.994120	1498.18	6.00	1504.18
11	44.161005	-74.994107	1462.05	6.00	1468.05
12	44.161016	-74.992723	1459.86	6.00	1465.86
13	44.159308	-74.992722	1437.03	6.00	1443.03
14	44.159311	-74.992870	1435.99	6.00	1441.99
15	44.158767	-74.992865	1432.62	6.00	1438.62
16	44.158768	-74.993015	1433.66	6.00	1439.66
17	44.158519	-74.993002	1431.48	6.00	1437.48
18	44.158520	-74.993332	1427.34	6.00	1433.34
19	44.158262	-74.993338	1431.75	6.00	1437.75
20	44.158263	-74.995240	1421.60	6.00	1427.60
21	44.158493	-74.995226	1423.96	6.00	1429.96
22	44.158491	-74.995869	1424.38	6.00	1430.38
23	44.158731	-74.995859	1425.96	6.00	1431.96
24	44.158739	-74.996595	1422.59	6.00	1428.59
25	44.159291	-74.996595	1428.26	6.00	1434.26
26	44.159286	-74.997648	1422.67	6.00	1428.67
27	44.159539	-74.997648	1424.56	6.00	1430.56
28	44.159542	-74.998440	1427.05	6.00	1433.05
29	44.159808	-74.998429	1425.06	6.00	1431.06
30	44.159801	-74.999241	1421.87	6.00	1427.87
31	44.160423	-74.999239	1429.96	6.00	1435.96
32	44.160431	-75.000742	1425.47	6.00	1431.47
33	44.160707	-75.000747	1426.11	6.00	1432.11
34	44.160699	-75.001964	1420.26	6.00	1426.26
35	44.160952	-75.001954	1420.60	6.00	1426.60
36	44.160958	-75.002394	1423.83	6.00	1429.83
37	44.161485	-75.002390	1426.18	6.00	1432.19
38	44.161487	-75.002961	1423.64	6.00	1429.64
39	44.161744	-75.002968	1426.76	6.00	1432.76
40	44.161731	-75.003771	1416.15	6.00	1422.15
41	44.161964	-75.003773	1424.67	6.00	1430.67
42	44.161968	-75.004398	1418.76	6.00	1424.76
43	44.162557	-75.004396	1427.98	6.00	1433.98
44	44.162536	-75.002870	1427.01	6.00	1433.01
45	44.163205	-75.002856	1430.69	6.00	1436.69
46	44.163204	-75.002624	1434.13	6.00	1440.13
47	44.163434	-75.002620	1436.92	6.00	1442.92
48	44.163433	-75.002448	1439.69	6.00	1445.69
49	44.163714	-75.002440	1439.24	6.00	1445.24
50	44.163709	-75.002253	1442.70	6.00	1448.70
51	44.163708	-75.001956	1448.32	6.00	1454.32
52	44.163706	-75.001565	1451.61	6.00	1457.61
53	44.164244	-75.001582	1454.19	6.00	1460.19
54	44.164239	-74.999923	1480.75	6.00	1486.75
55	44.164513	-74.999907	1482.42	6.00	1488.42
56	44.164490	-74.998399	1502.04	6.00	1508.04

Discrete Observation Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (ft)	Height (ft)
OP 1	1	44.163961	-75.003581	1419.24	5.50
OP 2	2	44.164803	-74.990572	1441.74	5.50

Route Receptor(s)

Name: NY HWY 3 - 11 feet above ground
Path type: Two-way
Observer view angle: 180.0°

> **Note:** Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	44.163785	-75.012728	1400.62	11.00	1411.62
2	44.164785	-75.005668	1401.87	11.00	1412.87
3	44.165093	-75.004467	1404.56	11.00	1415.56
4	44.165555	-75.002707	1400.31	11.00	1411.31
5	44.166140	-75.000905	1404.91	11.00	1415.91
6	44.166694	-74.999446	1421.05	11.00	1432.05
7	44.167063	-74.997214	1432.98	11.00	1443.98
8	44.167217	-74.994339	1435.76	11.00	1446.76
9	44.166817	-74.991850	1431.96	11.00	1442.96
10	44.165524	-74.989404	1433.06	11.00	1444.06
11	44.163708	-74.986571	1441.60	11.00	1452.60
12	44.161768	-74.984125	1466.84	11.00	1477.84
13	44.160752	-74.983138	1475.10	11.00	1486.10

Name: NY HWY 3 - 5 feet above ground
Path type: Two-way
Observer view angle: 180.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	44.163797	-75.012741	1400.37	5.00	1405.37
2	44.164967	-75.004458	1404.56	5.00	1409.56
3	44.166168	-75.000853	1405.17	5.00	1410.17
4	44.166691	-74.999223	1422.01	5.00	1427.01
5	44.167091	-74.997120	1432.18	5.00	1437.18
6	44.167245	-74.994287	1436.79	5.00	1441.79
7	44.166722	-74.991498	1431.54	5.00	1436.54
8	44.165121	-74.988622	1432.11	5.00	1437.11
9	44.163459	-74.986090	1443.62	5.00	1448.62
10	44.161335	-74.983516	1470.32	5.00	1475.32
11	44.160934	-74.983129	1474.74	5.00	1479.74

Name: Snowmobile Path
Path type: Two-way
Observer view angle: 180.0°

> **Note:** Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	44.167076	-74.993896	1435.69	4.50	1440.19
2	44.164868	-74.994470	1519.55	4.50	1524.05
3	44.164720	-74.994510	1526.63	4.50	1531.13
4	44.164854	-74.994968	1530.92	4.50	1535.42
5	44.164948	-74.995325	1532.18	4.50	1536.68
6	44.164952	-74.995599	1535.24	4.50	1539.74
7	44.164962	-74.996049	1533.92	4.50	1538.42
8	44.165068	-74.996503	1531.09	4.50	1535.59
9	44.165102	-74.996849	1525.81	4.50	1530.31
10	44.165087	-74.997205	1522.59	4.50	1527.09
11	44.164698	-74.999389	1489.60	4.50	1494.10
12	44.164427	-75.000676	1467.99	4.50	1472.49
13	44.164298	-75.001650	1453.76	4.50	1458.26
14	44.164233	-75.002064	1447.16	4.50	1451.66
15	44.164079	-75.002361	1441.78	4.50	1446.28
16	44.163623	-75.002599	1436.30	4.50	1440.80
17	44.163209	-75.003069	1428.76	4.50	1433.26
18	44.162842	-75.003509	1424.79	4.50	1429.29
19	44.162928	-75.004077	1424.93	4.50	1429.43
20	44.163144	-75.004879	1427.29	4.50	1431.79
21	44.163307	-75.005392	1430.97	4.50	1435.47
22	44.163280	-75.006526	1430.26	4.50	1434.76
23	44.163012	-75.007029	1431.46	4.50	1435.96
24	44.162782	-75.007325	1427.21	4.50	1431.71
25	44.162667	-75.007693	1424.11	4.50	1428.61
26	44.162336	-75.008326	1419.76	4.50	1424.26
27	44.161710	-75.009090	1419.85	4.50	1424.35
28	44.159703	-75.009238	1428.98	4.50	1433.48
29	44.157149	-75.009352	1402.25	4.50	1406.75
30	44.156364	-75.008708	1403.17	4.50	1407.67
31	44.155456	-75.007550	1435.81	4.50	1440.31
32	44.154840	-75.006133	1441.25	4.50	1445.75
33	44.154675	-75.005146	1444.29	4.50	1448.79
34	44.154701	-75.004696	1449.29	4.50	1453.79
35	44.155502	-74.995083	1425.83	4.50	1430.33
36	44.155687	-74.993259	1436.90	4.50	1441.40
37	44.155871	-74.992701	1423.05	4.50	1427.55
38	44.156226	-74.992336	1436.90	4.50	1441.40
39	44.156857	-74.991928	1466.43	4.50	1470.93
40	44.157180	-74.991842	1470.06	4.50	1474.56

GLARE ANALYSIS RESULTS

Summary of Glare

PV Array Name	Tilt (°)	Orient (°)	"Green" Glare min	"Yellow" Glare min	Energy kWh
PV Array - Benson Mines	SA tracking	SA tracking	0	0	-

Total annual glare received by each receptor

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
OP 1	0	0
OP 2	0	0
NY HWY 3 - 11 feet above ground	0	0
NY HWY 3 - 5 feet above ground	0	0
Snowmobile Path	0	0

Results for: PV Array - Benson Mines

Receptor	Green Glare (min)	Yellow Glare (min)
OP 1	0	0
OP 2	0	0
NY HWY 3 - 11 feet above ground	0	0
NY HWY 3 - 5 feet above ground	0	0
Snowmobile Path	0	0

Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare
0 minutes of green glare

Route: NY HWY 3 - 11 feet above ground

0 minutes of yellow glare
0 minutes of green glare

Route: NY HWY 3 - 5 feet above ground

0 minutes of yellow glare
0 minutes of green glare

Route: Snowmobile Path

0 minutes of yellow glare
0 minutes of green glare

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions.
Several calculations utilize the PV array centroid, rather than the actual glare spot location, due to V1 algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare.
The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
Glare vector plots are simplified representations of analysis data. Actual glare emanations and results may differ.
The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual results and glare occurrence may differ.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
Refer to the Help page at **www.forgesolar.com/help/** for assumptions and limitations not listed here.

Attachment 2

BR Benson Mines Solar Project – 3 Degree Tracking Axis Tilt Solar Glare Hazard Analysis Reports

FORGESOLAR GLARE ANALYSIS

Project: **Benson Mines**
Site configuration: **Benson Mines_3 Degree Tracking Axis**
Analysis conducted by BreAnne Kahnk (bkahnk@trccompanies.com) at 18:00 on 26 Oct, 2021.

U.S. FAA 2013 Policy Adherence

The following table summarizes the policy adherence of the glare analysis based on the 2013 U.S. Federal Aviation Administration Interim Policy 78 FR 63276. This policy requires the following criteria be met for solar energy systems on airport property:

- No "yellow" glare (potential for after-image) for any flight path from threshold to 2 miles
- No glare of any kind for Air Traffic Control Tower(s) ("ATCT") at cab height.
- Default analysis and observer characteristics (see list below)

ForgeSolar does not represent or speak officially for the FAA and cannot approve or deny projects. Results are informational only.

COMPONENT	STATUS	DESCRIPTION
Analysis parameters	PASS	Analysis time interval and eye characteristics used are acceptable
2-mile flight path(s)	N/A	No flight paths analyzed
ATCT(s)	N/A	No ATCT receptors designated

Default glare analysis parameters and observer eye characteristics (for reference only):

- Analysis time interval: 1 minute
- Ocular transmission coefficient: 0.5
- Pupil diameter: 0.002 meters
- Eye focal length: 0.017 meters
- Sun subtended angle: 9.3 milliradians

FAA Policy 78 FR 63276 can be read at https://www.federalregister.gov/d/2013-24729

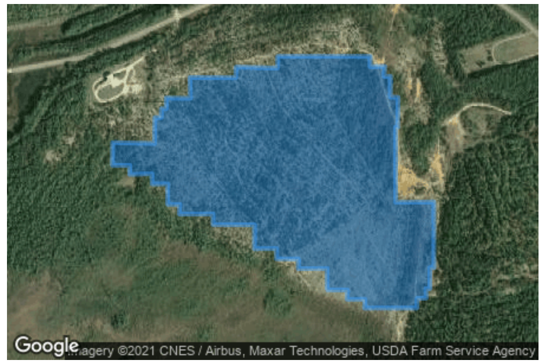
SITE CONFIGURATION

Analysis Parameters

DNI: peaks at 1,000.0 W/m^2
Time interval: 1 min
Ocular transmission coefficient: 0.5
Pupil diameter: 0.002 m
Eye focal length: 0.017 m
Sun subtended angle: 9.3 mrad
Site Config ID: 60315.10533

PV Array(s)

Name: PV Array - Benson Mines
Axis tracking: Single-axis rotation
Tracking axis orientation: 180.0°
Tracking axis tilt: 3.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Resting angle: 60.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	44.164792	-74.998392	1505.40	6.00	1511.40
2	44.164794	-74.995037	1532.59	6.00	1538.59
3	44.164528	-74.995040	1533.79	6.00	1539.79
4	44.164533	-74.994510	1527.39	6.00	1533.39
5	44.164273	-74.994529	1526.88	6.00	1532.88
6	44.164272	-74.994302	1526.46	6.00	1532.46
7	44.163736	-74.994303	1513.41	6.00	1519.41
8	44.163730	-74.994023	1517.33	6.00	1523.33
9	44.162947	-74.994041	1497.95	6.00	1503.96
10	44.162951	-74.994120	1498.18	6.00	1504.18
11	44.161005	-74.994107	1462.05	6.00	1468.05
12	44.161016	-74.992723	1459.86	6.00	1465.86
13	44.159308	-74.992722	1437.03	6.00	1443.03
14	44.159311	-74.992870	1435.99	6.00	1441.99
15	44.158767	-74.992865	1432.62	6.00	1438.62
16	44.158768	-74.993015	1433.66	6.00	1439.66
17	44.158519	-74.993002	1431.48	6.00	1437.48
18	44.158520	-74.993332	1427.34	6.00	1433.34
19	44.158262	-74.993338	1431.75	6.00	1437.75
20	44.158263	-74.995240	1421.60	6.00	1427.60
21	44.158493	-74.995226	1423.96	6.00	1429.96
22	44.158491	-74.995869	1424.38	6.00	1430.38
23	44.158731	-74.995859	1425.96	6.00	1431.96
24	44.158739	-74.996595	1422.59	6.00	1428.59
25	44.159291	-74.996595	1428.26	6.00	1434.26
26	44.159286	-74.997648	1422.67	6.00	1428.67
27	44.159539	-74.997648	1424.56	6.00	1430.56
28	44.159542	-74.998440	1427.05	6.00	1433.05
29	44.159808	-74.998429	1425.06	6.00	1431.06
30	44.159801	-74.999241	1421.87	6.00	1427.87
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33	44.160707	-75.000747	1426.11	6.00	1432.11
34	44.160699	-75.001964	1420.26	6.00	1426.26
35	44.160952	-75.001954	1420.60	6.00	1426.60
36	44.160958	-75.002394	1423.83	6.00	1429.83
37	44.161485	-75.002390	1426.18	6.00	1432.19
38	44.161487	-75.002961	1423.64	6.00	1429.64
39	44.161744	-75.002968	1426.76	6.00	1432.76
40	44.161731	-75.003771	1416.15	6.00	1422.15
41	44.161964	-75.003773	1424.67	6.00	1430.67
42	44.161968	-75.004398	1418.76	6.00	1424.76
43	44.162557	-75.004396	1427.98	6.00	1433.98
44	44.162536	-75.002870	1427.01	6.00	1433.01
45	44.163205	-75.002856	1430.69	6.00	1436.69
46	44.163204	-75.002624	1434.13	6.00	1440.13
47	44.163434	-75.002620	1436.92	6.00	1442.92
48	44.163433	-75.002448	1439.69	6.00	1445.69
49	44.163714	-75.002440	1439.24	6.00	1445.24
50	44.163709	-75.002253	1442.70	6.00	1448.70
51	44.163708	-75.001956	1448.32	6.00	1454.32
52	44.163706	-75.001565	1451.61	6.00	1457.61
53	44.164244	-75.001582	1454.19	6.00	1460.19
54	44.164239	-74.999923	1480.75	6.00	1486.75
55	44.164513	-74.999907	1482.42	6.00	1488.42
56	44.164490	-74.998399	1502.04	6.00	1508.04

Discrete Observation Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (ft)	Height (ft)
OP 1	1	44.163961	-75.003581	1419.24	5.50
OP 2	2	44.164803	-74.990572	1441.74	5.50

Route Receptor(s)

Name: NY HWY 3 - 11 feet above ground
Path type: Two-way
Observer view angle: 180.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	44.163785	-75.012728	1400.62	11.00	1411.62
2	44.164785	-75.005668	1401.87	11.00	1412.87
3	44.165093	-75.004467	1404.56	11.00	1415.56
4	44.165555	-75.002707	1400.31	11.00	1411.31
5	44.166140	-75.000905	1404.91	11.00	1415.91
6	44.166694	-74.999446	1421.05	11.00	1432.05
7	44.167063	-74.997214	1432.98	11.00	1443.98
8	44.167217	-74.994339	1435.76	11.00	1446.76
9	44.166817	-74.991850	1431.96	11.00	1442.96
10	44.165524	-74.989404	1433.06	11.00	1444.06
11	44.163708	-74.986571	1441.60	11.00	1452.60
12	44.161768	-74.984125	1466.84	11.00	1477.84
13	44.160752	-74.983138	1475.10	11.00	1486.10

Name: NY HWY 3 - 5 feet above ground
Path type: Two-way
Observer view angle: 180.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	44.163797	-75.012741	1400.37	5.00	1405.37
2	44.164967	-75.004458	1404.56	5.00	1409.56
3	44.166168	-75.000853	1405.17	5.00	1410.17
4	44.166691	-74.999223	1422.01	5.00	1427.01
5	44.167091	-74.997120	1432.18	5.00	1437.18
6	44.167245	-74.994287	1436.79	5.00	1441.79
7	44.166722	-74.991498	1431.54	5.00	1436.54
8	44.165121	-74.988622	1432.11	5.00	1437.11
9	44.163459	-74.986090	1443.62	5.00	1448.62
10	44.161335	-74.983516	1470.32	5.00	1475.32
11	44.160934	-74.983129	1474.74	5.00	1479.74

Name: Snowmobile Path
Path type: Two-way
Observer view angle: 180.0°

Note: Route receptors are excluded from this FAA policy review. Use the 2-mile flight path receptor to simulate flight paths according to FAA guidelines.

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	44.167076	-74.993896	1435.69	4.50	1440.19
2	44.164868	-74.994470	1519.55	4.50	1524.05
3	44.164720	-74.994510	1526.63	4.50	1531.13
4	44.164854	-74.994968	1530.92	4.50	1535.42
5	44.164948	-74.995325	1532.18	4.50	1536.68
6	44.164952	-74.995599	1535.24	4.50	1539.74
7	44.164962	-74.996049	1533.92	4.50	1538.42
8	44.165068	-74.996503	1531.09	4.50	1535.59
9	44.165102	-74.996849	1525.81	4.50	1530.31
10	44.165087	-74.997205	1522.59	4.50	1527.09
11	44.164698	-74.999389	1489.60	4.50	1494.10
12	44.164427	-75.000676	1467.99	4.50	1472.49
13	44.164298	-75.001650	1453.76	4.50	1458.26
14	44.164233	-75.002064	1447.16	4.50	1451.66
15	44.164079	-75.002361	1441.78	4.50	1446.28
16	44.163623	-75.002599	1436.30	4.50	1440.80
17	44.163209	-75.003069	1428.76	4.50	1433.26
18	44.162842	-75.003509	1424.79	4.50	1429.29
19	44.162928	-75.004077	1424.93	4.50	1429.43
20	44.163144	-75.004879	1427.29	4.50	1431.79
21	44.163307	-75.005392	1430.97	4.50	1435.47
22	44.163280	-75.006526	1430.26	4.50	1434.76
23	44.163012	-75.007029	1431.46	4.50	1435.96
24	44.162782	-75.007325	1427.21	4.50	1431.71
25	44.162667	-75.007693	1424.11	4.50	1428.61
26	44.162336	-75.008326	1419.76	4.50	1424.26
27	44.161710	-75.009090	1419.85	4.50	1424.35
28	44.159703	-75.009238	1428.98	4.50	1433.48
29	44.157149	-75.009352	1402.25	4.50	1406.75
30	44.156364	-75.008708	1403.17	4.50	1407.67
31	44.155456	-75.007550	1435.81	4.50	1440.31
32	44.154840	-75.006133	1441.25	4.50	1445.75
33	44.154675	-75.005146	1444.29	4.50	1448.79
34	44.154701	-75.004696	1449.29	4.50	1453.79
35	44.155502	-74.995083	1425.83	4.50	1430.33
36	44.155687	-74.993259	1436.90	4.50	1441.40
37	44.155871	-74.992701	1423.05	4.50	1427.55
38	44.156226	-74.992336	1436.90	4.50	1441.40
39	44.156857	-74.991928	1466.43	4.50	1470.93
40	44.157180	-74.991842	1470.06	4.50	1474.56

GLARE ANALYSIS RESULTS

Summary of Glare

PV Array Name	Tilt (°)	Orient (°)	"Green" Glare min	"Yellow" Glare min	Energy kWh
PV Array - Benson Mines	SA tracking	SA tracking	0	0	-

Total annual glare received by each receptor

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
OP 1	0	0
OP 2	0	0
NY HWY 3 - 11 feet above ground	0	0
NY HWY 3 - 5 feet above ground	0	0
Snowmobile Path	0	0

Results for: PV Array - Benson Mines

Receptor	Green Glare (min)	Yellow Glare (min)
OP 1	0	0
OP 2	0	0
NY HWY 3 - 11 feet above ground	0	0
NY HWY 3 - 5 feet above ground	0	0
Snowmobile Path	0	0

Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare
0 minutes of green glare

Route: NY HWY 3 - 11 feet above ground

0 minutes of yellow glare
0 minutes of green glare

Route: NY HWY 3 - 5 feet above ground

0 minutes of yellow glare
0 minutes of green glare

Route: Snowmobile Path

0 minutes of yellow glare
0 minutes of green glare

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.
Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover and geographic obstructions.
Several calculations utilize the PV array centroid, rather than the actual glare spot location, due to V1 algorithm limitations. This may affect results for large PV footprints. Additional analyses of array sub-sections can provide additional information on expected glare.
The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size. Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)
Glare locations displayed on receptor plots are approximate. Actual glare-spot locations may differ.
Glare vector plots are simplified representations of analysis data. Actual glare emanations and results may differ.
The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual results and glare occurrence may differ.
Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid based on aggregated research data. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.
Refer to the Help page at **www.forgesolar.com/help/** for assumptions and limitations not listed here.