Hardin Solar Energy II LLC
Case No. 18-1360-EL-BGN

Application Part 6 of 6

Part 6 includes:

- **Exhibit R TRC Viewshed Analysis and Aesthetic Resources Inventory October 2018**
- **Exhibit S Glare Analysis October 2018**
- **Exhibit T ODNR-DOW National Heritage Database July 2018**

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Date Filed: October 12, 2018

Attorneys for Hardin Solar Energy II LLC

Hardin Solar Energy II LLC
Case No. 18-1360-EL-BGN

Exhibit R

TRC Viewshed Analysis and Aesthetic Resources Inventory October 2018

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Attorneys for Hardin Solar Energy II LLC

SUMMARY OF THE VIEWSHED ANALYSIS AND AESTHETIC RESOURCES INVENTORY

Hardin Solar II Energy Center Project

Hardin County, Ohio

October 2018

TRC Project No. 302899.MOD1.0000

Prepared For:

Hardin Solar Energy II, LLC

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Senior Project Manager

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Senior GIS Specialist

Results you can rely on

CONFIDENTIAL BUSINESS INFORMATION

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ACRONYMS

2D	Two Dimensions/Dimensional
3D	Three Dimensions/Dimensional
ESRI	Earth Systems Research Institute (GIS software company)
Ft	Feet
GIS	Geographic Information System
GPS	Global Positioning System
HSE	Hardin Solar Energy II LLC
KOP	Key Observation Point
LBRS	Land Based Response System
LiDAR	Light Detection and Ranging
LAS	LiDAR Data File naming convention (i.e. *.las)
MW	Megawatt
m	Meter
NRHP	National Register of Historic Places
OAC	Ohio Administration Code
OGRIP	Ohio Geographically Referenced Information Program
OPSB	Ohio Power Siting Board
TRC	TRC Environmental Corporation
U.S.	United States
USGS	United States Geological Survey

1.0 INTRODUCTION

On behalf of Hardin Solar Energy II LLC (HSE), TRC Environmental Corporation (TRC) has prepared this Visual Impact Assessment as part of the environmental studies conducted for the Hardin Solar II Energy Center Project (Project). The proposed solar facility will generate up to 170 megawatts (MW) of power. The Project Area is the area which HSE will propose to include within their Ohio Power Siting Board (OPSB) application for a certificate of environmental compatibility and public need, issued by the OPSB. In total, the Project Area is approximately 3,388 acres (1,371 hectares), including 396 acres (160 hectares) of underground collection corridors. The privately-owned land is located approximately 2.5 miles (3.9 kilometers) southeast of Alger, in Hardin County, Ohio. The Project Area is bisected by Township Road 120 (east/west) and is bounded by Township Road 100 on the north, County Road 65 on the east, and neighboring landowners to the south and west in Marion, McDonald, and Roundhead Township, Hardin County, Ohio. The current land use / land cover on the Project site and solar panel layout location is primarily agricultural farmland with some small patches of forest and grassland.

Visual and aesthetic impacts were assessed within a visual study area extending out to a 2 mile (3.2 km) radius from the proposed site boundary. Based on desktop review of aerial photography and topographic data and maps, the Project area and surrounding areas are typical of northwest Ohio. This area primarily rural agricultural area, with generally flat topography. The Scioto River cuts through the study area and appears to have been channelized into straight sections through the Project area, likely for irrigation or other agricultural purposes. The Village of McGuffey also falls within the visual study area. This village has a population of approximately 500, is primarily residential, and includes the Upper Scioto Valley School campus, which comprises a large portion of the footprint of the village. The southern-most edge of the school property is approximately 650 feet (200 m) from the northern edge of proposed development for this Project.

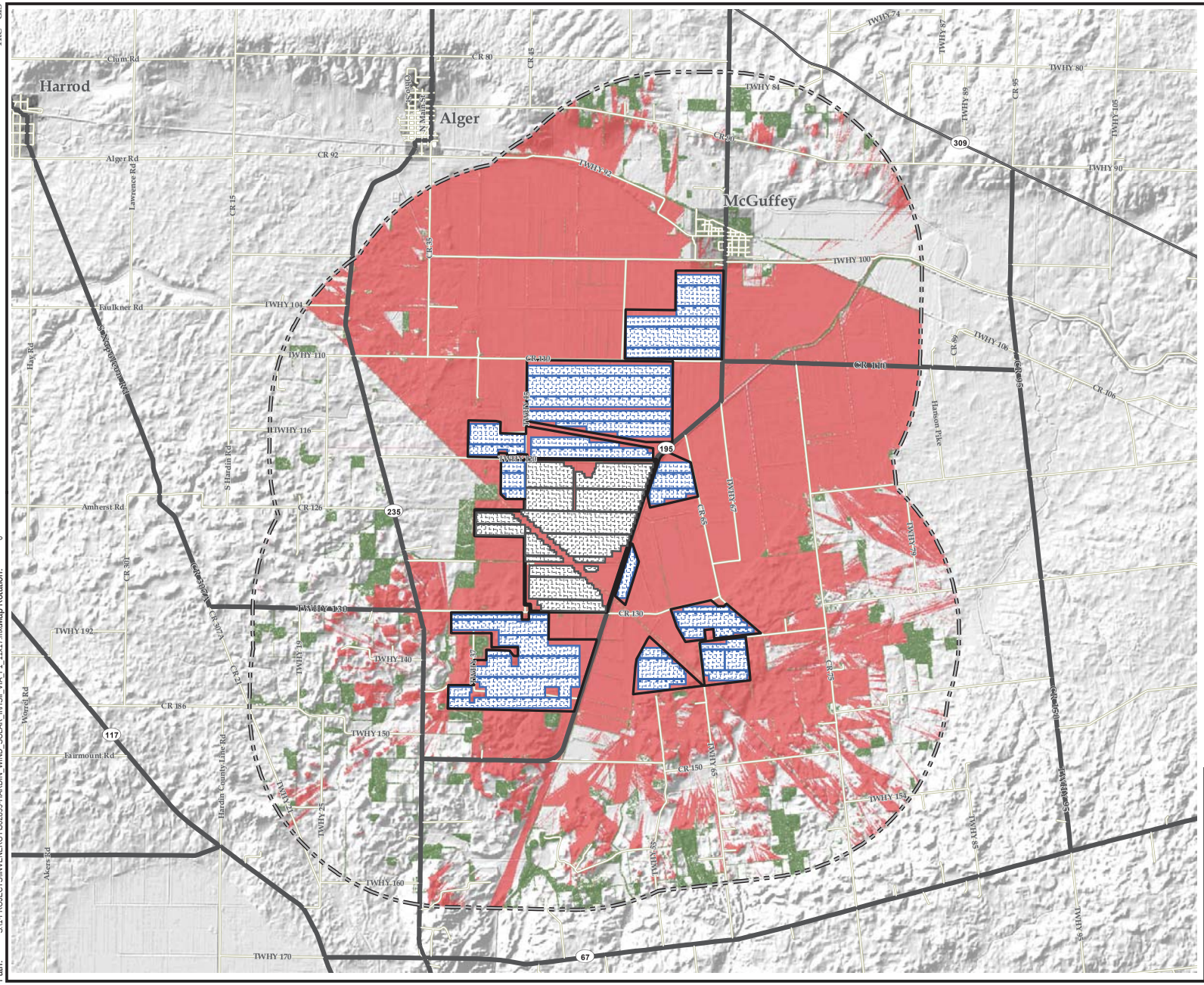
2.0 VIEWSHED ANALYSIS

A viewshed analysis out to 2 miles (3.2 km) was conducted. Due to the inherent low-profile nature of solar projects it is unlikely that locations shown as visible by the computer model greater than 2 miles from the site are representative of what the human eye can perceive. This analysis is a GIS analytical technique that allows for the determination and location of where project features, such as solar panels, fences, or substations will be likely to be visible in the surrounding area of the site. The results of the viewshed analysis are combined with other sensitive location information such as historic places, national forests, state parks, or other key observation points (KOPs) that are identified, and are typically displayed over a topographic map or aerial photo. The GIS combination of KOP locations and the viewshed analysis information assists in understanding the potential for project visibility at sensitive resource locations and provides a better understanding of the potential visual impacts the Project may have.

2.1 VIEWSHED METHODOLOGY

Light Detection and Ranging (LiDAR) data provided by the Ohio Geographically Referenced Information Program (OGRIP) was used for the analysis (Ohio, 2006). The LiDAR survey for Hardin County was conducted in 2006. Forested, vegetated areas, and structures were extracted from the first-return subset of the LiDAR data and was separated from the bare-earth (topographic) surface information. The site review shows no significant tall vegetation present; thus the vegetated surface model was used to conduct a viewshed analysis without accounting for any clearing during construction.

Environmental Systems Research Institute, Inc. (ESRI) Spatial Analyst GIS software was used to develop the viewshed model. X, Y and Z data representing the typical height of the solar panels were incorporated into the model with the LiDAR terrain information. The component height information was based on specifications for the NEXTracker, Inc. NEXTrackerSPT solar panels. An assumed panel height of 13.5’ (4.1m) (NEXTracker, 2015), and an assumed fence height of 7’ (2.1m) was used for this analysis. The results of the 2-mile model including vegetation can be found on **Figure 1**.



LEGEND

- PROJECT BOUNDARY
- 2-MILE SETBACK FROM PROJECT AREA
- PROPOSED SOLAR RACK AREA (HARDIN SOLAR II)
- PROPOSED SOLAR RACK AREA (HARDIN SOLAR I)
- AREAS WITH POTENTIAL SITE VISIBILITY
- AREAS WITH OBSTRUCTED VIEW OF SITE
- TREE COVER/VEGETATED AREA

NOTES

1. TOPOGRAPHIC INFORMATION FROM LiDAR LAS DATA PROVIDED BY OHIO GEOGRAPHICALLY REFERENCED INFORMATION PROGRAM (OGRIP).
2. THE VIEWSHED ANALYSIS WAS CONDUCTED USING THE DATA EXTRACTED FROM THE LiDAR DATA. VEGETATION AREAS ARE REPRESENTED AS THE DIFFERENCE BETWEEN THE FIRST-RETURN SURFACE AND THE BARE-EARTH SURFACE. AN OBSERVER HEIGHT OF 5.5' WAS USED FOR THE ANALYSIS.
3. SOLAR FACILITIES WERE MODELED USING A PANEL HEIGHT OF 13.5' AND A FENCE HEIGHT OF 7'.
4. INFORMATION PRESENTED HERE IS THE RESULTS OF A DESKTOP ANALYSIS AND HAS NOT BEEN GROUND-TRUTHED.

0 5,000 10,000 Feet

1 " = 5,000 '
1:60,000

PROJECT:
HARDIN SOLAR ENERGY II, LLC
HARDIN SOLAR ENERGY CENTER PROJECT
CONFIDENTIAL BUSINESS INFORMATION

TITLE:
VIEWSHED ANALYSIS WITHIN 2 MILES OF PROJECT SITE

DRAWN BY:	J. PAPEZ	PROJ NO.:	302899
CHECKED BY:	M. MOLNAR		
APPROVED BY:	T. ENGLE		**FIGURE 1**
DATE:	OCTOBER 2018		

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FILE NO.: HSII_VIA_F1_11x17.mxd

TRC - GIS
Coordinate System: NAD 1983 StatePlane Ohio North FIPS 3401 (Meter)
Map Rotation: 0
Plot Date: 10/3/2018, 17:01:15 PM by JPAPEZ -- LAYOUT: ANSI B(11"x17")
Path: S:\1-PROJECTS\MVENERGY\302899-HARDIN_WIND_SOLAR_II\HSII_VIA_F1_11x17.mxd

2.2 ASSUMPTIONS AND LIMITATIONS OF THE VIEWSHED MODEL

The viewshed analysis identifies cells (raster pixels) that contain elevation information and computes the differences along the terrain surface between an observer at any point within the study area and a target (e.g. substation component) (ESRI 2017). The analysis is a clear line of sight and therefore certain factors in the interpretation of results need to be considered:

1. The model does not account for the limitations of human vision at greater distances or atmospheric conditions that may cause reduced visibility. Additionally, at increasing distances away from project features, they will appear smaller and less detailed and will have a reduced visual impact even if shown as visible in the model.

2. Because an area may show visibility, it does not mean the entirety of a substation component will be seen. In many cases for this project, the existing tree stands and buildings in the area provide visual impediments for all or lower portion of the facility.

3. The viewshed model assumes that any vegetation is opaque and therefore represents a leaf-on condition. During leaf-off conditions or where ground level vegetation is sparse, visibility may be possible where the model did not indicate.

4. The model was developed with the assumption that a viewer would not see the Project if standing amongst tree groups.

5. Due to the large size of the Project and many panel locations, it was not readily possible to model every individual structure for the viewshed analysis, as such perimeter and high feature points were used for conducting the viewshed analysis.

2.3 VIEWSHED ANALYSIS RESULTS AND DISCUSSION

The Project study area is generally on and surrounded by agricultural farmland and is very flat, with approximately 130 feet (40 m) of elevation change within the two-mile search area based on LiDAR topography. With this flat, open setting there is increased potential for site visibility in the surrounding area. Given the lack of any significant forested land on the Project site, site clearing should have little impact on the visibility of the Project.

The detailed viewshed analysis utilizing vegetation and other non-terrain obstructions within 2 miles of the site, as described in Section 2.2 results are shown in **Figure 1**.

3.0 VISUAL RESOURCE INVENTORY

An inventory of publicly accessible KOPs was compiled for the area within two miles of the site boundary. Resources such as recreational areas, listed NRHP, bikeways, campgrounds, churches, schools, or other community landmark locations were evaluated and shown along with the results of the viewshed analysis in **Figure 2**. This list of resources was generated from a review of public sources including: Ohio Department of Natural Resources GIS Mapping Services (ODNR 2017), Ohio Location Based Response System (LBRS) Landmarks (OGRIP 2015), Google Earth Pro (2018), and USGS 7.5 Minute Quadrangle maps (USGS 1960, 1961). Architectural Resources listed in Table 1 are based on points listed by the Ohio History Connection (2018), which have not yet been evaluated for listing in the NRHP and may not actually have any significant aesthetic importance. **Table 1** summarizes the findings.

Table 1. Visual Resources Inventory within Two Miles (3.2 km) of Project Site

KOP ID	KOP Type	KOP Name	Potential Visibility
1	School	Upper Scioto Valley School Campus	Potentially
2	Church	McGuffey Freewill Baptist Church	Obstructed
3	Church	McGuffey Church of Christ	Obstructed
4	Church	Quickstep Pentecostal Church of God At 2040 Tr 120	Potentially
5	Church	Victory Chapel of Praise At 13436 Sr 235	Obstructed
6	Church	Pentecostal Tabernacle At 13783 Sr 235	Obstructed
7	Church	Flat Branch Church of Christ	Obstructed
8	Historic	Architectural Resource	Potentially
9	Historic	Architectural Resource	Potentially
10	Historic	Architectural Resource	Potentially
11	Historic	Architectural Resource	Potentially
12	Historic	Architectural Resource	Potentially
13	Historic	Architectural Resource	Potentially
14	Historic	Architectural Resource	Obstructed
15	Historic	Architectural Resource	Obstructed
16	Historic	Architectural Resource	Obstructed
17	Historic	Architectural Resource	Obstructed
18	Historic	Architectural Resource	Potentially
19	Historic	Architectural Resource	Potentially
20	Historic	Architectural Resource	Potentially
21	Historic	Architectural Resource	Potentially
22	Historic	Architectural Resource	Potentially
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24	Historic	Architectural Resource	Potentially
25	Historic	Architectural Resource	Potentially
26	Historic	Architectural Resource	Potentially
27	Historic	Architectural Resource	Potentially
28	Historic	Architectural Resource	Potentially
29	Historic	Architectural Resource	Obstructed
30	Historic	Architectural Resource	Obstructed
31	Historic	Architectural Resource	Potentially
32	Historic	Architectural Resource	Potentially
33	Historic	Architectural Resource	Obstructed
51	Historic	Architectural Resource	Potentially
52	Historic	Architectural Resource	Potentially
53	Historic	Architectural Resource	Potentially
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55	Historic	Architectural Resource	Potentially
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60	Historic	Architectural Resource	Potentially
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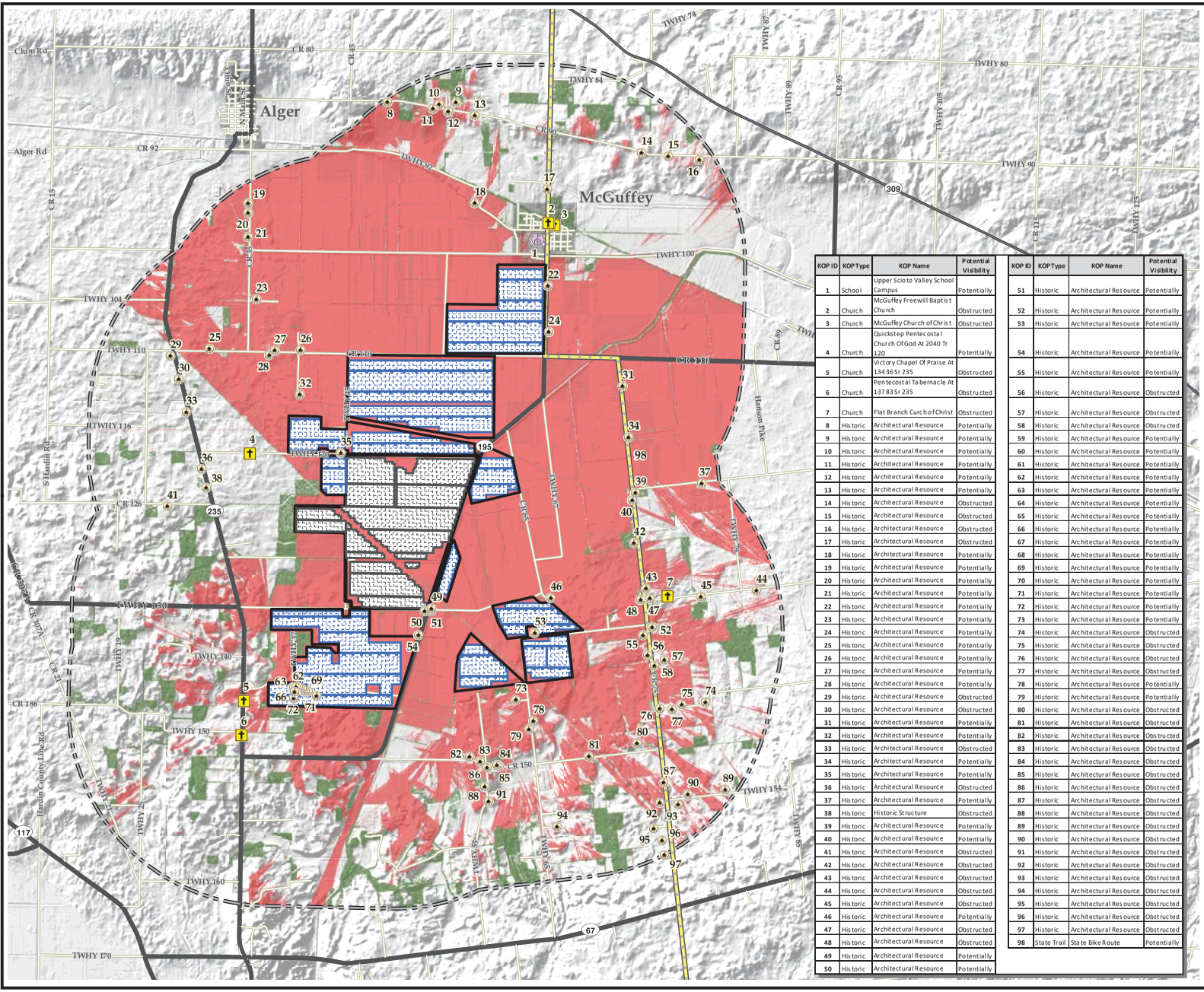
75	Historic	Architectural Resource	Obstructed
76	Historic	Architectural Resource	Obstructed
77	Historic	Architectural Resource	Obstructed
78	Historic	Architectural Resource	Potentially
79	Historic	Architectural Resource	Potentially
80	Historic	Architectural Resource	Obstructed
81	Historic	Architectural Resource	Obstructed
82	Historic	Architectural Resource	Obstructed
83	Historic	Architectural Resource	Obstructed

KOP ID	KOP Type	KOP Name	Potential Visibility
34	Historic	Architectural Resource	Potentially
35	Historic	Architectural Resource	Potentially
36	Historic	Architectural Resource	Obstructed
37	Historic	Architectural Resource	Potentially
38	Historic	Historic Structure	Obstructed
39	Historic	Architectural Resource	Potentially
40	Historic	Architectural Resource	Potentially
41	Historic	Architectural Resource	Obstructed
42	Historic	Architectural Resource	Obstructed
43	Historic	Architectural Resource	Obstructed
44	Historic	Architectural Resource	Obstructed
45	Historic	Architectural Resource	Obstructed
46	Historic	Architectural Resource	Potentially
47	Historic	Architectural Resource	Obstructed
48	Historic	Architectural Resource	Obstructed
49	Historic	Architectural Resource	Potentially
50	Historic	Architectural Resource	Potentially

KOP ID	KOP Type	KOP Name	Potential Visibility
84	Historic	Architectural Resource	Obstructed
85	Historic	Architectural Resource	Obstructed
86	Historic	Architectural Resource	Obstructed
87	Historic	Architectural Resource	Obstructed
88	Historic	Architectural Resource	Obstructed
89	Historic	Architectural Resource	Obstructed
90	Historic	Architectural Resource	Obstructed
91	Historic	Architectural Resource	Obstructed
92	Historic	Architectural Resource	Obstructed
93	Historic	Architectural Resource	Obstructed
94	Historic	Architectural Resource	Obstructed
95	Historic	Architectural Resource	Obstructed
96	Historic	Architectural Resource	Obstructed
97	Historic	Architectural Resource	Obstructed
98	State Trail	State Bike Route	Potentially



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56	Historic	Architectural Resource	Obstructed
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96	Historic	Architectural Resource	Obstructed
97	Historic	Architectural Resource	Obstructed
98	State Trail	State Bike Route	Potentially

LEGEND

- PROJECT BOUNDARY
- 2-MILE SETBACK FROM PROJECT AREA
- PROPOSED SOLAR RACK AREA (HARDIN SOLAR II)
- PROPOSED SOLAR RACK AREA (HARDIN SOLAR I)
- AREAS WITH POTENTIAL SITE VISIBILITY
- AREAS WITH OBSTRUCTED VIEW OF SITE
- TREE COVER/VEGETATED AREA

POTENTIAL AESTHETIC RESOURCES/KEY OBS. POINTS (KOP)

- SCHOOL
- CHURCH
- HISTORIC STRUCTURE
- STATE BIKE ROUTE

NOTES

1. TOPOGRAPHIC INFORMATION FROM LIDAR LAS DATA PROVIDED BY OHIO GEOGRAPHICALLY REFERENCED INFORMATION PROGRAM (OGRIP).
2. THE VIEWSHED ANALYSIS WAS CONDUCTED USING THE DATA EXTRACTED FROM THE LIDAR DATA. VEGETATION AREAS ARE REPRESENTED AS THE DIFFERENCE BETWEEN THE FIRST-RETURN SURFACE AND THE BARE-EARTH SURFACE. AN OBSERVER HEIGHT OF 5.5' WAS USED FOR THE ANALYSIS.
3. INFORMATION PRESENTED HERE IS THE RESULTS OF A DESKTOP ANALYSIS AND HAS NOT BEEN GROUND-TRUTHED.
4. ARCHITECTURAL RESOURCE POINTS ARE BASED ON PREVIOUSLY SURVEYED INFORMATION FROM THE OHIO HISTORY CONNECTION WEBMAP.

0 5,000 10,000 Feet

1 " = 5,000 '

1:60,000

PROJECT:

HARDIN SOLAR ENERGY II, LLC
HARDIN SOLAR ENERGY CENTER PROJECT
CONFIDENTIAL BUSINESS INFORMATION

TITLE:

VIEWSHED ANALYSIS AND POTENTIAL AESTHETIC RESOURCES

DRAWN BY:	J. PAPEZ	PROJ NO.:	302899
CHECKED BY:	M. MOLNAR		
APPROVED BY:	T. ENGLE		
DATE:	OCTOBER 2018		

FIGURE 2

TRC
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FILE NO.: HSII_VIA_F2_11x17.mxd

TRC - GIS
Plot Date: 10/3/2018, 20:44:40 PM by JPAPEZ -- LAYOUT: ANSI B (11"x17")
Path: S:\1-PROJECTS\INVENERGY\302899-HARDIN_WIND_SOLAR_II\HSII_VIA_F2_11x17.mxd
Coordinate System: NAD 1983 StatePlane Ohio North FIPS 3401 (Meter)
Map Rotation: 0

4.0 VISUAL SIMULATIONS

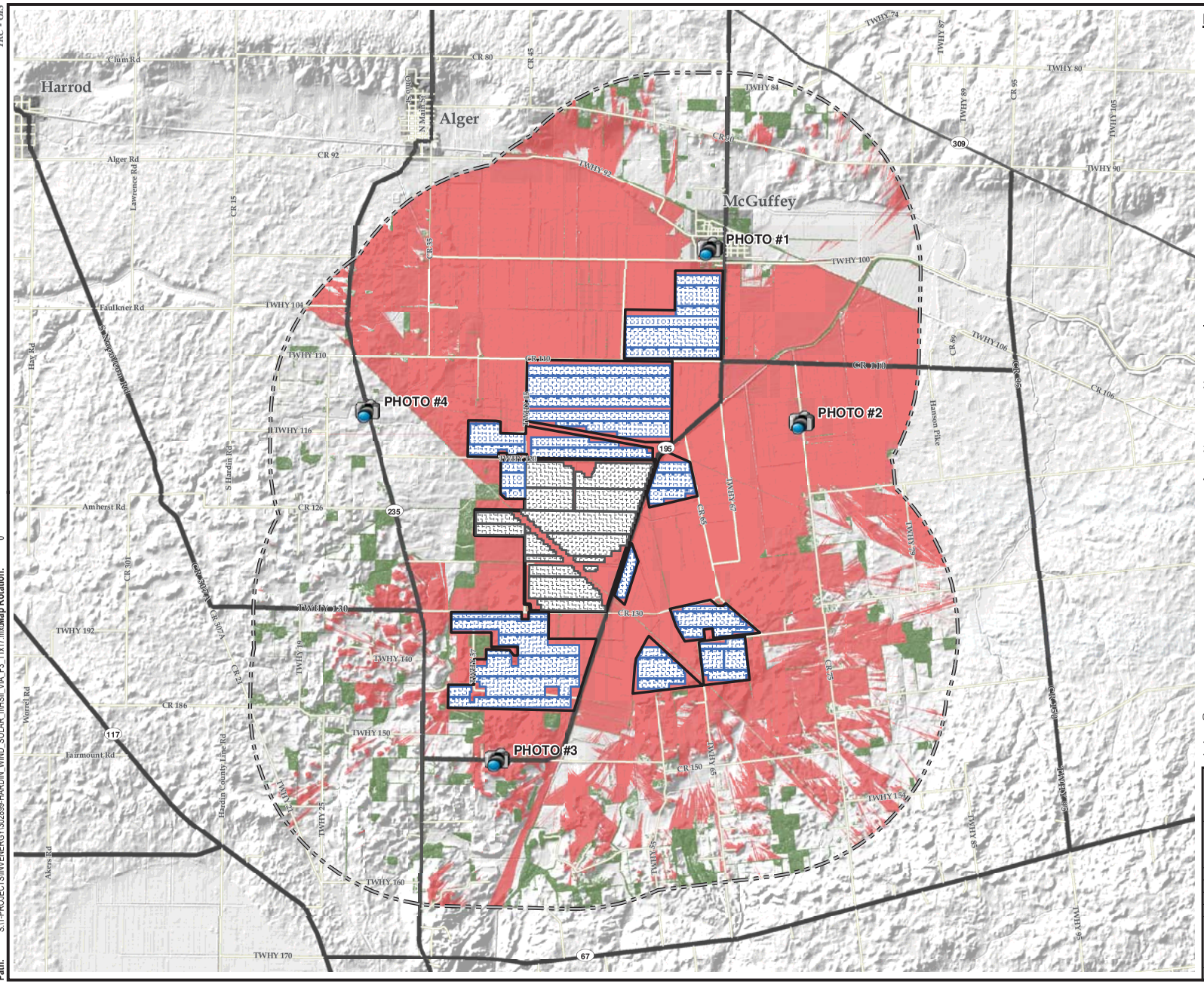
Field surveys were conducted on July 24, 2018 to acquire photographs for simulations. Four photographs are presented as simulations. Attempts were made to take photographs that provided the most unobstructed views possible at north, south, east, and west positions and/or in areas where the viewshed maps represent visibility that is proximal to the Hardin Solar II Energy Center.

4.1 METHODOLOGY

Photographs were taken with a Nikon Coolpix W100 digital camera. Coordinates of camera locations intended for simulations were recorded using a sub-meter Global Positioning System unit (GPS), as well as other reference points within the view. These reference locations were later used to refine the placement of the facility within the simulation photographs. Heights of select high reference points were measured with a tape measure or survey rod. The photograph locations are shown on **Figure 3**.

To create visual simulations, 3DS MAX 2016 software was used to correctly dimension a model of the Hardin Solar II Energy Center into the digital photographic image from each viewpoint location. The 3d model of the facility was created by TRC using engineering specifications (NEXTracker, Inc. NEXTrackerSPT solar panels) (NEXTracker, 2015), along with a 2D solar array and perimeter fencing location provided by Hardin Solar Energy II, LLC. The simulation model was further developed to position the viewer at the selected vantage point. For a given vantage point, the visualization software is capable of providing and adjusting a camera view that matches that of the actual photograph. From the field effort, the documented camera coordinate (x, y, z) positions were entered into the model. Reference locations, which are existing visible objects in the photograph such as light posts, building corners, trees, gate posts or utility poles were obtained by GPS to assist with refined placement of the proposed Project within the photograph. In some instances, GIS terrain modeling and analysis helped in locking in the 3D facility model within the photograph. Ground point elevations of the camera location and other referenced objects were obtained from the 2006 LiDAR LAS data provided by Ohio Geographically Referenced Information Program (OGRIP) (Ohio 2006).

The day and time of the photographs were also recorded and typically exist as electronic information embedded in the respective digital photograph files. This information was used to adjust for sun angle in the simulation software in order to represent lighting conditions for the time of day and year.



LEGEND

- PHOTO SIMULATION LOCATION
- PROJECT BOUNDARY
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- PROPOSED SOLAR RACK AREA (HARDIN SOLAR II)
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PROJECT:
HARDIN SOLAR ENERGY II ENERGY, LLC
HARDIN SOLAR ENERGY CENTER PROJECT
CONFIDENTIAL BUSINESS INFORMATION

TITLE:
VISUAL SIMULATION PHOTOGRAPH LOCATIONS

DRAWN BY:	J. PAPEZ	PROJ NO.:	302899
CHECKED BY:	M. MOLNAR		
APPROVED BY:	T. ENGLE		**FIGURE 3**
DATE:	OCTOBER 2018		

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Phone: 614.423.6334
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FILE NO.: HSII_VIA_F3_11x17.mxd

TRC - GIS
Plot Date: 10/3/2018, 20:23:06 PM by JPAPEZ -- LAYOUT: ANSI B (11"x17")
Path: S:\1-PROJECTS\INVENERGY\302899-HARDIN_WIND_SOLAR_II\HSII_VIA_F3_11x17.mxd
Coordinate System: NAD 1983 StatePlane Ohio North FIPS 3401 (Meter)
Map Rotation: 0

4.2 DISCUSSION OF SIMULATIONS

As noted with the viewshed mapping results (**Figures 1 through 3**), views from the north, east, and south of the Hardin Solar II Energy Center will have the least obstructed views in the viewshed. From select areas to the west and southwest, views will be limited due to forested land. Throughout the area small patches of trees and vegetation may obstruct some views, but the extent of visual obstructions is minimal and likely to be lessened during leaf-off conditions.

Figures 4 & 5: Photo Location #1: Upper Scioto Valley School Campus, 1,200 feet (366 m) south of the Project

Photo location #1 is from the parking lot west of the main school building, approximately 1,200 feet (366 m) north of the proposed edge of the solar array. The photo was taken on July 24, 2018 at 9:55am. The proposed-conditions simulation (Figure 5) shows that the solar facility is likely to be seen from this perspective between the gaps in buildings of the feed mill to the south of W Cottonwood Rd. The view between these structures is likely representative of views elsewhere on the school campus where observers may be located (baseball diamonds, track, and football field). This view is somewhat closer to the facility than the other locations mentioned, thus the visual vertical size of features will be larger than from locations farther away.

Figures 6 & 7: Photo Location #2: County Road 75, 1.3 miles (2.1 km) east of the Project

Photo location #2 is from County Road 75, south of County Road 110, approximately 1.3 miles (2.1 km) from the proposed southwest edge of the solar array. The photo was taken on July 24, 2018 at 10:21am. At this location the proposed solar facility may be visible along the horizon. The vertical profile from this distance will be narrow. The simulated photo has an enhanced enlargement of the simulated facility shown to show additional detail. It is possible that with atmospheric haze or when tall crops, like corn, are growing the facility may not be visible from this vantage point.

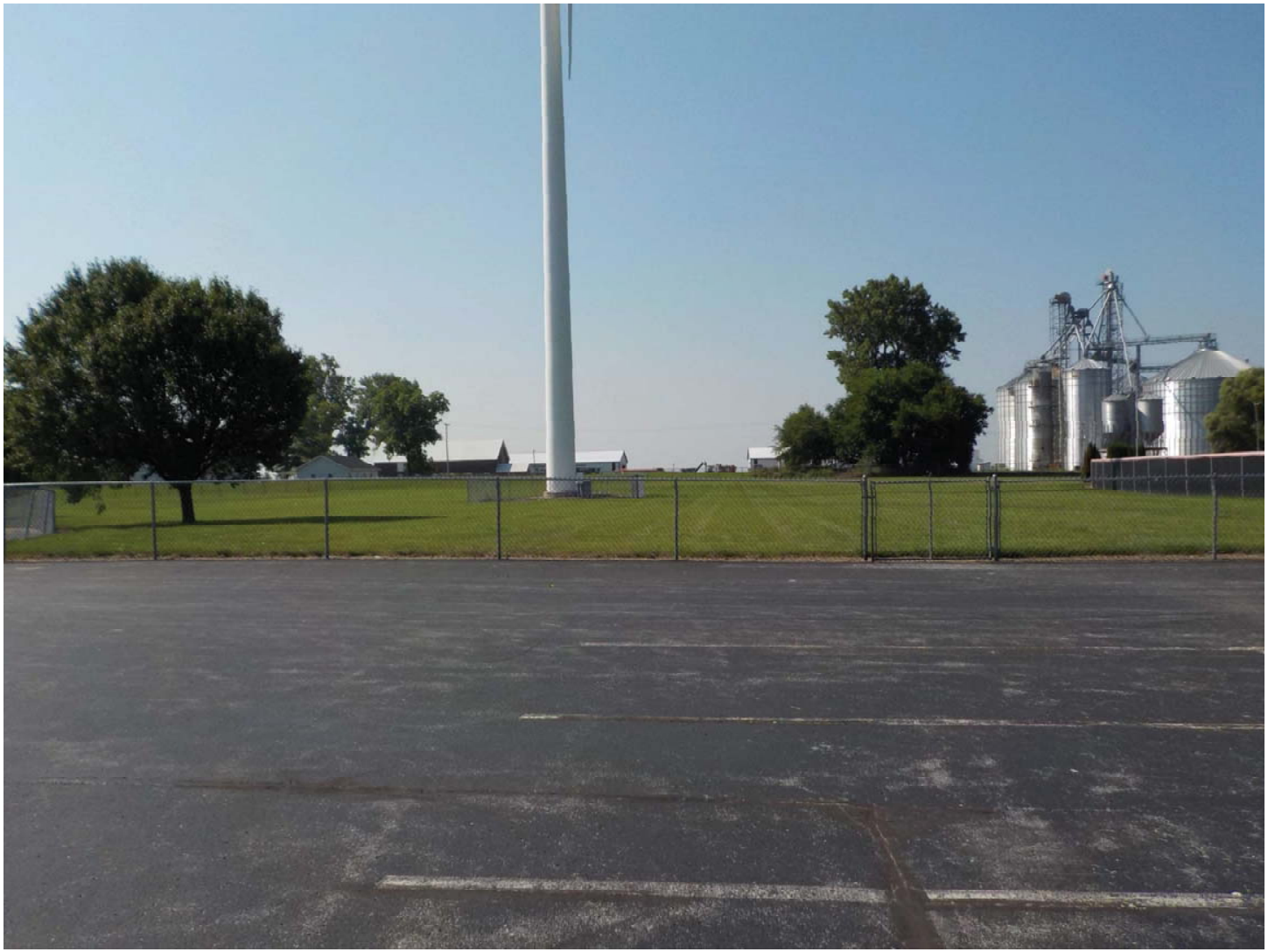
Figures 8 & 9: Photo Location #3: State Road 195, 0.5 miles (0.8 km) south of the Project

Photo location #3 is from State Road 195, east of State Road 235, approximately 0.5 miles (0.8 km) from the proposed southern edge of the solar array. The photo was taken on July 24, 2018 at 10:39am. At this location the proposed solar facility may be visible in the field and along the horizon. The vertical profile from this distance will be relatively narrow. It is possible that with atmospheric haze or when tall crops, like corn, are growing the facility may not be clearly visible from this vantage point.

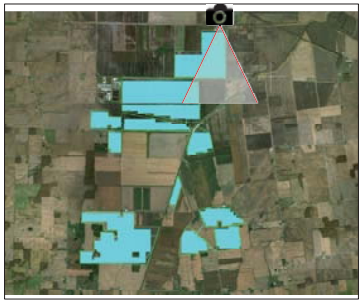
Figures 10 & 11: Photo Location #4: State Road 235, 1.0 miles (1.6 km) west of the Project

Photo location #4 is from State Road 235, approximately half way between County Road 110 and 120, approximately 1.0 miles (1.6 km) from the proposed western edge of the solar array. The photo was taken on July 24, 2018 at 12:42pm. At this location the proposed solar facility may be visible along the horizon

on the right side of the photo. The vertical profile from this distance will be relatively narrow. The simulated photo has an enhanced enlargement of the simulated facility shown to show additional detail. It is possible that with atmospheric haze or when tall crops, like corn, are growing the facility may not be visible from this vantage point.



VIEWPOINT LOCATION MAP



PROPOSED CONDITIONS

TECHNICAL INFORMATION

Viewpoint Coordinates in	1,611,301 E
OH NAD83 North State Feet	375,793 N
Viewpoint Location	Location 1
Viewer Eye Elevation	974 ft msl
Distance to Project	1,106 ft
Camera Model	COOLPIX W100 V1.5
Lens Setting	30 mm
Date/Time	7-24-2018/9:55 am

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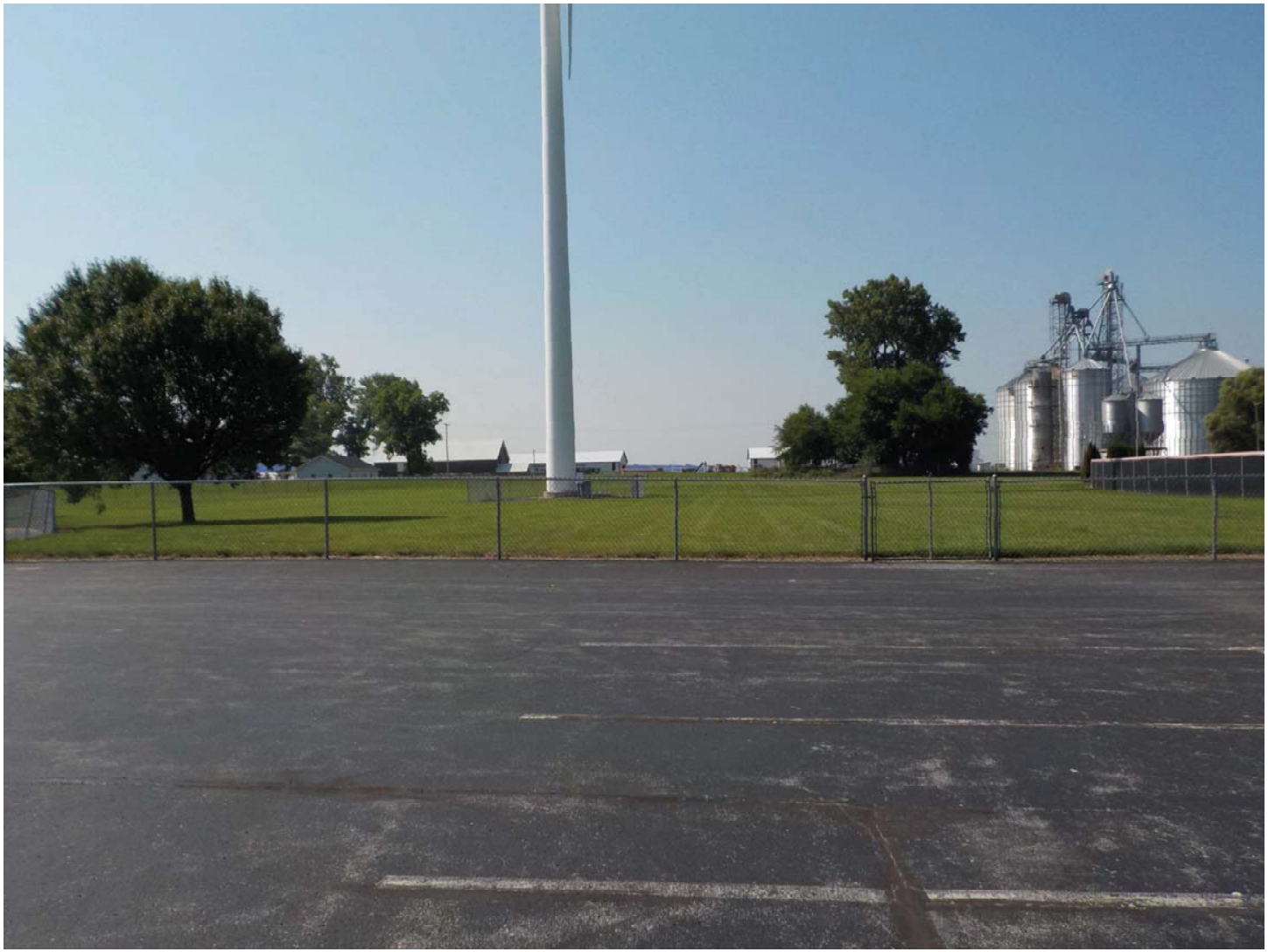
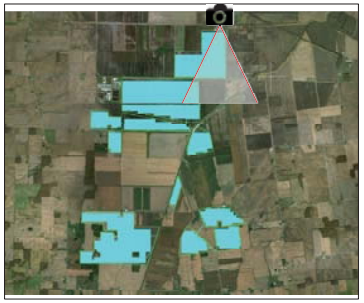
FIGURE 4. PHOTO LOCATION 1: UPPER SCIOTO VALLEY SCHOOL - EXISTING CONDITIONS

TRC Results you can rely on



VIEWPOINT LOCATION MAP



EXISTING CONDITIONS

TECHNICAL INFORMATION

Viewpoint Coordinates in	1,611,301 E
OH NAD83 North State Feet	375,793 N
Viewpoint Location	Location 1
Viewer Eye Elevation	974 ft msl
Distance to Project	1,106 ft
Camera Model	COOLPIX W100 V1.5
Lens Setting	30 mm
Date/Time	7-24-2018/9:55 am

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FIGURE 5. PHOTO LOCATION 1: UPPER SCIOTO VALLEY SCHOOL - PROPOSED CONDITIONS

TRC
Results you can rely on

VIEWPOINT LOCATION MAP

PROPOSED CONDITIONS

TECHNICAL INFORMATION

Viewpoint Coordinates in	1,616,188 E
OH NAD83 North State Feet	366,599 N
Viewpoint Location	Location 2
Viewer Eye Elevation	974 ft msl
Distance to Project	6,106 ft
Camera Model	COOLPIX W100 V1.5
Lens Setting	30 mm
Date/Time	7-24-2018/10:21 am

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FIGURE 6. PHOTO LOCATION 2: COUNTY ROAD 75 - EXISTING CONDITIONS

TRC Results you can rely on

VIEWPOINT LOCATION MAP

EXISTING CONDITIONS

TECHNICAL INFORMATION

Viewpoint Coordinates in	1,616,188 E
OH NAD83 North State Feet	366,599 N
Viewpoint Location	Location 2
Viewer Eye Elevation	974 ft msl
Distance to Project	6,106 ft
Camera Model	COOLPIX W100 V1.5
Lens Setting	30 mm
Date/Time	7-24-2018/10:21 am

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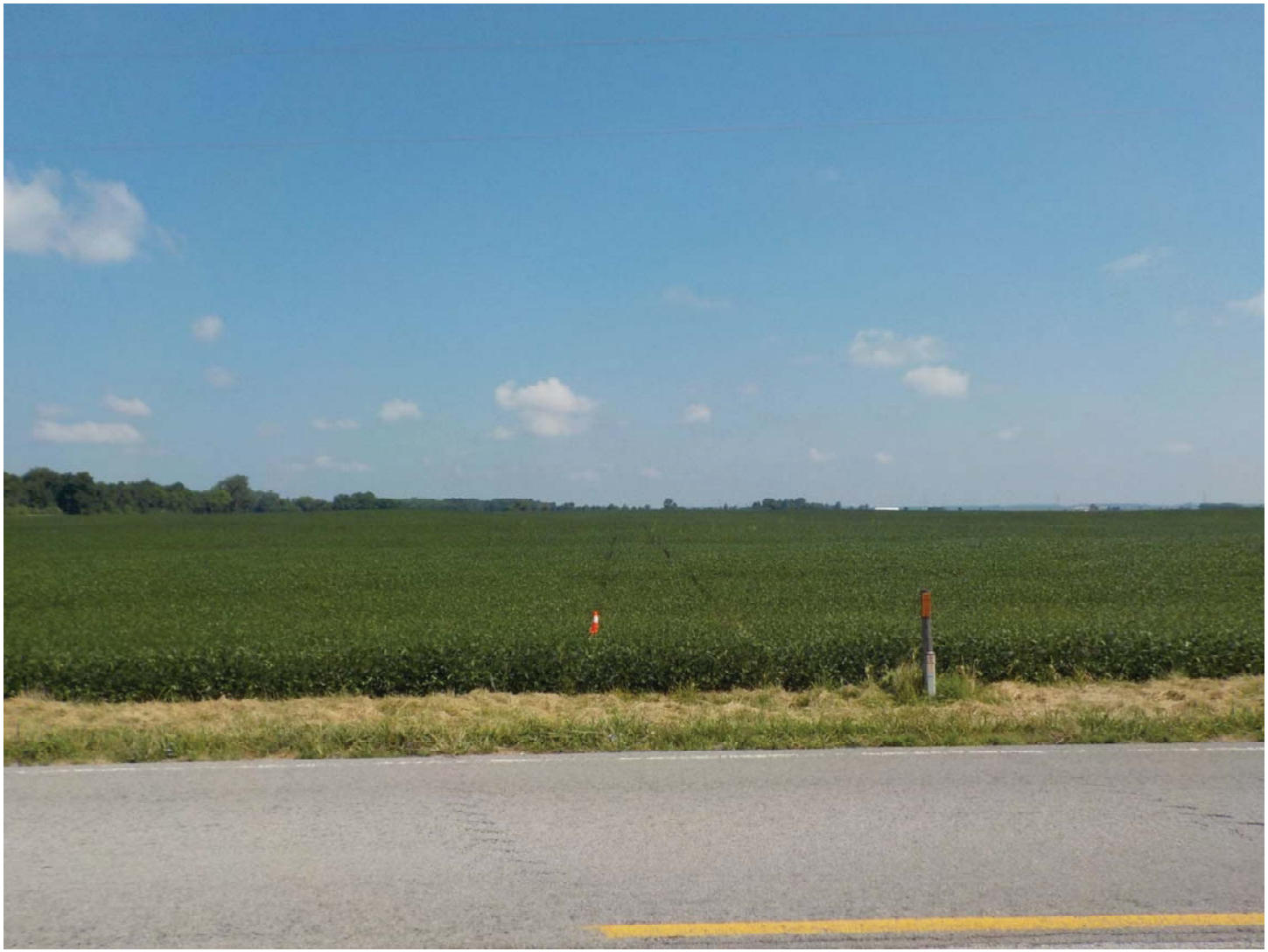
FIGURE 7. PHOTO LOCATION 2: COUNTY ROAD 75 - PROPOSED CONDITIONS

TRC
Results you can rely on



VIEWPOINT LOCATION MAP

PROPOSED CONDITIONS

TECHNICAL INFORMATION

Viewpoint Coordinates in	1,599,978 E
OH NAD83 North State Feet	348,685 N
Viewpoint Location	Location 3
Viewer Eye Elevation	1,010 ft msl
Distance to Project	2,638 ft
Camera Model	COOLPIX W100 V1.5
Lens Setting	30 mm
Date/Time	7-24-2018/10:39 am

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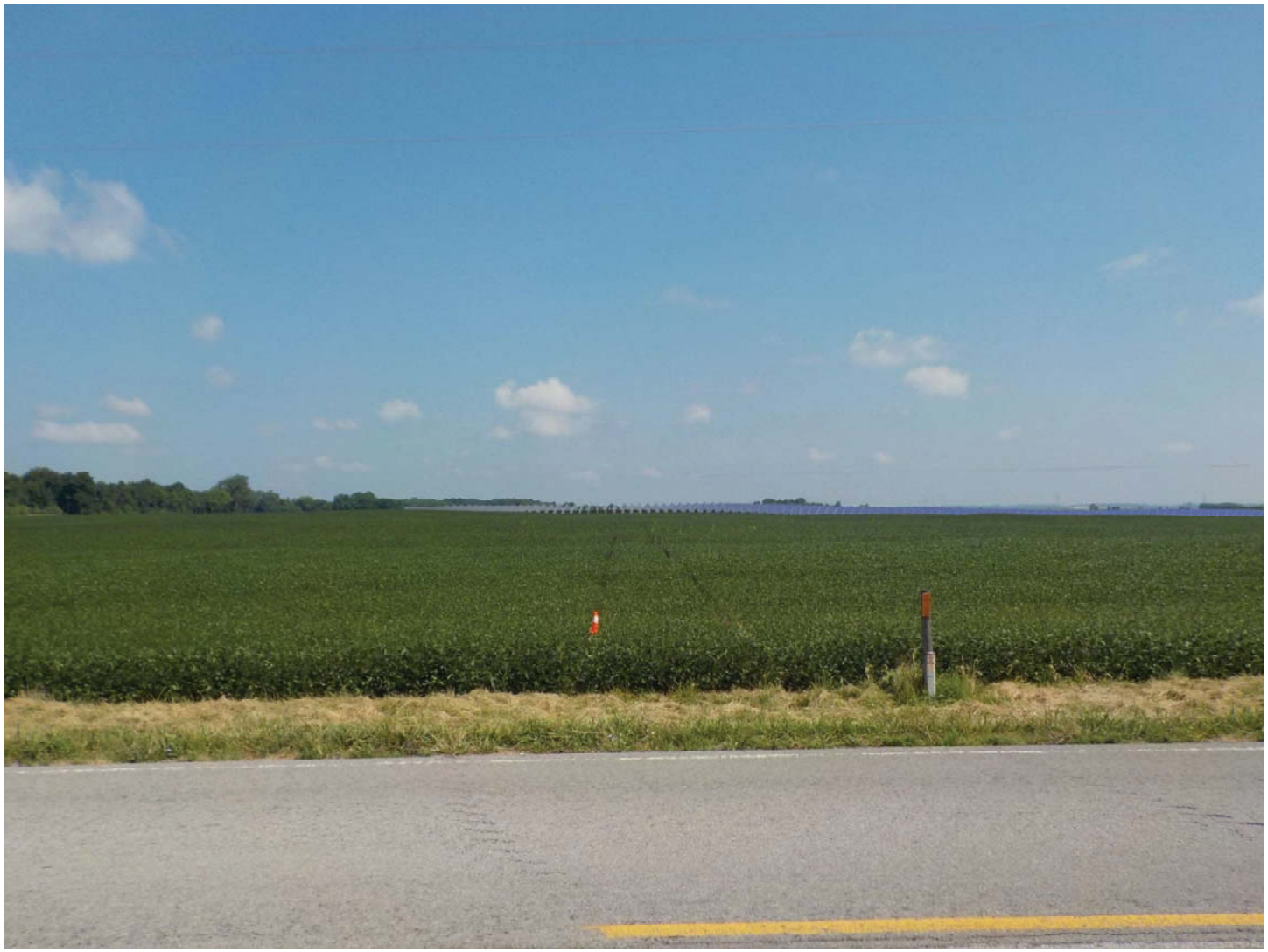
FIGURE 8. PHOTO LOCATION 3: STATE ROAD 195 - EXISTING CONDITIONS

TRC Results you can rely on



VIEWPOINT LOCATION MAP

EXISTING CONDITIONS

TECHNICAL INFORMATION

Viewpoint Coordinates in	1,599,978 E
OH NAD83 North State Feet	348,685 N
Viewpoint Location	Location 3
Viewer Eye Elevation	1,010 ft msl
Distance to Project	2,638 ft
Camera Model	COOLPIX W100 V1.5
Lens Setting	30 mm
Date/Time	7-24-2018/10:39 am

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FIGURE 9. PHOTO LOCATION 3: STATE ROAD 195 - PROPOSED CONDITIONS

TRC Results you can rely on

VIEWPOINT LOCATION MAP

PROPOSED CONDITIONS

TECHNICAL INFORMATION

Viewpoint Coordinates in	1,593,068 E
OH NAD83 North State Feet	367,223 N
Viewpoint Location	Location 4
Viewer Eye Elevation	995 ft msl
Distance to Project	8,346 ft
Camera Model	COOLPIX W100 V1.5
Lens Setting	30 mm
Date/Time	7-24-2018/12:42 pm

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FIGURE 10. PHOTO LOCATION 4: STATE ROAD 235 - EXISTING CONDITIONS

TRC Results you can rely on

VIEWPOINT LOCATION MAP

EXISTING CONDITIONS

TECHNICAL INFORMATION

Viewpoint Coordinates in	1,593,068 E
OH NAD83 North State Feet	367,223 N
Viewpoint Location	Location 4
Viewer Eye Elevation	995 ft msl
Distance to Project	8,346 ft
Camera Model	COOLPIX W100 V1.5
Lens Setting	30 mm
Date/Time	7-24-2018/12:42 pm

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FIGURE 11. PHOTO LOCATION 4: STATE ROAD 235 - PROPOSED CONDITIONS

TRC Results you can rely on

4.3 CONCLUSION OF SIMULATIONS

Given the remote location of the site and the limited neighbors, the overall visual impact of the proposed facility remains minimal. The vegetation to the west of the Hardin Solar II Energy Center may shield the site from significant views from that direction, and the expanse of agricultural fields to the north, east and south minimize visual impacts. Views of the Project will likely be possible from various locations within the Village of McGuffey. Given the low-profile nature of solar projects and the lack of exiting major aesthetic or scenic resources in the study area, the aesthetic impacts of views of this Project should be minimal. Additional landscaping screening may be desired along the nearest edges of the Project to the Village of McGuffey if local concerns arise.

5.0 REFERENCES CITED

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Exhibit S

Glare Analysis October 2018

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Attorneys for Hardin Solar Energy II LLC

FORGESOLAR GLARE ANALYSIS

Project: **Hardin-OH**
A general glare analysis for the Hardin-OH solar site

Site configuration: **Hardin Solar Phase II**
Analysis conducted by Paul Thienpont (pthienpont@invenergyllc.com) at 00:02 on 02 Oct, 2018.

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
Flight path(s)	PASS	Flight path receptor(s) do not receive yellow glare
ATCT(s)	N/A	No ATCT receptors designated

Default glare analysis and observer eye characteristics are as follows:

- 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

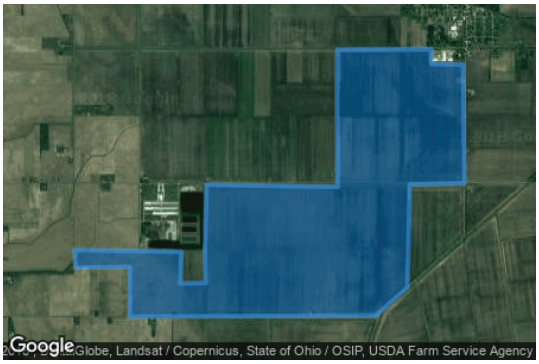
SITE CONFIGURATION

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: 7016.1188

PV Array(s)

Name: PV array 1
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: 0.0°
Rated power: -
Panel material: Light textured 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	40.667382	-83.842085	982.31	0.00	982.31
2	40.667187	-83.826592	968.97	0.00	968.97
3	40.663704	-83.826743	971.90	0.00	971.90
4	40.663785	-83.823084	967.54	0.00	967.54
5	40.667382	-83.823202	967.83	0.00	967.83
6	40.674543	-83.822945	965.21	0.00	965.21
7	40.674312	-83.804014	966.72	0.00	966.72
8	40.689348	-83.804014	960.73	0.00	960.73
9	40.689413	-83.790453	966.09	0.00	966.09
10	40.687786	-83.790453	967.38	0.00	967.38
11	40.687721	-83.785818	968.05	0.00	968.05
12	40.674703	-83.785647	966.65	0.00	966.65
13	40.674572	-83.793543	962.56	0.00	962.56
14	40.663310	-83.793886	966.86	0.00	966.86
15	40.660185	-83.798435	966.02	0.00	966.02
16	40.660055	-83.834055	974.13	0.00	974.13
17	40.665524	-83.834055	976.11	0.00	976.11
18	40.665458	-83.841866	983.17	0.00	983.17

Name: PV array 2
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: 0.0°
Rated power: -
Panel material: Light textured 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	40.651880	-83.800872	965.72	0.00	965.72
2	40.651001	-83.798340	965.34	0.00	965.34
3	40.652727	-83.789327	965.93	0.00	965.93
4	40.660150	-83.791559	964.50	0.00	964.50
5	40.663552	-83.792503	966.73	0.00	966.73
6	40.660622	-83.796966	969.18	0.00	969.18

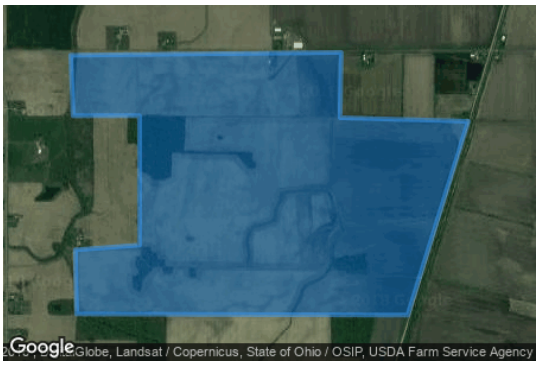
Name: PV array 3
Axis tracking: Single-axis rotation
Tracking axis orientation: 180.0°
Tracking axis tilt: 0.0°
Tracking axis panel offset: 0.0°
Max tracking angle: 60.0°
Resting angle: 0.0°
Rated power: -
Panel material: Light textured glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material

Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	40.637775	-83.806701	960.08	0.00	960.08
2	40.637677	-83.803912	969.96	0.00	969.96
3	40.644613	-83.800822	967.98	0.00	967.98
4	40.648000	-83.802496	961.76	0.00	961.76

Name: PV array 4
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: 0.0°
Rated power: -
Panel material: Light textured 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	40.652273	-83.827705	972.37	0.00	972.37
2	40.652338	-83.822812	969.17	0.00	969.17
3	40.659957	-83.822984	969.44	0.00	969.44
4	40.659957	-83.827705	973.21	0.00	973.21

Name: PV array 5
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: 0.0°
Rated power: -
Panel material: Light textured 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	40.637569	-83.817839	970.32	0.00	970.32
2	40.633987	-83.817924	970.05	0.00	970.05
3	40.633791	-83.808655	971.56	0.00	971.56
4	40.623146	-83.813032	970.76	0.00	970.76
5	40.623211	-83.836979	998.60	0.00	998.60
6	40.626729	-83.837065	997.29	0.00	997.29
7	40.626989	-83.832430	1002.98	0.00	1002.98
8	40.634089	-83.832430	994.14	0.00	994.14
9	40.634089	-83.837236	980.56	0.00	980.56
10	40.637411	-83.837408	979.83	0.00	979.83

Name: PV array 6
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: 0.0°
Rated power: -
Panel material: Light textured 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	40.625751	-83.801617	971.41	0.00	971.41
2	40.631028	-83.801187	967.92	0.00	967.92
3	40.636174	-83.796553	967.48	0.00	967.48
4	40.637346	-83.797239	967.84	0.00	967.84
5	40.639821	-83.785652	973.95	0.00	973.95
6	40.634741	-83.776812	986.16	0.00	986.16
7	40.634480	-83.779987	985.86	0.00	985.86
8	40.628162	-83.778957	984.41	0.00	984.41

Flight Path Receptor(s)

Name: Landing N to S
Description:
Threshold height: 50 ft
Direction: 220.5°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 180.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	40.614295	-83.639710	1004.83	50.00	1054.83
Two-mile	40.636280	-83.614945	970.74	637.55	1608.29

Name: Landing S to N
Description:
Threshold height: 50 ft
Direction: 41.2°
Glide slope: 3.0°
Pilot view restricted? Yes
Vertical view: 30.0°
Azimuthal view: 180.0°

Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	40.605254	-83.649623	1028.43	50.00	1078.43
Two-mile	40.583499	-83.674737	1086.59	545.30	1631.89

Discrete Observation Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (ft)	Height (ft)
OP 1	1	40.660138	-83.797583	955.84	0.00
OP 2	2	40.674917	-83.804249	966.35	0.00
OP 3	3	40.635848	-83.807853	971.63	0.00
OP 4	4	40.637672	-83.843073	997.46	0.00
OP 5	5	40.659878	-83.851141	990.98	0.00

GLARE ANALYSIS RESULTS

Summary of Glare

PV Array Name	Tilt (°)	Orient (°)	"Green" Glare min	"Yellow" Glare min	Energy kWh
PV array 1	SA tracking	SA tracking	319	1,102	-
PV array 2	SA tracking	SA tracking	1,492	0	-
PV array 3	SA tracking	SA tracking	725	0	-
PV array 4	SA tracking	SA tracking	426	50	-
PV array 5	SA tracking	SA tracking	283	4,461	-
PV array 6	SA tracking	SA tracking	700	154	-

Total annual glare received by each receptor

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
Landing N to S	498	0
Landing S to N	1211	0
OP 1	0	0
OP 2	0	0
OP 3	55	4426
OP 4	1255	178
OP 5	926	1163

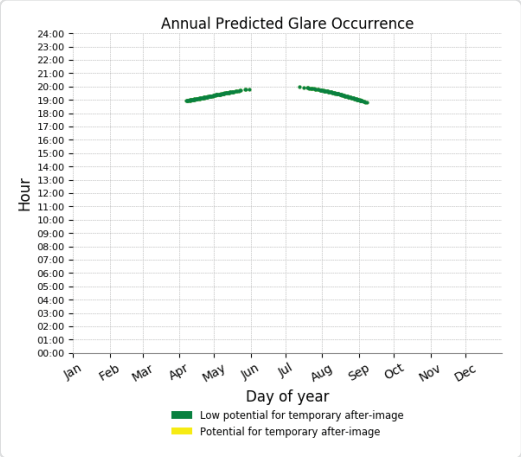
Results for: PV array 1

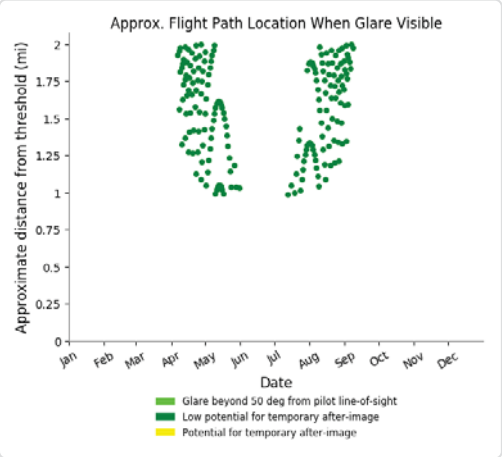
Receptor	Green Glare (min)	Yellow Glare (min)
Landing N to S	189	0
Landing S to N	130	0
OP 1	0	0
OP 2	0	0
OP 3	0	0

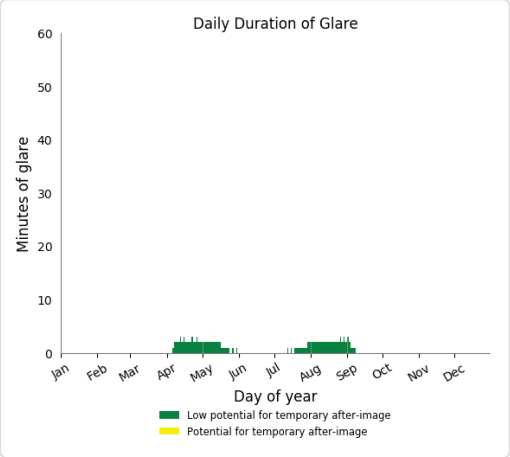
Receptor	Green Glare (min)	Yellow Glare (min)
OP 4	0	0
OP 5	0	1102

Flight Path: Landing N to S

0 minutes of yellow glare
189 minutes of green glare

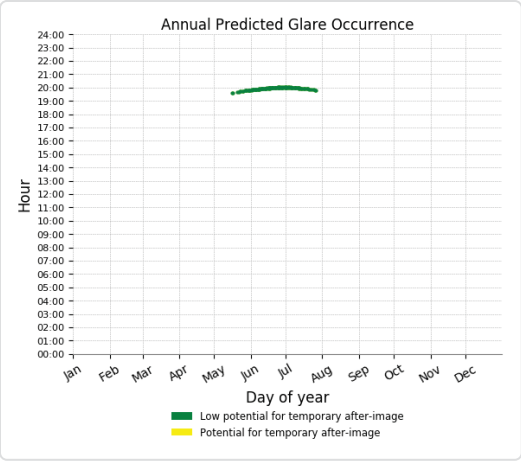


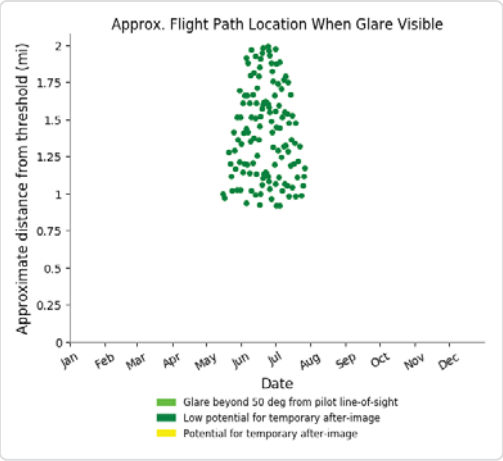


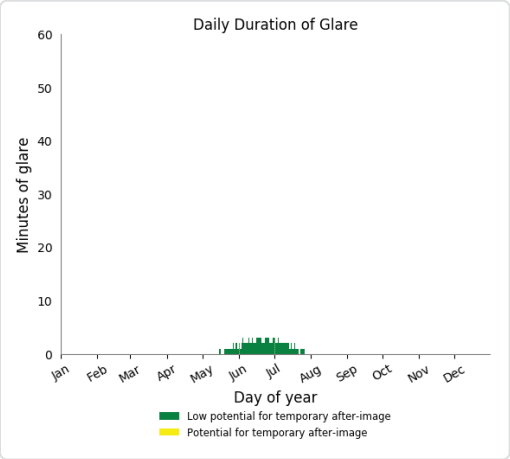


Flight Path: Landing S to N

0 minutes of yellow glare
130 minutes of green glare







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

Point Receptor: OP 3

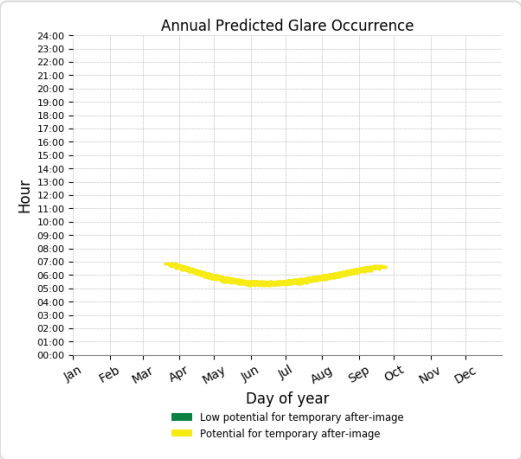
0 minutes of yellow glare
0 minutes of green glare

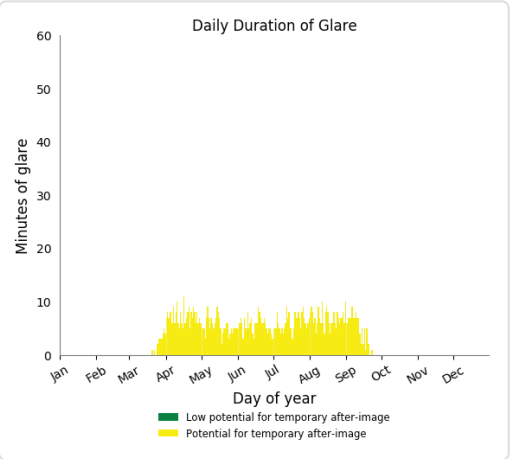
Point Receptor: OP 4

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 5

1102 minutes of yellow glare
0 minutes of green glare



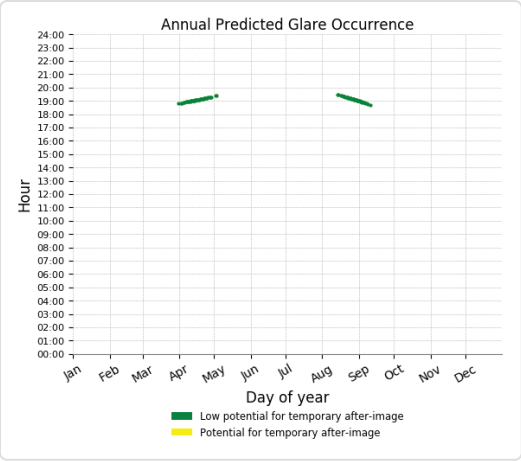


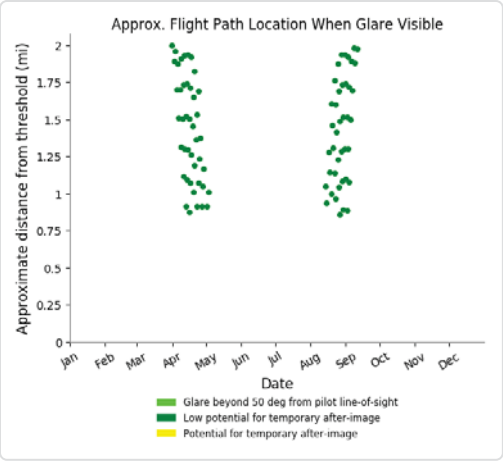
Results for: PV array 2

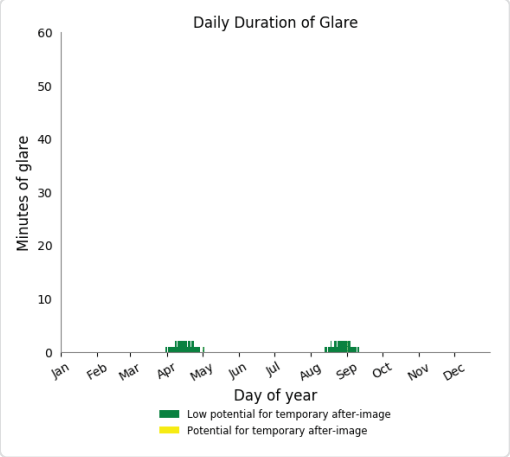
Receptor	Green Glare (min)	Yellow Glare (min)
Landing N to S	84	0
Landing S to N	117	0
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	930	0
OP 5	361	0

Flight Path: Landing N to S

0 minutes of yellow glare
84 minutes of green glare



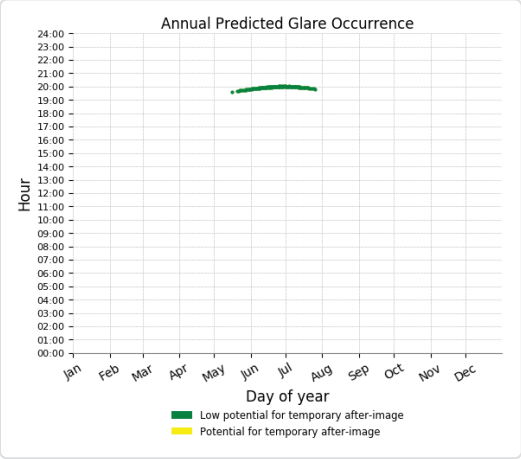


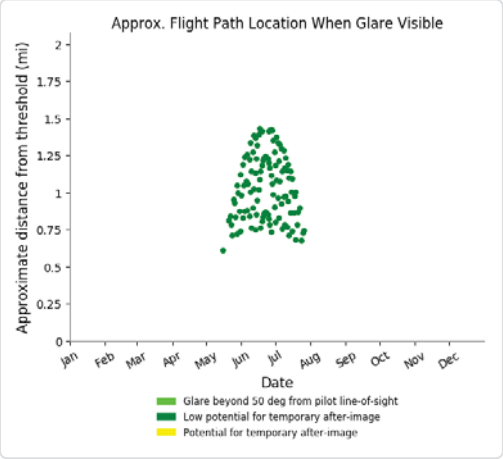


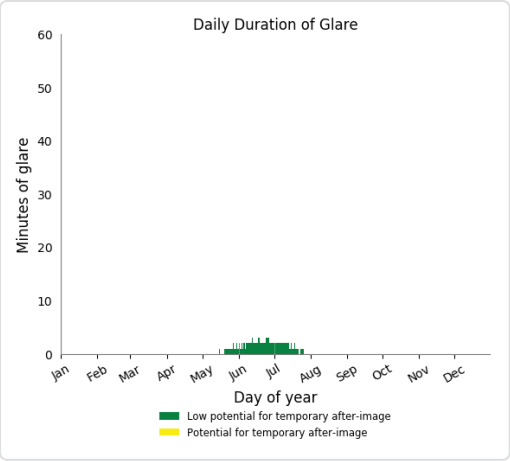
Flight Path: Landing S to N

0 minutes of yellow glare

117 minutes of green glare







Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

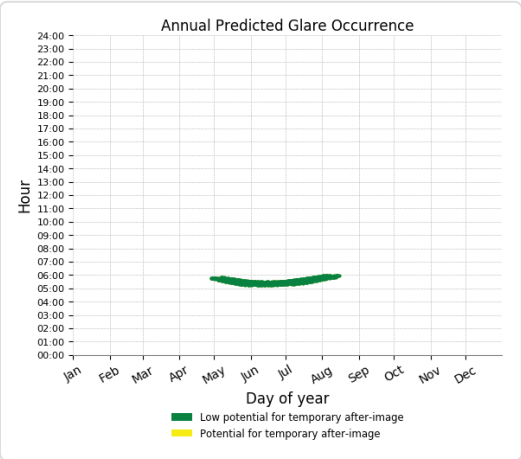
0 minutes of yellow glare
0 minutes of green glare

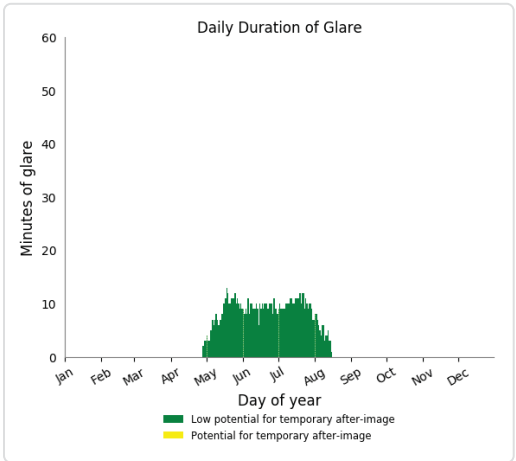
Point Receptor: OP 3

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 4

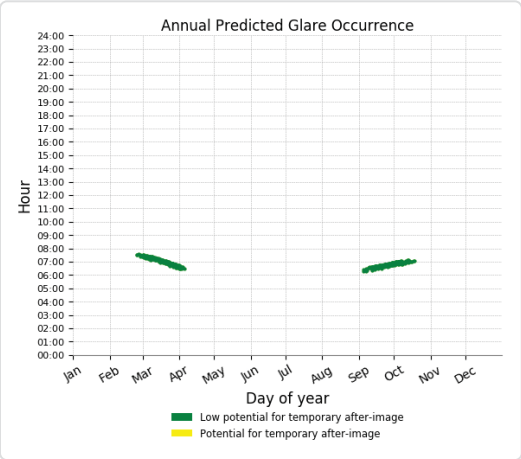
0 minutes of yellow glare
930 minutes of green glare

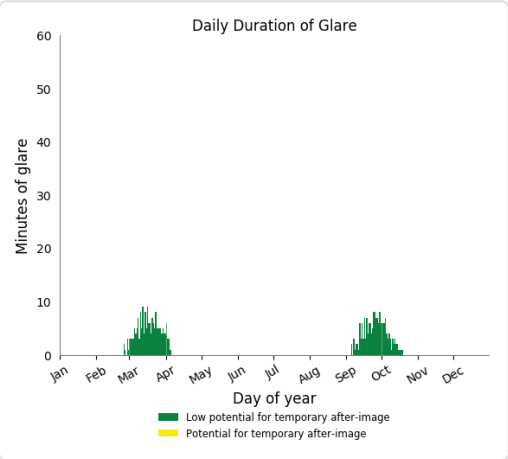




Point Receptor: OP 5

0 minutes of yellow glare
361 minutes of green glare



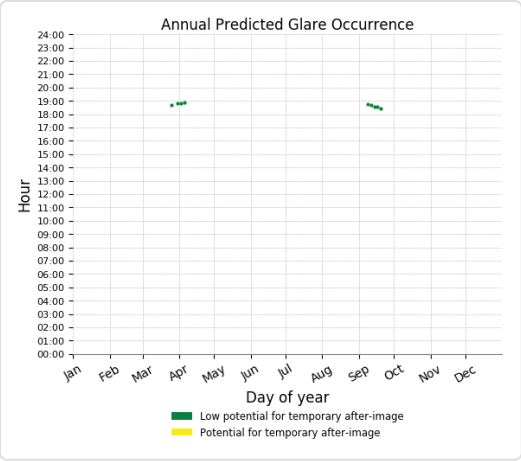


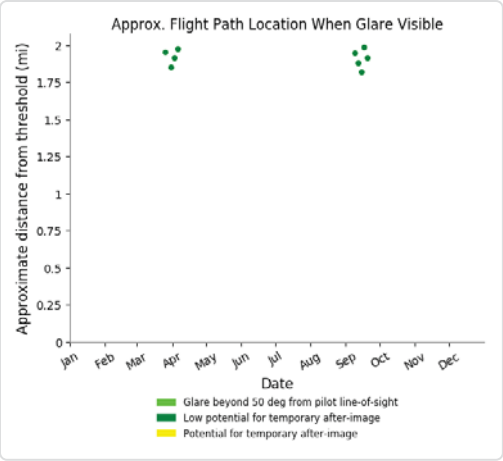
Results for: PV array 3

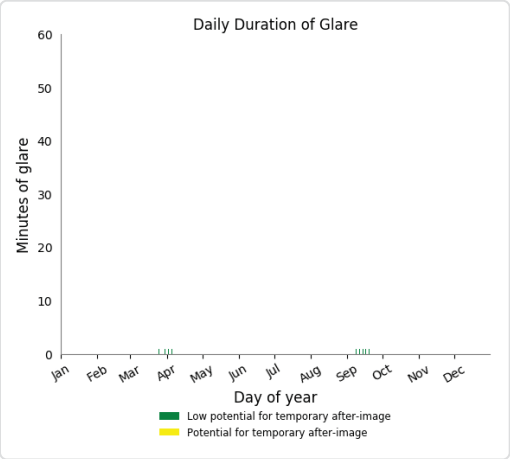
Receptor	Green Glare (min)	Yellow Glare (min)
Landing N to S	9	0
Landing S to N	118	0
OP 1	0	0
OP 2	0	0
OP 3	54	0
OP 4	270	0
OP 5	274	0

Flight Path: Landing N to S

0 minutes of yellow glare
9 minutes of green glare



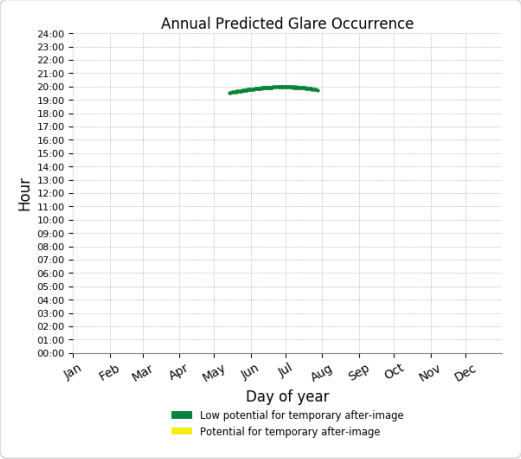


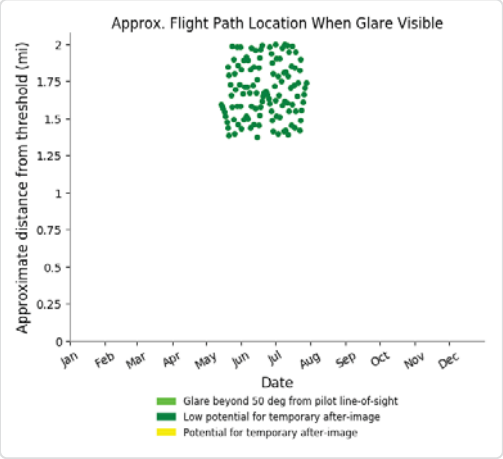


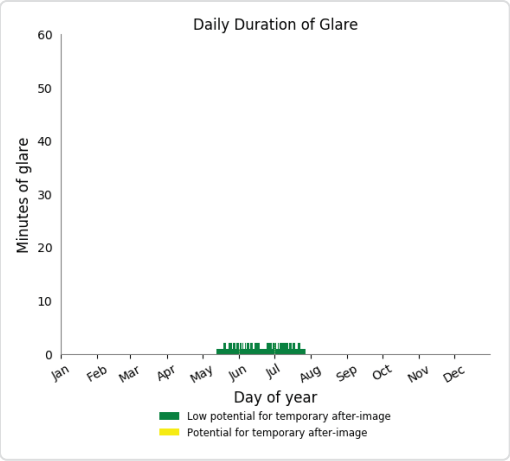
Flight Path: Landing S to N

0 minutes of yellow glare

118 minutes of green glare







Point Receptor: OP 1

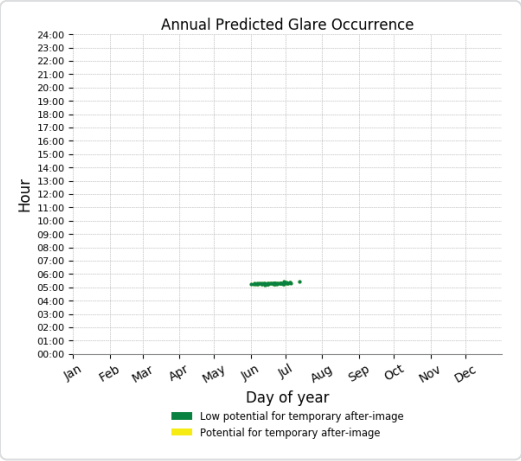
0 minutes of yellow glare
0 minutes of green glare

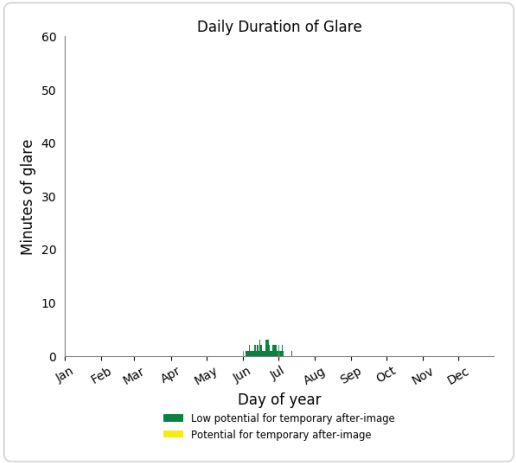
Point Receptor: OP 2

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 3

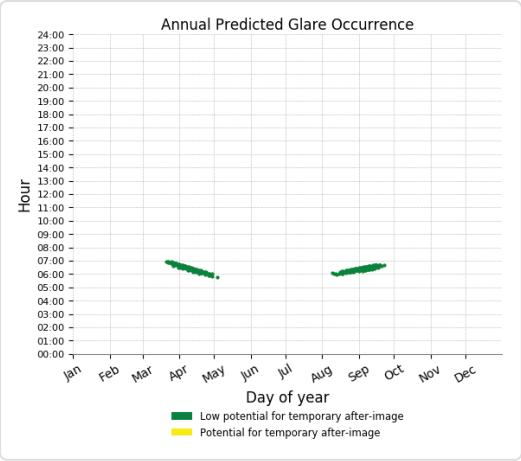
0 minutes of yellow glare
54 minutes of green glare

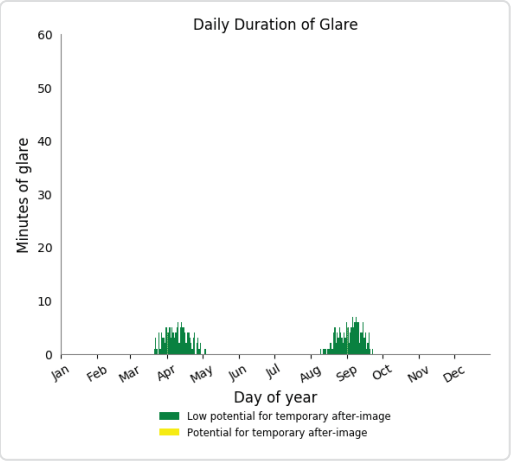




Point Receptor: OP 4

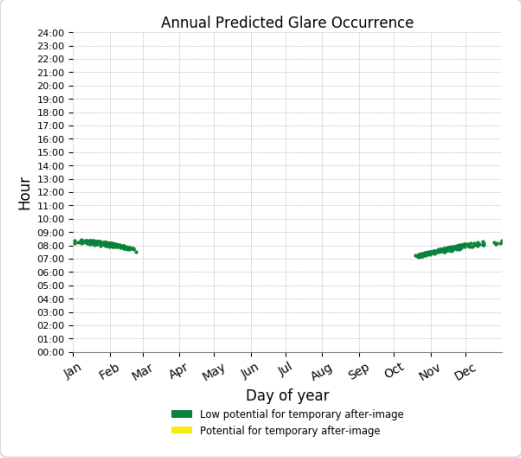
0 minutes of yellow glare
270 minutes of green glare

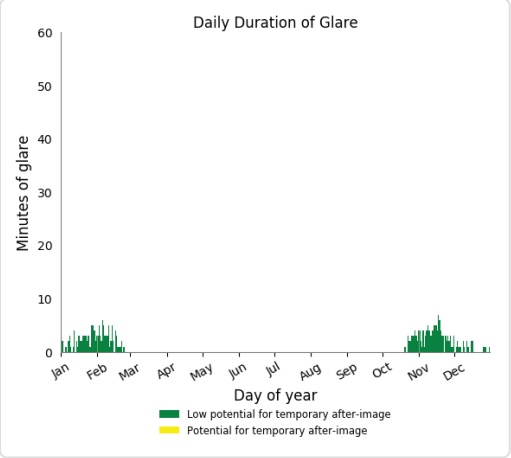




Point Receptor: OP 5

0 minutes of yellow glare
274 minutes of green glare





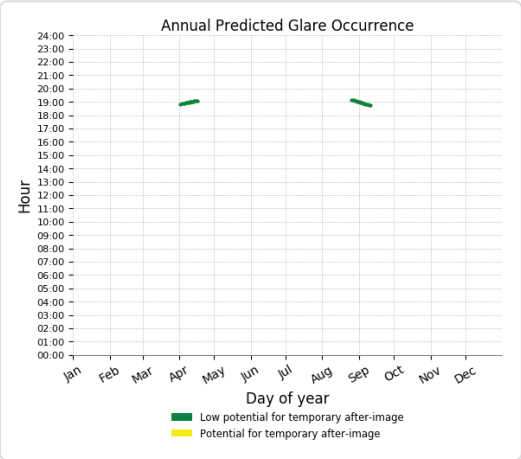
Results for: PV array 4

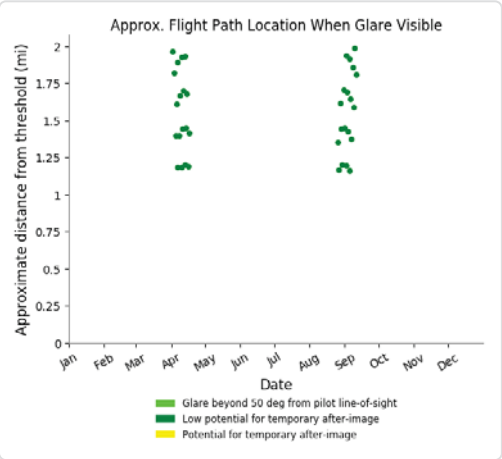
Receptor	Green Glare (min)	Yellow Glare (min)
Landing N to S	37	0
Landing S to N	170	0
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	0	0
OP 5	219	50

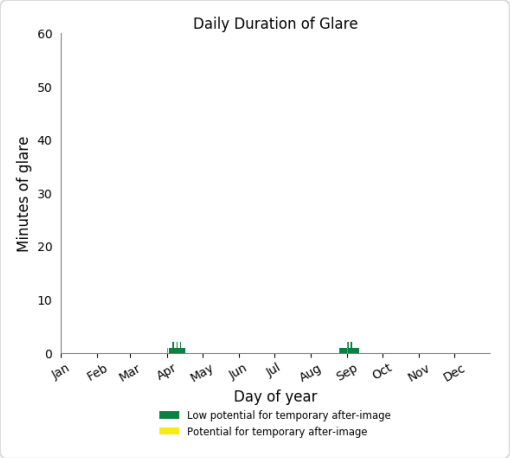
Flight Path: Landing N to S

0 minutes of yellow glare

37 minutes of green glare



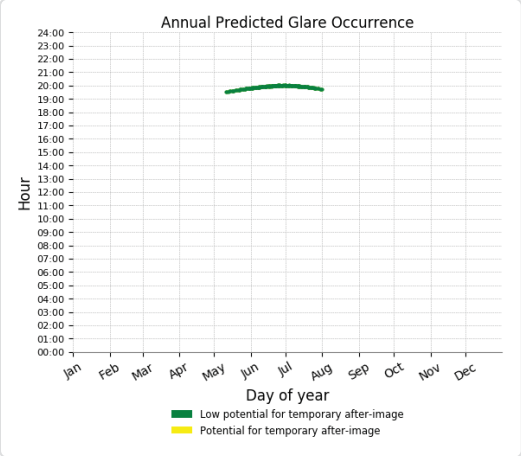


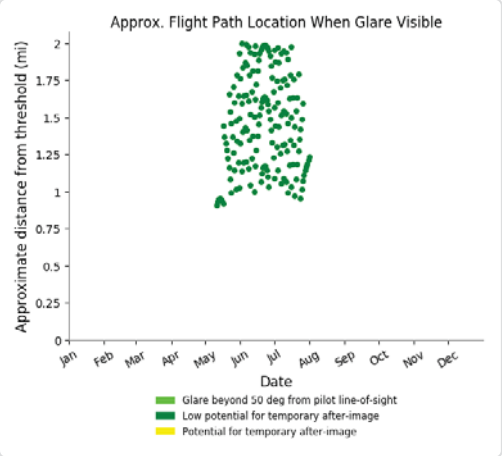


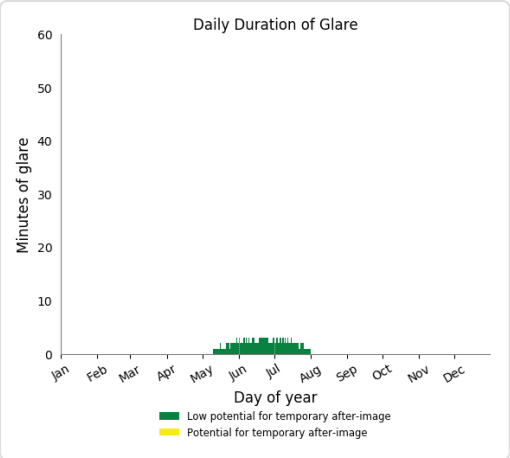
Flight Path: Landing S to N

0 minutes of yellow glare

170 minutes of green glare







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

Point Receptor: OP 3

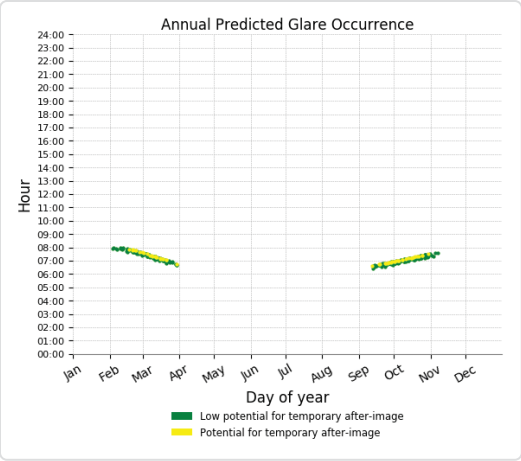
0 minutes of yellow glare
0 minutes of green glare

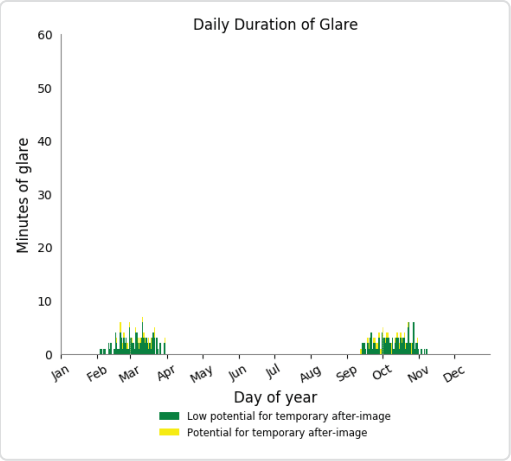
Point Receptor: OP 4

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 5

50 minutes of yellow glare
219 minutes of green glare





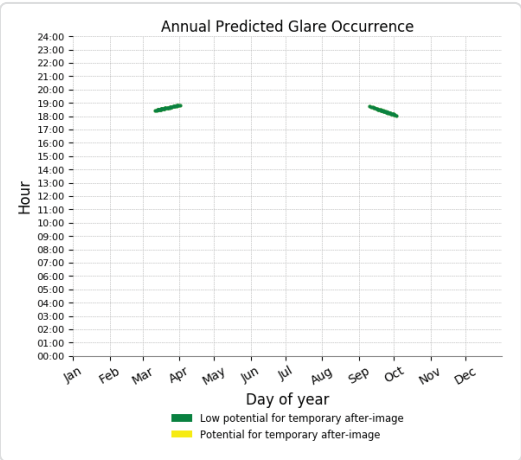
Results for: PV array 5

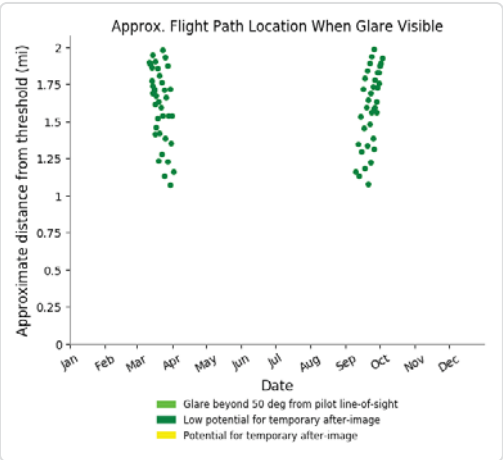
Receptor	Green Glare (min)	Yellow Glare (min)
Landing N to S	75	0
Landing S to N	207	0
OP 1	0	0
OP 2	0	0
OP 3	1	4426
OP 4	0	35
OP 5	0	0

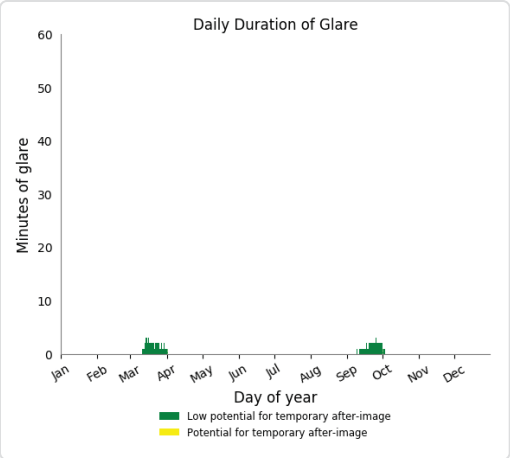
Flight Path: Landing N to S

0 minutes of yellow glare

75 minutes of green glare



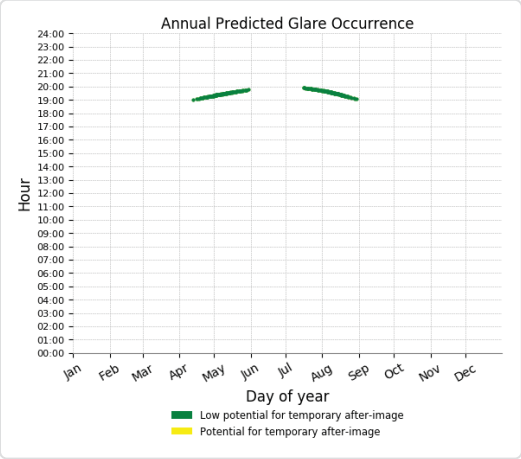


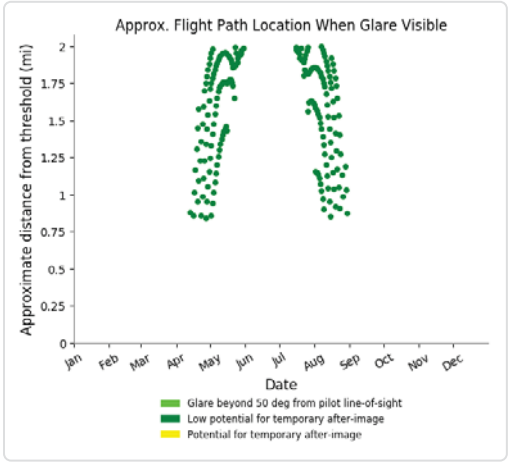


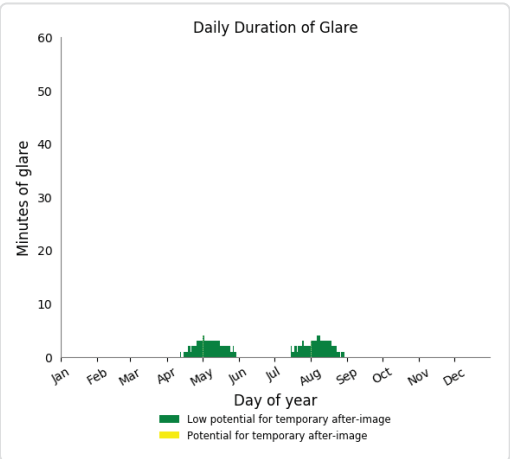
Flight Path: Landing S to N

0 minutes of yellow glare

207 minutes of green glare







Point Receptor: OP 1

0 minutes of yellow glare

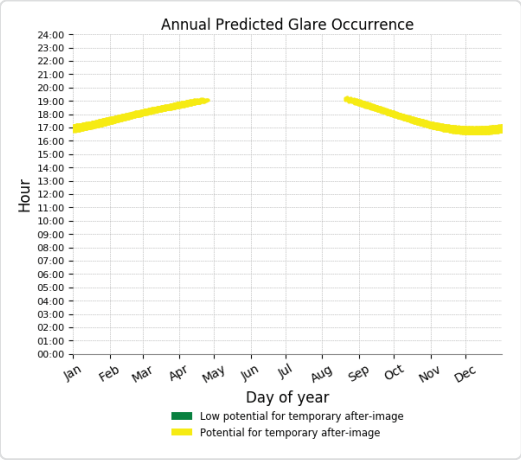
0 minutes of green glare

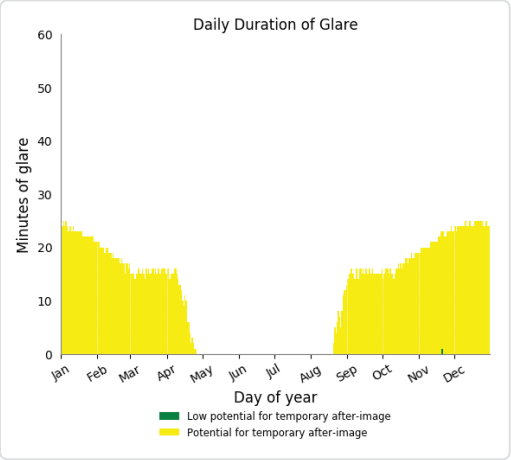
Point Receptor: OP 2

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 3

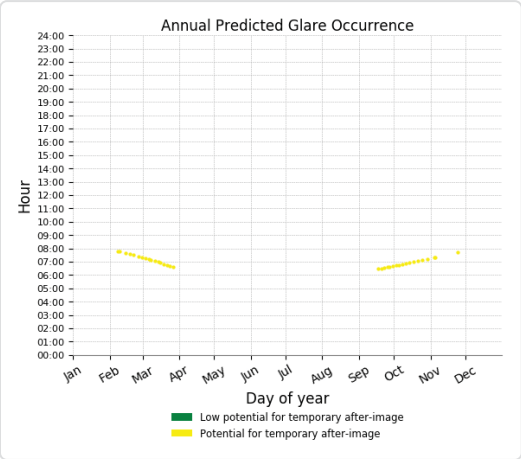
4426 minutes of yellow glare
1 minutes of green glare

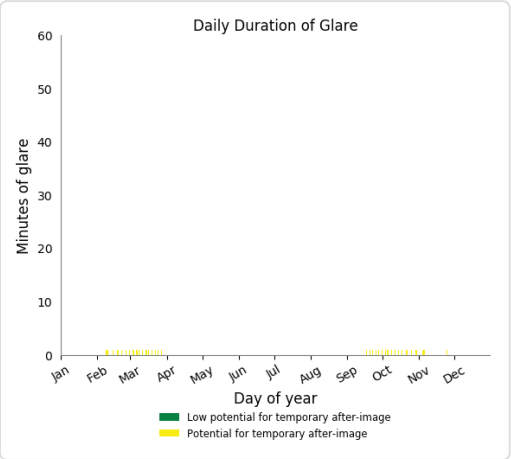




Point Receptor: OP 4

35 minutes of yellow glare
0 minutes of green glare





Point Receptor: OP 5

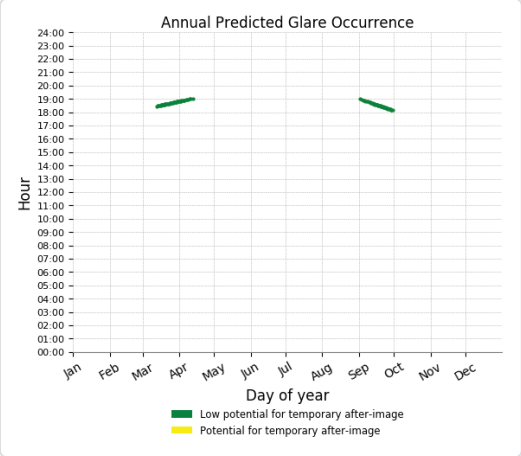
0 minutes of yellow glare
0 minutes of green glare

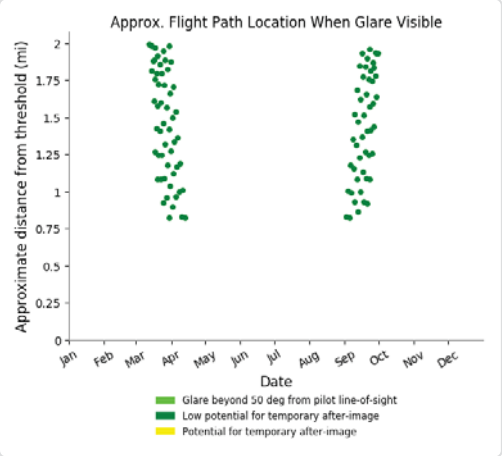
Results for: PV array 6

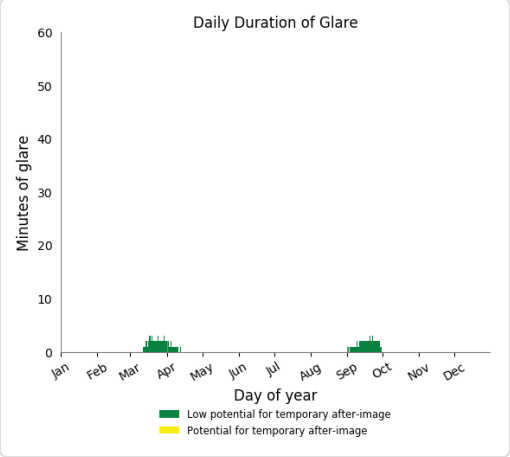
Receptor	Green Glare (min)	Yellow Glare (min)
Landing N to S	104	0
Landing S to N	469	0
OP 1	0	0
OP 2	0	0
OP 3	0	0
OP 4	55	143
OP 5	72	11

Flight Path: Landing N to S

0 minutes of yellow glare
104 minutes of green glare



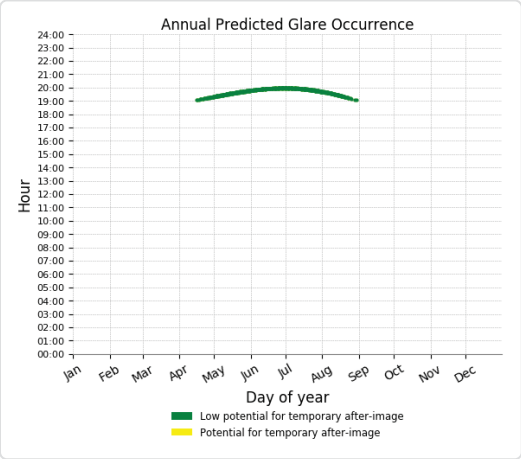


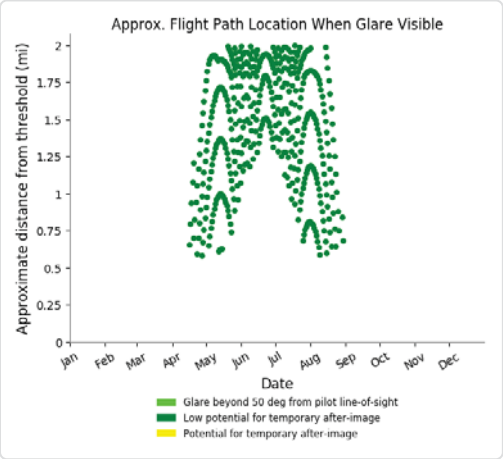


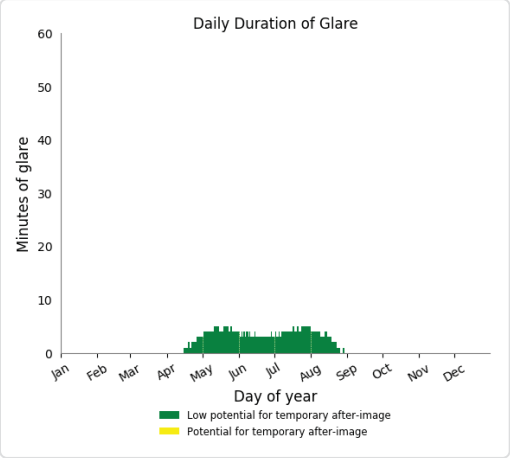
Flight Path: Landing S to N

0 minutes of yellow glare

469 minutes of green glare







Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

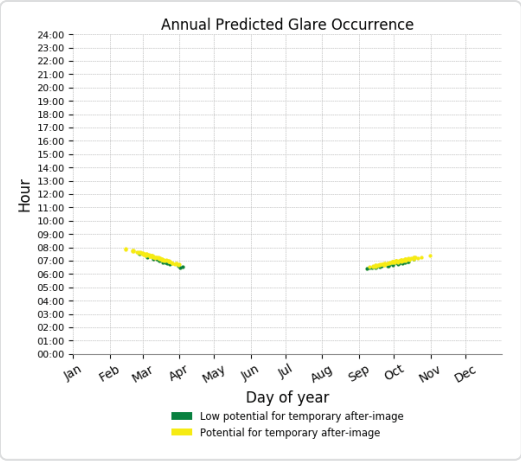
0 minutes of yellow glare
0 minutes of green glare

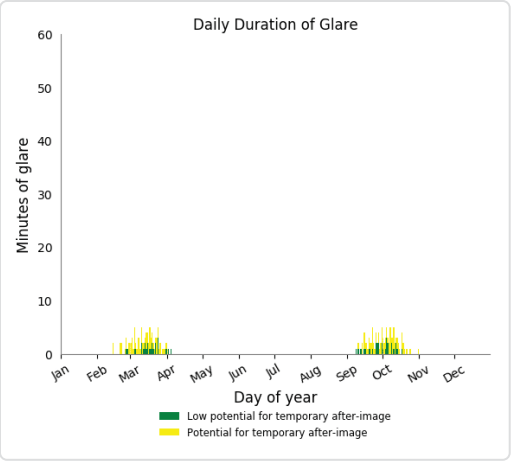
Point Receptor: OP 3

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 4

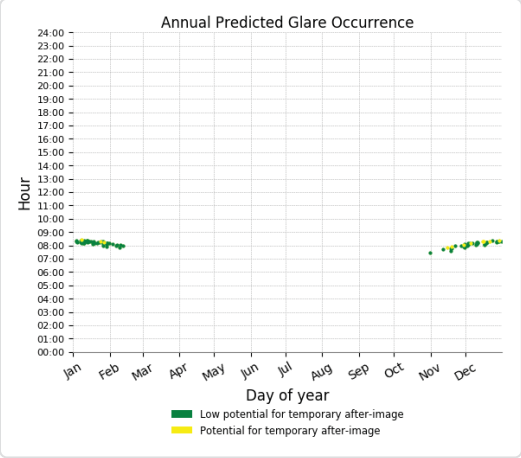
143 minutes of yellow glare
55 minutes of green glare

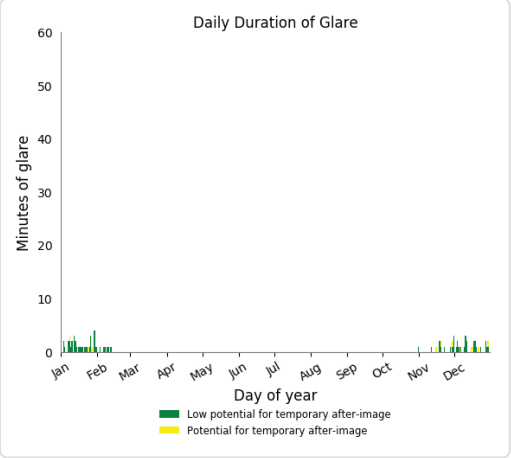




Point Receptor: OP 5

11 minutes of yellow glare
72 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.
The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual values 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.

Hardin Solar Energy II LLC
Case No. 18-1360-EL-BGN

Exhibit T

ODNR-DOW National Heritage Database July 2018

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July 2, 2018

Justin Pitts
TRC
921 Eastwind Drive, Suite 122
Westerville, Ohio 43081

Re: 18-722; Hardin Solar II Energy Center Project

Project: The proposed project encompasses approximately 3,554 acres for the siting of the photovoltaic (PV) solar facility.

Location: The proposed project is located in Marion Township, Hardin County, Ohio.

The Ohio Department of Natural Resources (ODNR) has completed a review of the above referenced project. These comments were generated by an inter-disciplinary review within the Department. These comments have been prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), the National Environmental Policy Act, the Coastal Zone Management Act, Ohio Revised Code and other applicable laws and regulations. These comments are also based on ODNR's experience as the state natural resource management agency and do not supersede or replace the regulatory authority of any local, state or federal agency nor relieve the applicant of the obligation to comply with any local, state or federal laws or regulations.

Natural Heritage Database: The Natural Heritage Database has no records at or within a one-mile radius of the project area.

A review of the Ohio Natural Heritage Database indicates there are no other records of state endangered or threatened plants or animals within the project area. There are also no records of state potentially threatened plants, special interest or species of concern animals, or any federally listed species. In addition, we are unaware of any unique ecological sites, geologic features, animal assemblages, scenic rivers, state wildlife areas, state nature preserves, state or national parks, state or national forests, national wildlife refuges, or other protected natural areas within the project area. The review was performed on the project area you specified in your request as well as an additional one-mile radius. Records searched date from 1980.

Please note that Ohio has not been completely surveyed and we rely on receiving information from many sources. Therefore, a lack of records for any particular area is not a statement that rare species or unique features are absent from that area. Although all types of plant communities have been surveyed, we only maintain records on the highest quality areas.

Fish and Wildlife: The Division of Wildlife (DOW) has the following comments.

The DOW recommends that impacts to wetlands and other water resources be avoided and minimized to the fullest extent possible, and that best management practices be utilized to minimize erosion and sedimentation.

The project is within the range of the Indiana bat (*Myotis sodalis*), a state endangered and federally endangered species. The following species of trees have relatively high value as potential Indiana bat roost trees to include: shagbark hickory (*Carya ovata*), shellbark hickory (*Carya laciniosa*), bitternut hickory (*Carya cordiformis*), black ash (*Fraxinus nigra*), green ash (*Fraxinus pennsylvanica*), white ash (*Fraxinus americana*), shingle oak (*Quercus imbricaria*), northern red oak (*Quercus rubra*), slippery elm (*Ulmus rubra*), American elm (*Ulmus americana*), eastern cottonwood (*Populus deltoides*), silver maple (*Acer saccharinum*), sassafras (*Sassafras albidum*), post oak (*Quercus stellata*), and white oak (*Quercus alba*). Indiana bat roost trees consists of trees that include dead and dying trees with exfoliating bark, crevices, or cavities in upland areas or riparian corridors and living trees with exfoliating bark, cavities, or hollow areas formed from broken branches or tops. However, Indiana bats are also dependent on the forest structure surrounding roost trees. If suitable habitat occurs within the project area, the DOW recommends trees be conserved. If suitable habitat occurs within the project area and trees must be cut, the DOW recommends cutting occur between October 1 and March 31. If suitable trees must be cut during the summer months, the DOW recommends a net survey be conducted between May 15 and August 15, prior to any cutting. Net surveys should incorporate either nine net nights per square 0.5 kilometer of project area, or four net nights per kilometer for linear projects. If no tree removal is proposed, this project is not likely to impact this species.

The project is within the range of the clubshell (*Pleurobema clava*), a state endangered and federally endangered mussel, the rayed bean (*Villosa fabalis*), a state endangered and federally endangered mussel, the purple lilliput (*Toxolasma lividus*), a state endangered mussel, and the pondhorn (*Uniomerus tetralasmus*), a state threatened mussel. This project must not have an impact on freshwater native mussels at the project site. This applies to both listed and non-listed species. Per the Ohio Mussel Survey Protocol (2016), all Group 2, 3, and 4 streams (Appendix A) require a mussel survey. Per the Ohio Mussel Survey Protocol, Group 1 streams (Appendix A) and unlisted streams with a watershed of 10 square miles or larger above the point of impact should be assessed using the Reconnaissance Survey for Unionid Mussels (Appendix B) to determine if mussels are present. Mussel surveys may be recommended for these streams as well. This is further explained within the Ohio Mussel Survey Protocol. Therefore, if in-water work is planned in any stream that meets any of the above criteria, the DOW recommends the applicant provide information to indicate no mussel impacts will occur. If this is not possible, the DOW recommends a professional malacologist conduct a mussel survey in the project area. If mussels that cannot be avoided are found in the project area, as a last resort, the DOW recommends a professional malacologist collect and relocate the mussels to suitable and similar habitat upstream of the project site. Mussel surveys and any subsequent mussel relocation should be done in accordance with the Ohio Mussel Survey Protocol. The Ohio Mussel Survey Protocol (2016) can be found at:

http://wildlife.ohiodnr.gov/portals/wildlife/pdfs/licenses%20&%20permits/OH%20Mussel%20Survey%20Protocol.pdf

The project is within the range of the eastern massasauga (*Sistrurus catenatus*), a state endangered and a federal candidate snake species. The eastern massasauga uses a range of

habitats including wet prairies, fens, and other wetlands, as well as drier upland habitat. Due to the location, the type of habitat present at the project site and within the vicinity of the project area, and the type of work proposed, this project is not likely to impact this species.

The project is within the range of the upland sandpiper (*Bartramia longicauda*), a state endangered bird. Nesting upland sandpipers utilize dry grasslands including native grasslands, seeded grasslands, grazed and ungrazed pasture, hayfields, and grasslands established through the Conservation Reserve Program (CRP). If this type of habitat will be impacted, construction should be avoided in this habitat during the species' nesting period of April 15 to July 31. If this type of habitat will not be impacted, the project is not likely to impact this species.

The project is within the range of the northern harrier (*Circus cyaneus*), a state endangered bird. This is a common migrant and winter species. Nesters are much rarer, although they occasionally breed in large marshes and grasslands. Harriers often nest in loose colonies. The female builds a nest out of sticks on the ground, often on top of a mound. Harriers hunt over grasslands. If this type of habitat will be impacted, construction should be avoided in this habitat during the species' nesting period of May 15 to August 1. If this habitat will not be impacted, the project is not likely to impact this species.

Due to the potential of impacts to federally listed species, as well as to state listed species, we recommend that this project be coordinated with the U.S. Fish & Wildlife Service.

Water Resources: The Division of Water Resources has the following comment.

The local floodplain administrator should be contacted concerning the possible need for any floodplain permits or approvals for this project. Your local floodplain administrator contact information can be found at the website below.

http://water.ohiodnr.gov/portals/soilwater/pdf/floodplain/Floodplain%20Manager%20Community%20Contact%20List_8_16.pdf

ODNR appreciates the opportunity to provide these comments. Please contact John Kessler at (614) 265-6621 if you have questions about these comments or need additional information.

John Kessler
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Columbus, Ohio 43229-6693
John.Kessler@dnr.state.oh.us

Summary: Application Part 6 of 6, Exhibits R through T electronically filed by Christine M.T. Pirik on behalf of Hardin Solar Energy II LLC