Appendix 7F: Aviation Receptor Glare (10 Deg)

ForgeSolar

Kingston Solar Farm

Kingston Solar Farm Aviation

Created July 27, 2021
Updated Aug. 9, 2021
Time-step 1 minute
Timezone offset UTC0
Site ID 56739.10138

Project type Advanced
Project status: active
Category 10 MW to 100 MW

Misc. Analysis Settings

DNI: **varies (1,000.0 W/m^2 peak)**
Ocular transmission coefficient: **0.5**
Pupil diameter: **0.002 m**
Eye focal length: **0.017 m**
Sun subtended angle: **9.3 mrad**

Analysis Methodologies:
- Observation point: **Version 2**
- 2-Mile Flight Path: **Version 2**
- Route: **Version 2**

Summary of Results Glare with low potential for temporary after-image predicted

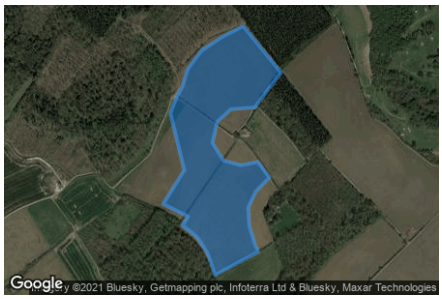
PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced
	deg	deg	min	min	kWh
Central PV Array	10.0	180.0	2,420	0	-
Eastern PV Array	10.0	180.0	677	0	-
Southern PV Array	10.0	180.0	1,805	0	-
Western PV Array	10.0	180.0	3,872	0	-

Component Data

PV Array(s)

Total PV footprint area: 652,007 m^2

Name: Central PV Array
Axis tracking: Fixed (no rotation)
Tilt: 10.0 deg
Orientation: 180.0 deg
Footprint area: 132,824 m^2
Rated power: -
Panel material: Light textured glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 9.16 mrad



Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	52.848987	-1.201839	96.58	2.80	99.38
2	52.847743	-1.200166	96.44	2.80	99.24
3	52.846810	-1.201324	93.14	2.80	95.94
4	52.846758	-1.202397	91.84	2.80	94.64
5	52.846421	-1.202998	90.05	2.80	92.85
6	52.845851	-1.203213	89.14	2.80	91.94
7	52.845385	-1.202719	89.74	2.80	92.54
8	52.845255	-1.201947	90.82	2.80	93.62
9	52.845346	-1.201196	92.07	2.80	94.87
10	52.844931	-1.200681	91.18	2.80	93.98
11	52.844555	-1.201282	89.97	2.80	92.77
12	52.844127	-1.201625	88.30	2.80	91.10
13	52.843648	-1.201582	86.48	2.80	89.28
14	52.843129	-1.201324	84.47	2.80	87.27
15	52.842935	-1.201174	82.65	2.80	85.45
16	52.842313	-1.203084	80.74	2.80	83.54
17	52.842896	-1.203427	84.27	2.80	87.07
18	52.843324	-1.203878	87.66	2.80	90.46
19	52.843648	-1.204543	86.76	2.80	89.56
20	52.843881	-1.204286	86.82	2.80	89.62
21	52.844218	-1.205401	81.43	2.80	84.23
22	52.845125	-1.204457	85.10	2.80	87.90
23	52.846655	-1.205080	82.01	2.80	84.81
24	52.847056	-1.204822	85.02	2.80	87.82
25	52.847367	-1.204543	86.44	2.80	89.24
26	52.847834	-1.204307	87.45	2.80	90.25
27	52.848326	-1.203706	91.82	2.80	94.62
28	52.848702	-1.202762	92.71	2.80	95.51

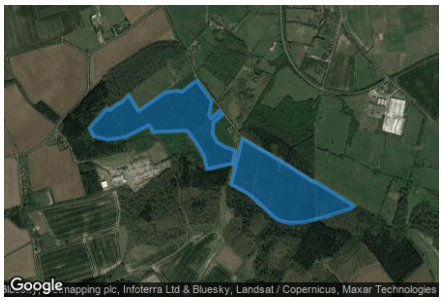
Name: Eastern PV Array
Axis tracking: Fixed (no rotation)
Tilt: 10.0 deg
Orientation: 180.0 deg
Footprint area: 105,300 m^2
Rated power: -
Panel material: Light textured glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 9.16 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	52.848995	-1.197688	96.44	2.80	99.24
2	52.848360	-1.197387	95.39	2.80	98.19
3	52.847479	-1.197044	94.28	2.80	97.08
4	52.846818	-1.196615	93.25	2.80	96.05
5	52.846325	-1.196164	92.60	2.80	95.40
6	52.846196	-1.195714	92.11	2.80	94.91
7	52.845807	-1.194877	92.17	2.80	94.97
8	52.845379	-1.194061	92.96	2.80	95.76
9	52.844991	-1.192388	93.06	2.80	95.86
10	52.844991	-1.191959	93.08	2.80	95.88
11	52.844330	-1.192688	93.00	2.80	95.80
12	52.843889	-1.193461	93.10	2.80	95.90
13	52.843254	-1.194469	92.64	2.80	95.44
14	52.845613	-1.198203	94.92	2.80	97.72
15	52.846001	-1.197580	95.01	2.80	97.81
16	52.847777	-1.199941	96.64	2.80	99.44

Name: Southern PV Array
Axis tracking: Fixed (no rotation)
Tilt: 10.0 deg
Orientation: 180.0 deg
Footprint area: 63,120 m^2
Rated power: -
Panel material: Light textured glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 9.16 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	52.843772	-1.195693	91.46	2.80	94.26
2	52.843111	-1.194663	93.99	2.80	96.79
3	52.842683	-1.195564	92.28	2.80	95.08
4	52.842152	-1.196315	91.71	2.80	94.51
5	52.841426	-1.196980	91.38	2.80	94.18
6	52.840713	-1.197624	90.47	2.80	93.27
7	52.840441	-1.197838	90.31	2.80	93.11
8	52.840182	-1.199212	88.30	2.80	91.10
9	52.840013	-1.199641	87.99	2.80	90.79
10	52.839741	-1.199791	87.54	2.80	90.34
11	52.839443	-1.199984	88.09	2.80	90.89
12	52.840052	-1.201014	83.30	2.80	86.10
13	52.840480	-1.200993	78.20	2.80	81.00
14	52.840648	-1.200735	79.17	2.80	81.97
15	52.840804	-1.200134	82.43	2.80	85.23
16	52.841024	-1.199576	84.40	2.80	87.20
17	52.841452	-1.199104	85.12	2.80	87.92
18	52.841996	-1.198890	83.52	2.80	86.32
19	52.842359	-1.198418	85.08	2.80	87.88
20	52.842657	-1.197881	87.03	2.80	89.83

Name: Western PV Array
Axis tracking: Fixed (no rotation)
Tilt: 10.0 deg
Orientation: 180.0 deg
Footprint area: 350,763 m^2
Rated power: -
Panel material: Light textured glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 9.16 mrad



Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	52.857326	-1.226006	85.78	2.80	88.58
2	52.856276	-1.227551	83.98	2.80	86.78
3	52.855836	-1.227186	83.12	2.80	85.92
4	52.855641	-1.225941	78.84	2.80	81.64
5	52.855797	-1.224396	78.16	2.80	80.96
6	52.856445	-1.222251	83.48	2.80	86.28
7	52.856069	-1.221907	79.29	2.80	82.09
8	52.856147	-1.218860	82.71	2.80	85.51
9	52.855343	-1.217938	79.35	2.80	82.15
10	52.854760	-1.217358	81.43	2.80	84.23
11	52.854086	-1.217122	83.25	2.80	86.05
12	52.854281	-1.215706	85.51	2.80	88.31
13	52.854384	-1.214891	86.05	2.80	88.85
14	52.854247	-1.214556	86.06	2.80	88.86
15	52.853288	-1.215007	86.17	2.80	88.97
16	52.852861	-1.213676	85.74	2.80	88.54
17	52.852679	-1.213247	86.03	2.80	88.83
18	52.852096	-1.212153	85.92	2.80	88.72
19	52.851500	-1.211080	86.35	2.80	89.15
20	52.851332	-1.210608	86.08	2.80	88.88
21	52.851228	-1.209750	86.36	2.80	89.16
22	52.851254	-1.208591	87.09	2.80	89.89
23	52.851500	-1.206917	88.98	2.80	91.78
24	52.851993	-1.204342	93.00	2.80	95.80
25	52.852135	-1.204042	94.13	2.80	96.93
26	52.853392	-1.207411	90.98	2.80	93.78
27	52.853431	-1.207754	90.78	2.80	93.58
28	52.854364	-1.210114	89.71	2.80	92.51
29	52.855349	-1.212947	88.27	2.80	91.07
30	52.855723	-1.213975	88.26	2.80	91.06
31	52.854443	-1.214484	85.99	2.80	88.79
32	52.854502	-1.214806	85.93	2.80	88.73
33	52.855104	-1.214613	86.27	2.80	89.07
34	52.855273	-1.215471	85.97	2.80	88.77
35	52.855545	-1.216244	86.11	2.80	88.91
36	52.855985	-1.216619	86.33	2.80	89.13
37	52.856554	-1.216551	86.52	2.80	89.32
38	52.857007	-1.215735	84.90	2.80	87.70
39	52.857201	-1.216057	84.81	2.80	87.61
40	52.856787	-1.216723	86.58	2.80	89.38
41	52.856955	-1.216937	86.63	2.80	89.43
42	52.857694	-1.216701	81.71	2.80	84.51
43	52.858821	-1.218031	78.47	2.80	81.27
44	52.858225	-1.219319	86.14	2.80	88.94
45	52.858277	-1.219855	85.88	2.80	88.68
46	52.858173	-1.220842	86.53	2.80	89.33
47	52.857188	-1.223202	86.58	2.80	89.38
48	52.858031	-1.224082	87.46	2.80	90.26
49	52.857661	-1.224672	87.59	2.80	90.39
50	52.857532	-1.225155	86.72	2.80	89.52
51	52.857234	-1.225734	86.78	2.80	89.58

2-Mile Flight Path Receptor(s)

Name: East Mid RWY 09
Description:
Threshold height : 15 m
Direction: 88.7 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	52.830639	-1.349593	92.74	15.24	107.98
2-mile point	52.829963	-1.397491	74.96	201.70	276.67

Name: East Mid RWY 27
Description:
Threshold height : 15 m
Direction: 268.1 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	52.831468	-1.306421	84.58	15.24	99.82
2-mile point	52.832432	-1.258535	32.71	235.79	268.50

Name: Nott City RWY 03
Description:
Threshold height : 15 m
Direction: 27.4 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	52.916652	-1.079635	34.64	15.24	49.88
2-mile point	52.890985	-1.101735	40.14	178.42	218.56

Name: Nott City RWY 09
Description:
Threshold height : 15 m
Direction: 88.5 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	52.920676	-1.085407	38.37	15.24	53.61
2-mile point	52.919929	-1.133401	40.12	182.18	222.30

Name: Nott City RWY 21
Description:
Threshold height : 15 m
Direction: 208.0 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	52.923121	-1.073798	26.98	15.24	42.22
2-mile point	52.948652	-1.051265	20.31	190.59	210.90

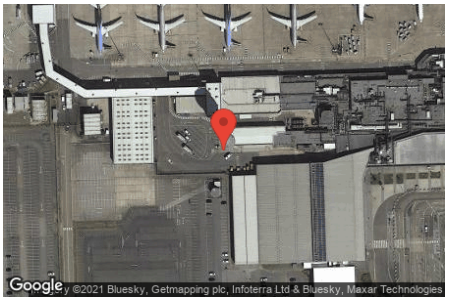
Name: Nott City RWY 27
Description:
Threshold height : 15 m
Direction: 269.2 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	52.920857	-1.072983	26.73	15.24	41.97
2-mile point	52.921286	-1.024978	55.87	154.78	210.66

Discrete Observation Receptors

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	m	m	m
1-ATCT	52.826280	-1.332135	86.47	51.00	137.47

1-ATCT map image



Summary of PV Glare Analysis

PV configuration and total predicted glare

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced	Data File
	deg	deg	min	min	kWh	
Central PV Array	10.0	180.0	2,420	0	-	-
Eastern PV Array	10.0	180.0	677	0	-	-
Southern PV Array	10.0	180.0	1,805	0	-	-
Western PV Array	10.0	180.0	3,872	0	-	-

Distinct glare per month

Excludes overlapping glare from PV array for multiple receptors at matching time(s)

PV	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
central-pv-a (green)	0	0	27	720	150	0	0	643	251	0	0	0
central-pv-a (yellow)	0	0	0	0	0	0	0	0	0	0	0	0
eastern-pv-a (green)	0	0	8	330	0	0	0	231	108	0	0	0
eastern-pv-a (yellow)	0	0	0	0	0	0	0	0	0	0	0	0
southern-pv (green)	0	0	68	617	0	0	0	375	314	0	0	0
southern-pv (yellow)	0	0	0	0	0	0	0	0	0	0	0	0
western-pv-a (green)	0	0	0	443	659	653	656	662	40	0	0	0
western-pv-a (yellow)	0	0	0	0	0	0	0	0	0	0	0	0

PV & Receptor Analysis Results

Results for each PV array and receptor

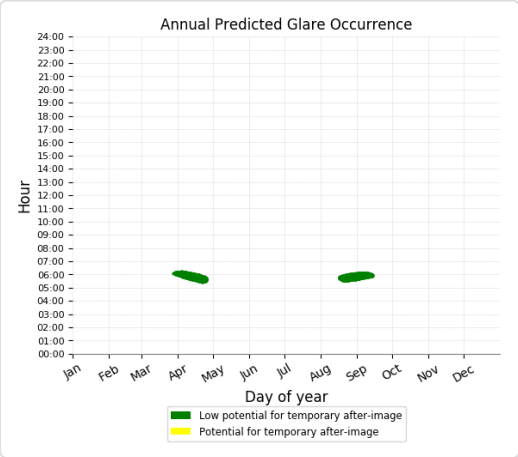
Central PV Array low potential for temporary after-image

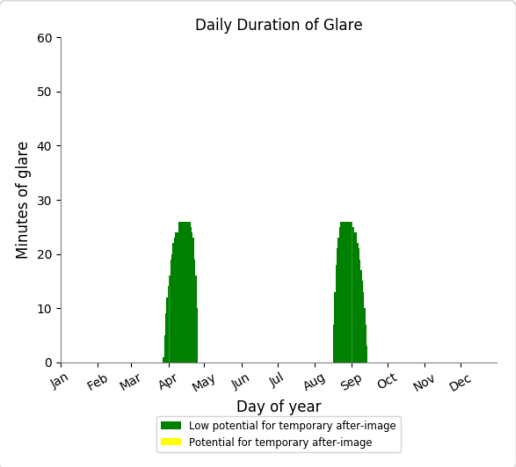
Component	Green glare (min)	Yellow glare (min)
FP: East Mid RWY 09	1182	0
FP: East Mid RWY 27	0	0
FP: Nott City RWY 03	0	0
FP: Nott City RWY 09	0	0
FP: Nott City RWY 21	0	0
FP: Nott City RWY 27	0	0
OP: 1-ATCT	1238	0

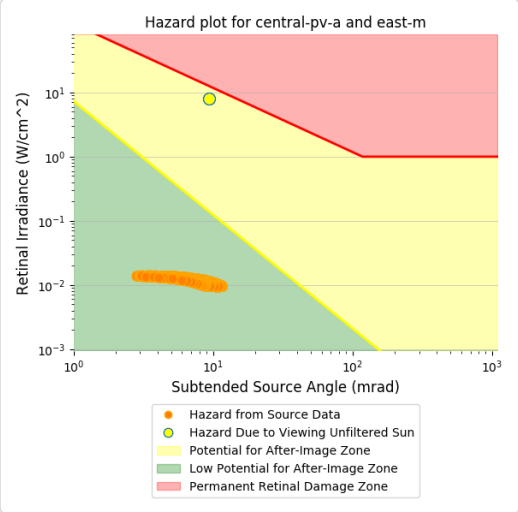
Central PV Array - Receptor (East Mid RWY 09)

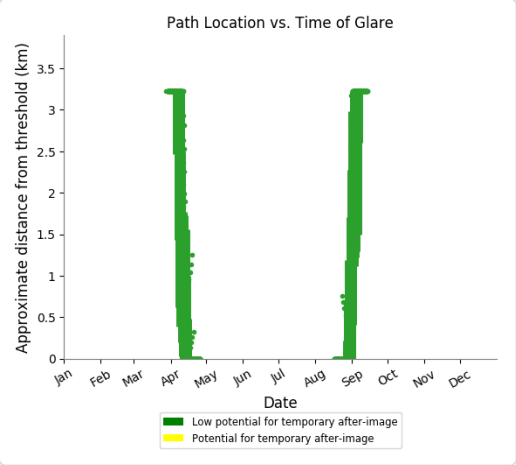
PV array is expected to produce the following glare for observers on this flight path:

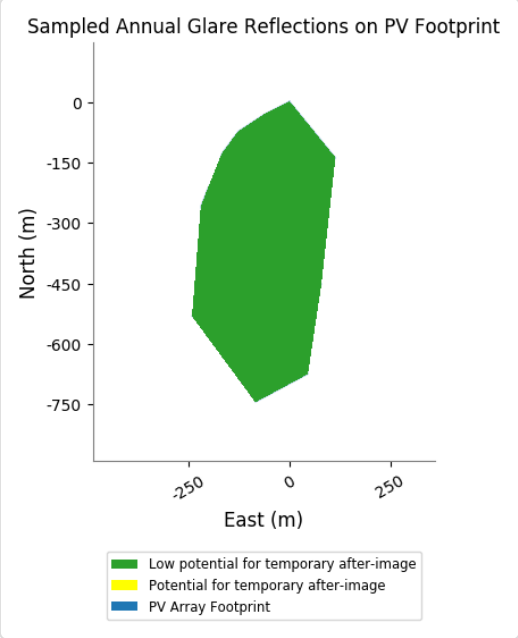
- 1,182 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.

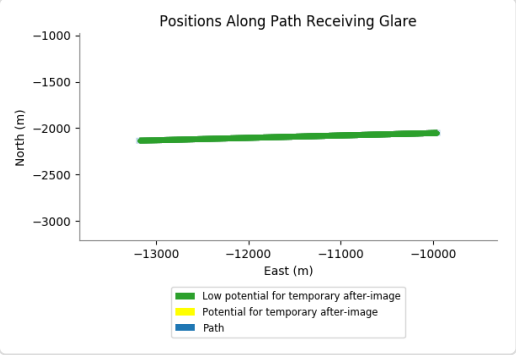












Central PV Array - Receptor (East Mid RWY 27)

No glare found

Central PV Array - Receptor (Nott City RWY 03)

No glare found

Central PV Array - Receptor (Nott City RWY 09)

No glare found

Central PV Array - Receptor (Nott City RWY 21)

No glare found

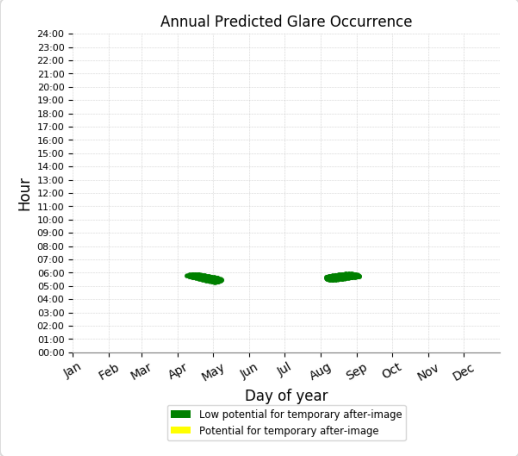
Central PV Array - Receptor (Nott City RWY 27)

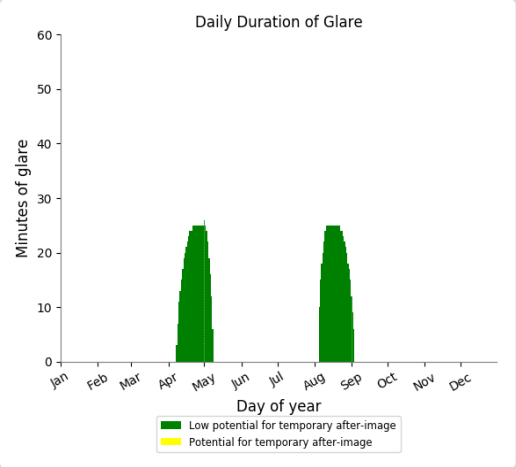
No glare found

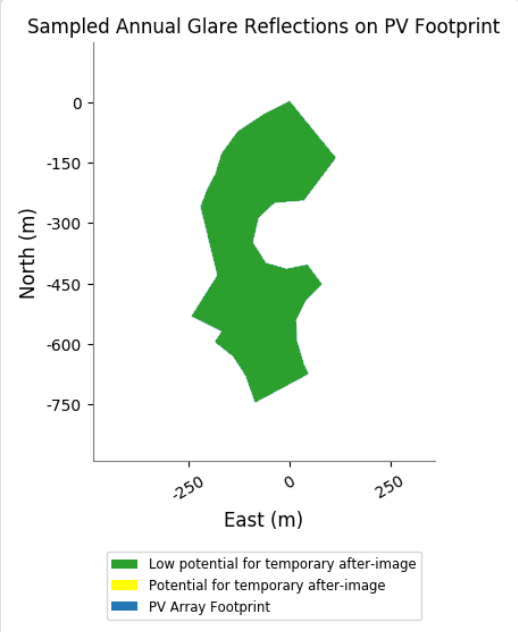
Central PV Array - OP Receptor (1-ATCT)

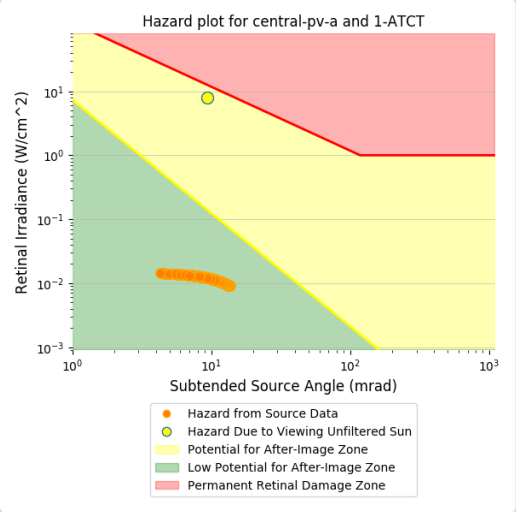
PV array is expected to produce the following glare for receptors at this location:

- 1,238 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.









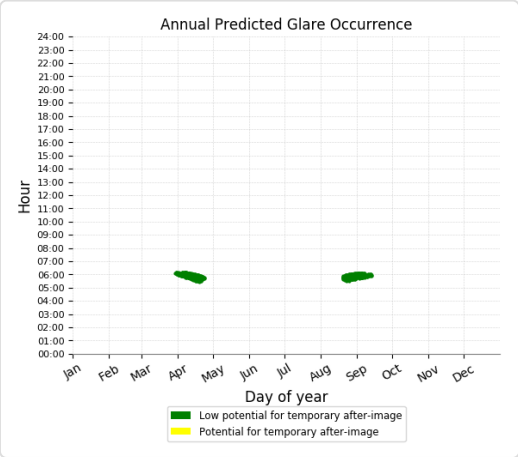
Eastern PV Array low potential for temporary after-image

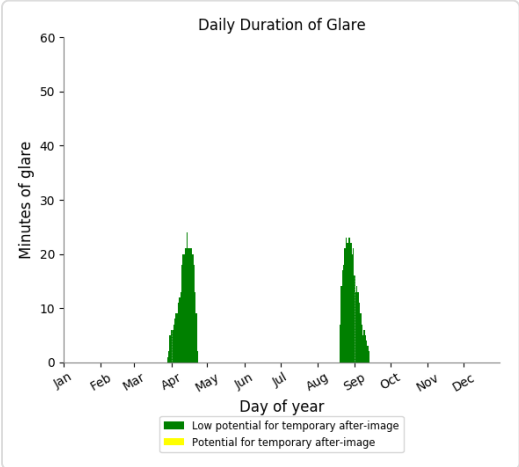
Component	Green glare (min)	Yellow glare (min)
FP: East Mid RWY 09	677	0
FP: East Mid RWY 27	0	0
FP: Nott City RWY 03	0	0
FP: Nott City RWY 09	0	0
FP: Nott City RWY 21	0	0
FP: Nott City RWY 27	0	0
OP: 1-ATCT	0	0

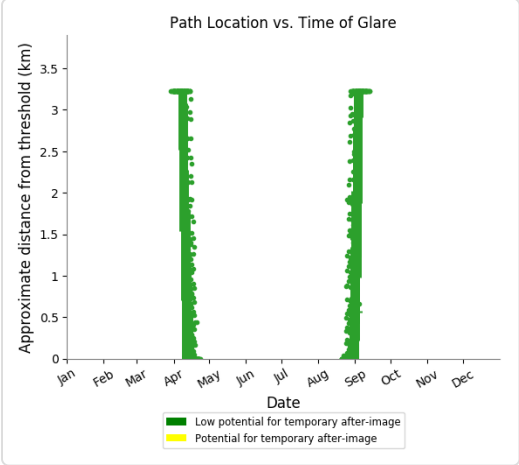
Eastern PV Array - Receptor (East Mid RWY 09)

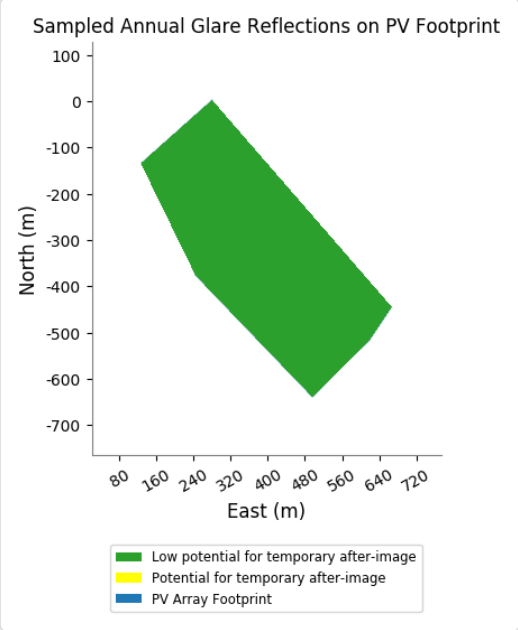
PV array is expected to produce the following glare for observers on this flight path:

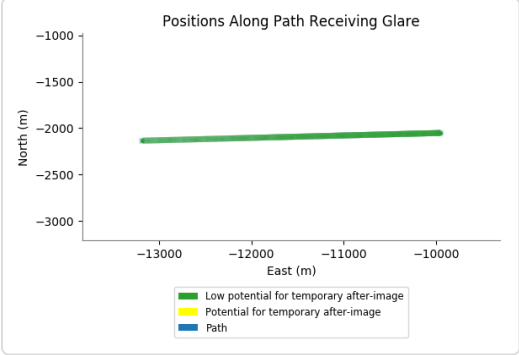
- 677 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.











Eastern PV Array - Receptor (East Mid RWY 27)

No glare found

Eastern PV Array - Receptor (Nott City RWY 03)

No glare found

Eastern PV Array - Receptor (Nott City RWY 09)

No glare found

Eastern PV Array - Receptor (Nott City RWY 21)

No glare found

Eastern PV Array - Receptor (Nott City RWY 27)

No glare found

Eastern PV Array - OP Receptor (1-ATCT)

No glare found

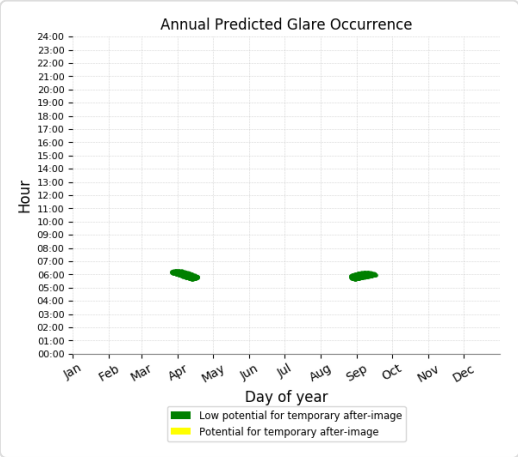
Southern PV Array low potential for temporary after-image

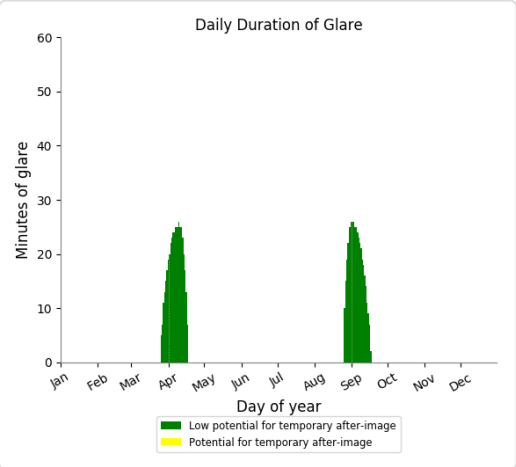
Component	Green glare (min)	Yellow glare (min)
FP: East Mid RWY 09	861	0
FP: East Mid RWY 27	0	0
FP: Nott City RWY 03	0	0
FP: Nott City RWY 09	0	0
FP: Nott City RWY 21	0	0
FP: Nott City RWY 27	0	0
OP: 1-ATCT	944	0

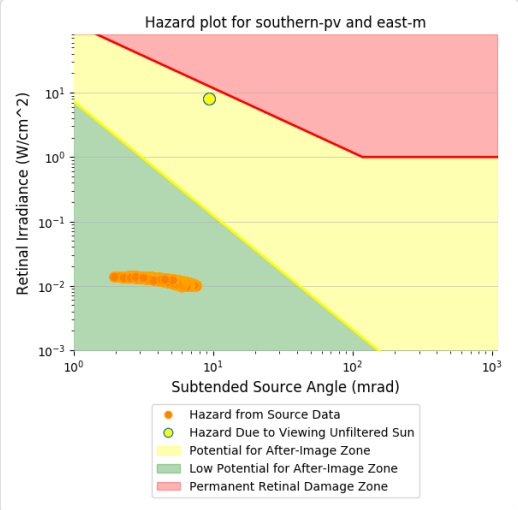
Southern PV Array - Receptor (East Mid RWY 09)

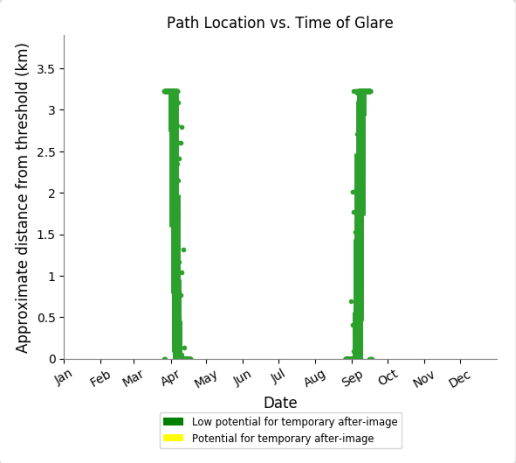
PV array is expected to produce the following glare for observers on this flight path:

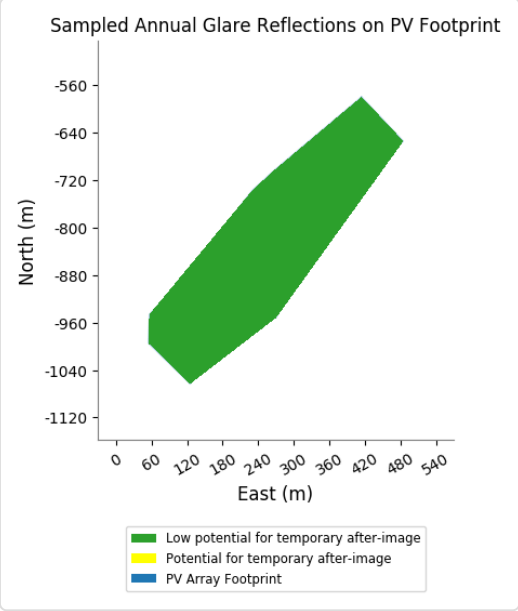
- 861 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.

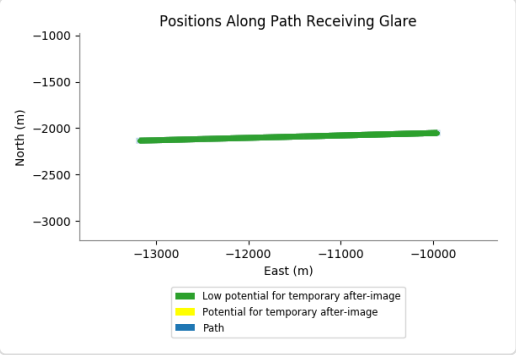












Southern PV Array - Receptor (East Mid RWY 27)

No glare found

Southern PV Array - Receptor (Nott City RWY 03)

No glare found

Southern PV Array - Receptor (Nott City RWY 09)

No glare found

Southern PV Array - Receptor (Nott City RWY 21)

No glare found

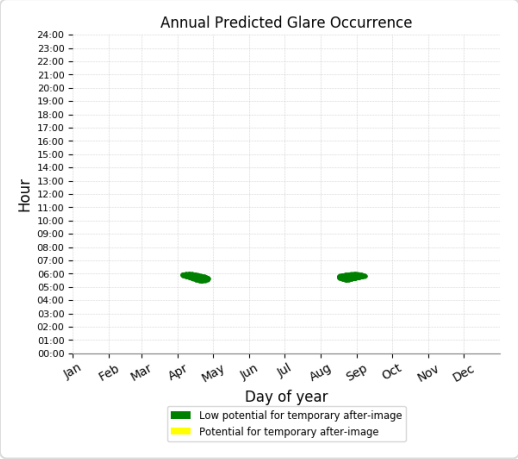
Southern PV Array - Receptor (Nott City RWY 27)

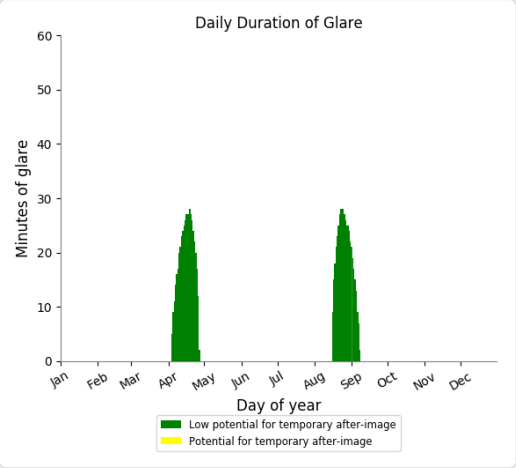
No glare found

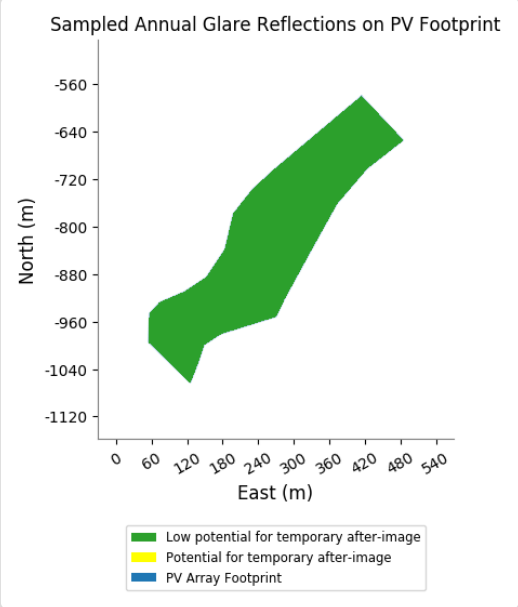
Southern PV Array - OP Receptor (1-ATCT)

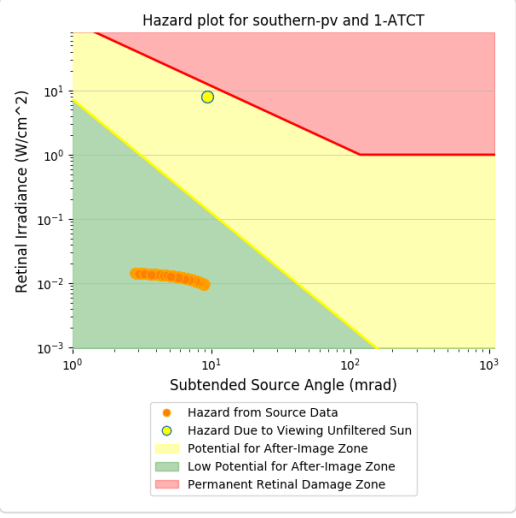
PV array is expected to produce the following glare for receptors at this location:

- 944 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.









Western PV Array low potential for temporary after-image

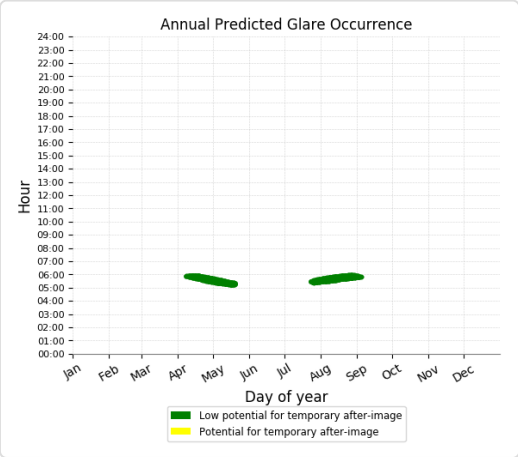
Component	Green glare (min)	Yellow glare (min)

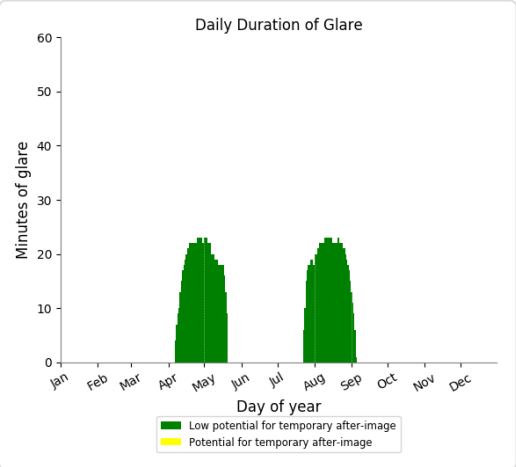
FP: East Mid RWY 09	1660	0
FP: East Mid RWY 27	0	0
FP: Nott City RWY 03	0	0
FP: Nott City RWY 09	0	0
FP: Nott City RWY 21	0	0
FP: Nott City RWY 27	0	0
OP: 1-ATCT	2212	0

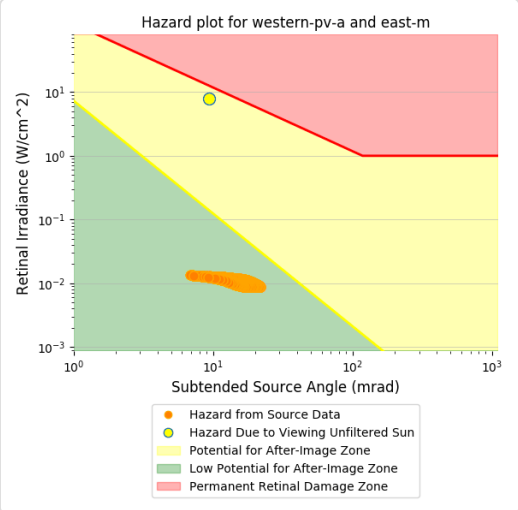
Western PV Array - Receptor (East Mid RWY 09)

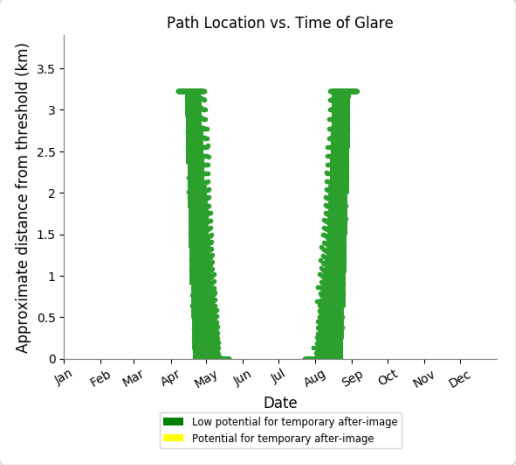
PV array is expected to produce the following glare for observers on this flight path:

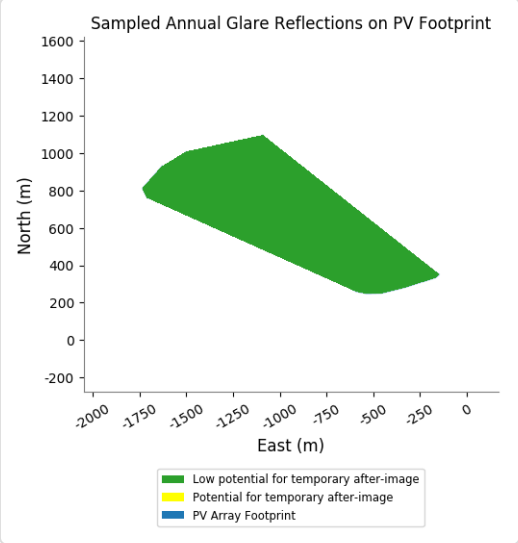
- 1,660 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.

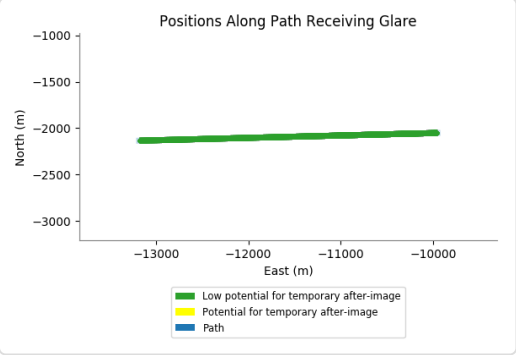












Western PV Array - Receptor (East Mid RWY 27)

No glare found

Western PV Array - Receptor (Nott City RWY 03)

No glare found

Western PV Array - Receptor (Nott City RWY 09)

No glare found

Western PV Array - Receptor (Nott City RWY 21)

No glare found

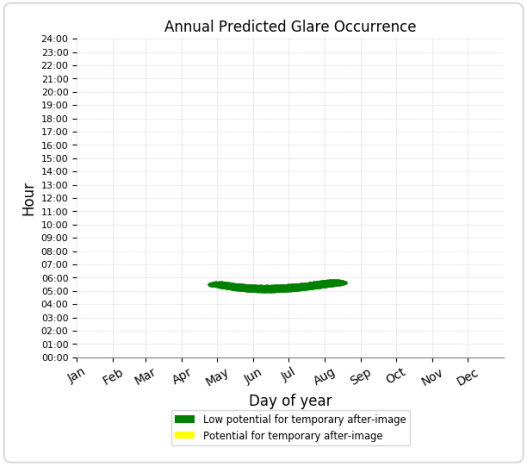
Western PV Array - Receptor (Nott City RWY 27)

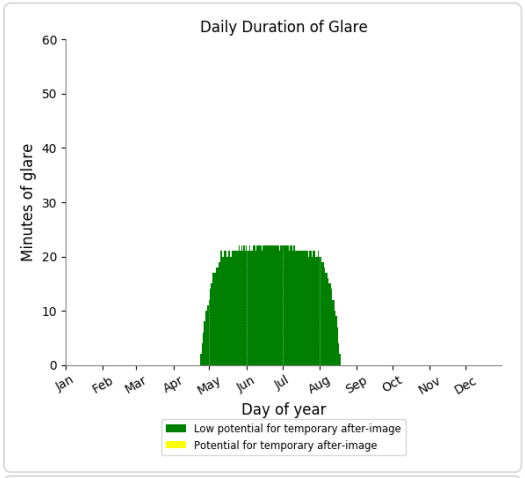
No glare found

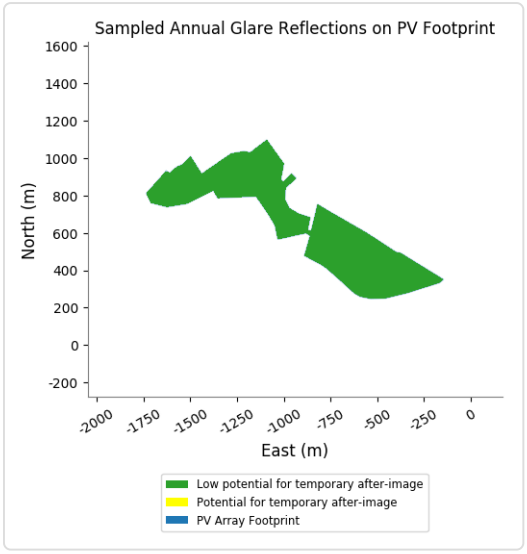
Western PV Array - OP Receptor (1-ATCT)

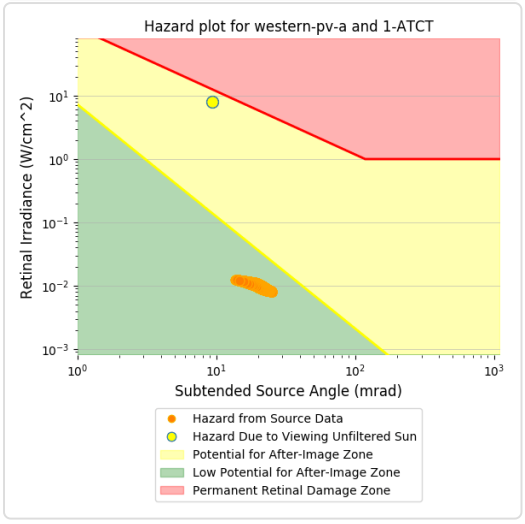
PV array is expected to produce the following glare for receptors at this location:

- 2,212 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.









Assumptions

- 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
- Detailed system geometry is not rigorously simulated.
- The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual values and results may vary.
- The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
- Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for larg 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.)
- Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid. Actual ocular impact outcomes encompass a continuous, nc discrete, spectrum.
- 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.
- Refer to the **Help page** for detailed assumptions and limitations not listed here.

Appendix 7G: Aviation Receptor Glare (40 Deg)

ForgeSolar

Kingston Solar Farm

Kingston Solar Farm Aviation

Created July 27, 2021
Updated Aug. 9, 2021
Time-step 1 minute
Timezone offset UTC0
Site ID 56739.10138

Project type Advanced
Project status: active
Category 10 MW to 100 MW

Misc. Analysis Settings

DNI: **varies (1,000.0 W/m^2 peak)**
Ocular transmission coefficient: **0.5**
Pupil diameter: **0.002 m**
Eye focal length: **0.017 m**
Sun subtended angle: **9.3 mrad**

Analysis Methodologies:

- Observation point: **Version 2**
- 2-Mile Flight Path: **Version 2**
- Route: **Version 2**

Summary of Results Glare with low potential for temporary after-image predicted

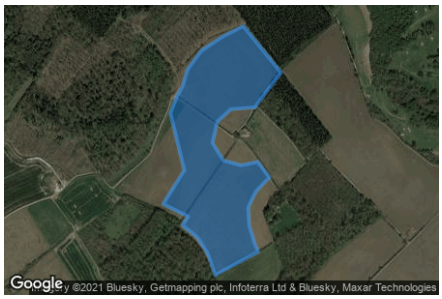
PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced
	deg	deg	min	min	kWh
Central PV Array	40.0	180.0	2,462	0	-
Eastern PV Array	40.0	180.0	937	0	-
Southern PV Array	40.0	180.0	2,359	0	-
Western PV Array	40.0	180.0	3,748	0	-

Component Data

PV Array(s)

Total PV footprint area: 652,007 m^2

Name: Central PV Array
Axis tracking: Fixed (no rotation)
Tilt: 40.0 deg
Orientation: 180.0 deg
Footprint area: 132,824 m^2
Rated power: -
Panel material: Light textured glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 9.16 mrad



Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	52.848987	-1.201839	96.58	2.80	99.38
2	52.847743	-1.200166	96.44	2.80	99.24
3	52.846810	-1.201324	93.14	2.80	95.94
4	52.846758	-1.202397	91.84	2.80	94.64
5	52.846421	-1.202998	90.05	2.80	92.85
6	52.845851	-1.203213	89.14	2.80	91.94
7	52.845385	-1.202719	89.74	2.80	92.54
8	52.845255	-1.201947	90.82	2.80	93.62
9	52.845346	-1.201196	92.07	2.80	94.87
10	52.844931	-1.200681	91.18	2.80	93.98
11	52.844555	-1.201282	89.97	2.80	92.77
12	52.844127	-1.201625	88.30	2.80	91.10
13	52.843648	-1.201582	86.48	2.80	89.28
14	52.843129	-1.201324	84.47	2.80	87.27
15	52.842935	-1.201174	82.65	2.80	85.45
16	52.842313	-1.203084	80.74	2.80	83.54
17	52.842896	-1.203427	84.27	2.80	87.07
18	52.843324	-1.203878	87.66	2.80	90.46
19	52.843648	-1.204543	86.76	2.80	89.56
20	52.843881	-1.204286	86.82	2.80	89.62
21	52.844218	-1.205401	81.43	2.80	84.23
22	52.845125	-1.204457	85.10	2.80	87.90
23	52.846655	-1.205080	82.01	2.80	84.81
24	52.847056	-1.204822	85.02	2.80	87.82
25	52.847367	-1.204543	86.44	2.80	89.24
26	52.847834	-1.204307	87.45	2.80	90.25
27	52.848326	-1.203706	91.82	2.80	94.62
28	52.848702	-1.202762	92.71	2.80	95.51

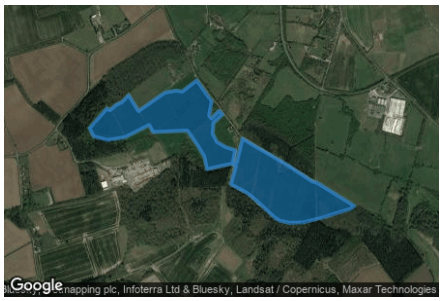
Name: Eastern PV Array
Axis tracking: Fixed (no rotation)
Tilt: 40.0 deg
Orientation: 180.0 deg
Footprint area: 105,300 m^2
Rated power: -
Panel material: Light textured glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 9.16 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	52.848995	-1.197688	96.44	2.80	99.24
2	52.848360	-1.197387	95.39	2.80	98.19
3	52.847479	-1.197044	94.28	2.80	97.08
4	52.846818	-1.196615	93.25	2.80	96.05
5	52.846325	-1.196164	92.60	2.80	95.40
6	52.846196	-1.195714	92.11	2.80	94.91
7	52.845807	-1.194877	92.17	2.80	94.97
8	52.845379	-1.194061	92.96	2.80	95.76
9	52.844991	-1.192388	93.06	2.80	95.86
10	52.844991	-1.191959	93.08	2.80	95.88
11	52.844330	-1.192688	93.00	2.80	95.80
12	52.843889	-1.193461	93.10	2.80	95.90
13	52.843254	-1.194469	92.64	2.80	95.44
14	52.845613	-1.198203	94.92	2.80	97.72
15	52.846001	-1.197580	95.01	2.80	97.81
16	52.847777	-1.199941	96.64	2.80	99.44

Name: Southern PV Array
Axis tracking: Fixed (no rotation)
Tilt: 40.0 deg
Orientation: 180.0 deg
Footprint area: 63,120 m^2
Rated power: -
Panel material: Light textured glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 9.16 mrad

Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	52.843772	-1.195693	91.46	2.80	94.26
2	52.843111	-1.194663	93.99	2.80	96.79
3	52.842683	-1.195564	92.28	2.80	95.08
4	52.842152	-1.196315	91.71	2.80	94.51
5	52.841426	-1.196980	91.38	2.80	94.18
6	52.840713	-1.197624	90.47	2.80	93.27
7	52.840441	-1.197838	90.31	2.80	93.11
8	52.840182	-1.199212	88.30	2.80	91.10
9	52.840013	-1.199641	87.99	2.80	90.79
10	52.839741	-1.199791	87.54	2.80	90.34
11	52.839443	-1.199984	88.09	2.80	90.89
12	52.840052	-1.201014	83.30	2.80	86.10
13	52.840480	-1.200993	78.20	2.80	81.00
14	52.840648	-1.200735	79.17	2.80	81.97
15	52.840804	-1.200134	82.43	2.80	85.23
16	52.841024	-1.199576	84.40	2.80	87.20
17	52.841452	-1.199104	85.12	2.80	87.92
18	52.841996	-1.198890	83.52	2.80	86.32
19	52.842359	-1.198418	85.08	2.80	87.88
20	52.842657	-1.197881	87.03	2.80	89.83

Name: Western PV Array
Axis tracking: Fixed (no rotation)
Tilt: 40.0 deg
Orientation: 180.0 deg
Footprint area: 350,763 m^2
Rated power: -
Panel material: Light textured glass with AR coating
Vary reflectivity with sun position? Yes
Correlate slope error with surface type? Yes
Slope error: 9.16 mrad



Vertex	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
1	52.857326	-1.226006	85.78	2.80	88.58
2	52.856276	-1.227551	83.98	2.80	86.78
3	52.855836	-1.227186	83.12	2.80	85.92
4	52.855641	-1.225941	78.84	2.80	81.64
5	52.855797	-1.224396	78.16	2.80	80.96
6	52.856445	-1.222251	83.48	2.80	86.28
7	52.856069	-1.221907	79.29	2.80	82.09
8	52.856147	-1.218860	82.71	2.80	85.51
9	52.855343	-1.217938	79.35	2.80	82.15
10	52.854760	-1.217358	81.43	2.80	84.23
11	52.854086	-1.217122	83.25	2.80	86.05
12	52.854281	-1.215706	85.51	2.80	88.31
13	52.854384	-1.214891	86.05	2.80	88.85
14	52.854247	-1.214556	86.06	2.80	88.86
15	52.853288	-1.215007	86.17	2.80	88.97
16	52.852861	-1.213676	85.74	2.80	88.54
17	52.852679	-1.213247	86.03	2.80	88.83
18	52.852096	-1.212153	85.92	2.80	88.72
19	52.851500	-1.211080	86.35	2.80	89.15
20	52.851332	-1.210608	86.08	2.80	88.88
21	52.851228	-1.209750	86.36	2.80	89.16
22	52.851254	-1.208591	87.09	2.80	89.89
23	52.851500	-1.206917	88.98	2.80	91.78
24	52.851993	-1.204342	93.00	2.80	95.80
25	52.852135	-1.204042	94.13	2.80	96.93
26	52.853392	-1.207411	90.98	2.80	93.78
27	52.853431	-1.207754	90.78	2.80	93.58
28	52.854364	-1.210114	89.71	2.80	92.51
29	52.855349	-1.212947	88.27	2.80	91.07
30	52.855723	-1.213975	88.26	2.80	91.06
31	52.854443	-1.214484	85.99	2.80	88.79
32	52.854502	-1.214806	85.93	2.80	88.73
33	52.855104	-1.214613	86.27	2.80	89.07
34	52.855273	-1.215471	85.97	2.80	88.77
35	52.855545	-1.216244	86.11	2.80	88.91
36	52.855985	-1.216619	86.33	2.80	89.13
37	52.856554	-1.216551	86.52	2.80	89.32
38	52.857007	-1.215735	84.90	2.80	87.70
39	52.857201	-1.216057	84.81	2.80	87.61
40	52.856787	-1.216723	86.58	2.80	89.38
41	52.856955	-1.216937	86.63	2.80	89.43
42	52.857694	-1.216701	81.71	2.80	84.51
43	52.858821	-1.218031	78.47	2.80	81.27
44	52.858225	-1.219319	86.14	2.80	88.94
45	52.858277	-1.219855	85.88	2.80	88.68
46	52.858173	-1.220842	86.53	2.80	89.33
47	52.857188	-1.223202	86.58	2.80	89.38
48	52.858031	-1.224082	87.46	2.80	90.26
49	52.857661	-1.224672	87.59	2.80	90.39
50	52.857532	-1.225155	86.72	2.80	89.52
51	52.857234	-1.225734	86.78	2.80	89.58

2-Mile Flight Path Receptor(s)

Name: East Mid RWY 09
Description:
Threshold height : 15 m
Direction: 88.7 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	52.830639	-1.349593	92.74	15.24	107.98
2-mile point	52.829963	-1.397491	74.96	201.70	276.67

Name: East Mid RWY 27
Description:
Threshold height : 15 m
Direction: 268.1 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	52.831468	-1.306421	84.58	15.24	99.82
2-mile point	52.832432	-1.258535	32.71	235.79	268.50

Name: Nott City RWY 03
Description:
Threshold height : 15 m
Direction: 27.4 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	52.916652	-1.079635	34.64	15.24	49.88
2-mile point	52.890985	-1.101735	40.14	178.42	218.56

Name: Nott City RWY 09
Description:
Threshold height : 15 m
Direction: 88.5 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	52.920676	-1.085407	38.37	15.24	53.61
2-mile point	52.919929	-1.133401	40.12	182.18	222.30

Name: Nott City RWY 21
Description:
Threshold height : 15 m
Direction: 208.0 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	52.923121	-1.073798	26.98	15.24	42.22
2-mile point	52.948652	-1.051265	20.31	190.59	210.90

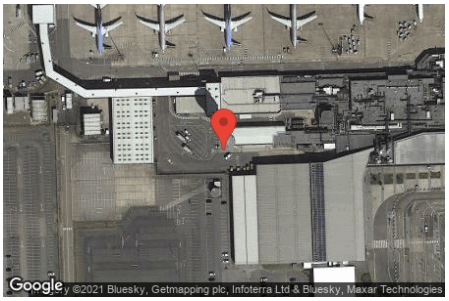
Name: Nott City RWY 27
Description:
Threshold height : 15 m
Direction: 269.2 deg
Glide slope: 3.0 deg
Pilot view restricted? Yes
Vertical view restriction: 30.0 deg
Azimuthal view restriction: 50.0 deg

Point	Latitude	Longitude	Ground elevation	Height above ground	Total elevation
	deg	deg	m	m	m
Threshold	52.920857	-1.072983	26.73	15.24	41.97
2-mile point	52.921286	-1.024978	55.87	154.78	210.66

Discrete Observation Receptors

Number	Latitude	Longitude	Ground elevation	Height above ground	Total Elevation
	deg	deg	m	m	m
1-ATCT	52.826280	-1.332135	86.47	51.00	137.47

1-ATCT map image



Summary of PV Glare Analysis

PV configuration and total predicted glare

PV Name	Tilt	Orientation	"Green" Glare	"Yellow" Glare	Energy Produced	Data File
	deg	deg	min	min	kWh	
Central PV Array	40.0	180.0	2,462	0	-	-
Eastern PV Array	40.0	180.0	937	0	-	-
Southern PV Array	40.0	180.0	2,359	0	-	-
Western PV Array	40.0	180.0	3,748	0	-	-

Distinct glare per month

Excludes overlapping glare from PV array for multiple receptors at matching time(s)

PV	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
central-pv-a (green)	0	0	98	692	129	0	0	570	352	0	0	0
central-pv-a (yellow)	0	0	0	0	0	0	0	0	0	0	0	0
eastern-pv-a (green)	0	0	29	452	0	0	0	226	230	0	0	0
eastern-pv-a (yellow)	0	0	0	0	0	0	0	0	0	0	0	0
southern-pv (green)	0	0	185	710	0	0	0	399	495	0	0	0
southern-pv (yellow)	0	0	0	0	0	0	0	0	0	0	0	0
western-pv-a (green)	0	0	0	496	608	517	597	624	103	0	0	0
western-pv-a (yellow)	0	0	0	0	0	0	0	0	0	0	0	0

PV & Receptor Analysis Results

Results for each PV array and receptor

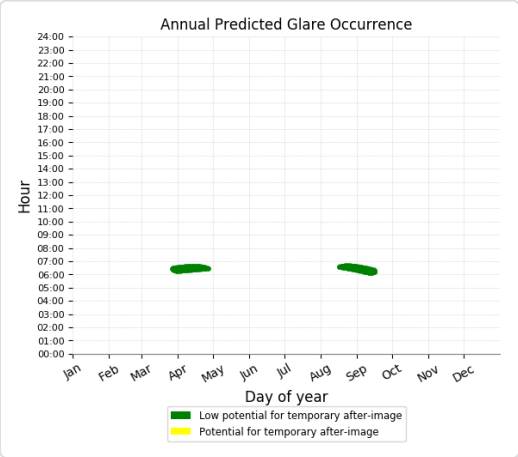
Central PV Array low potential for temporary after-image

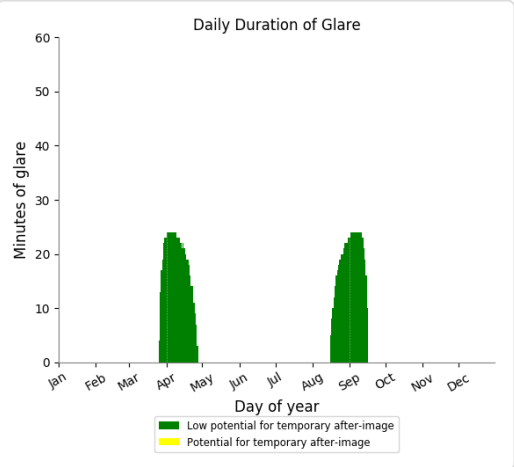
Component	Green glare (min)	Yellow glare (min)
FP: East Mid RWY 09	1239	0
FP: East Mid RWY 27	0	0
FP: Nott City RWY 03	0	0
FP: Nott City RWY 09	0	0
FP: Nott City RWY 21	0	0
FP: Nott City RWY 27	0	0
OP: 1-ATCT	1223	0

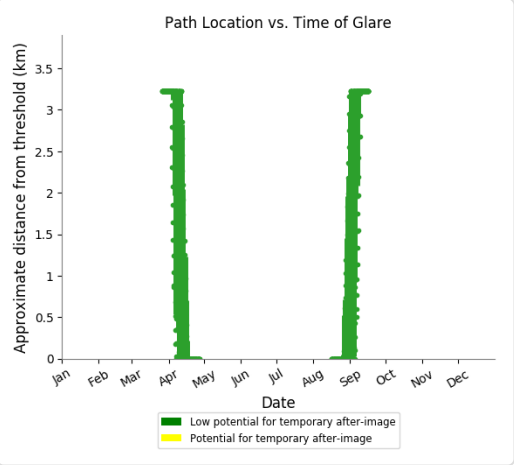
Central PV Array - Receptor (East Mid RWY 09)

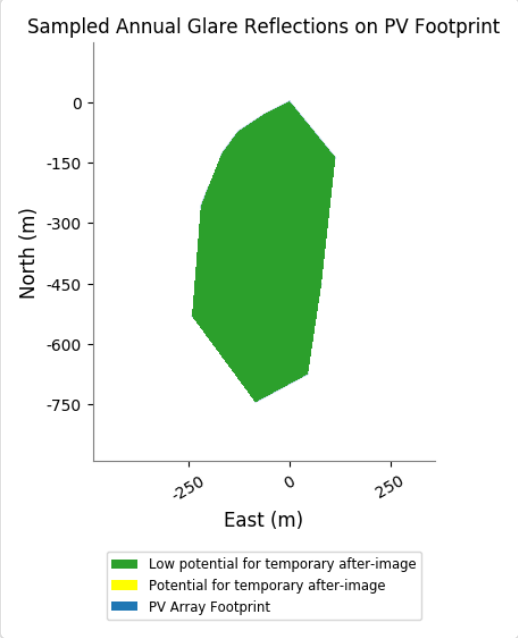
PV array is expected to produce the following glare for observers on this flight path:

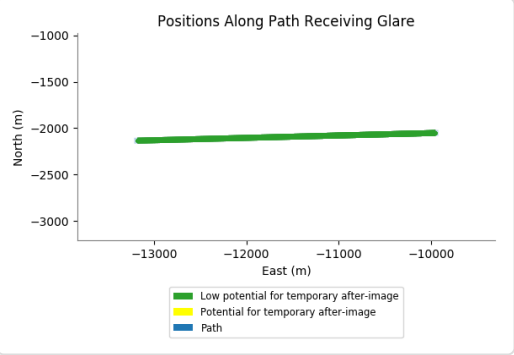
- 1,239 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.











Central PV Array - Receptor (East Mid RWY 27)

No glare found

Central PV Array - Receptor (Nott City RWY 03)

No glare found

Central PV Array - Receptor (Nott City RWY 09)

No glare found

Central PV Array - Receptor (Nott City RWY 21)

No glare found

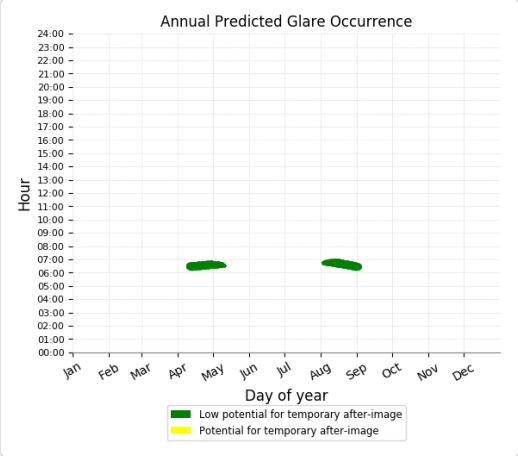
Central PV Array - Receptor (Nott City RWY 27)

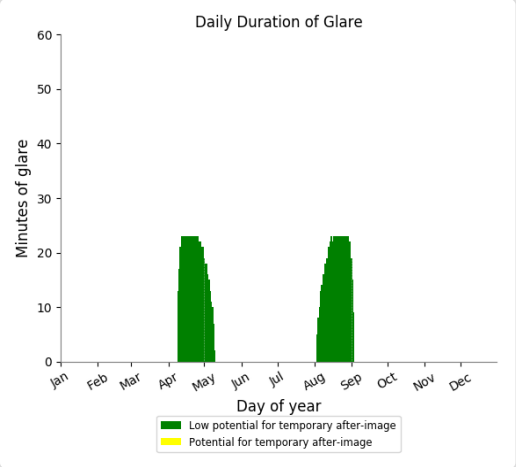
No glare found

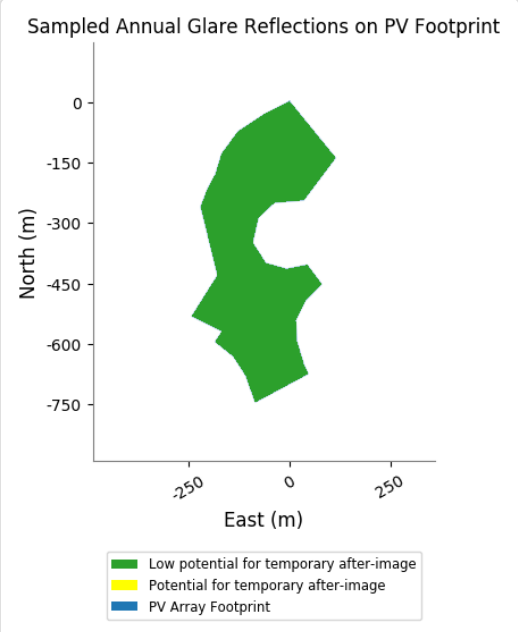
Central PV Array - OP Receptor (1-ATCT)

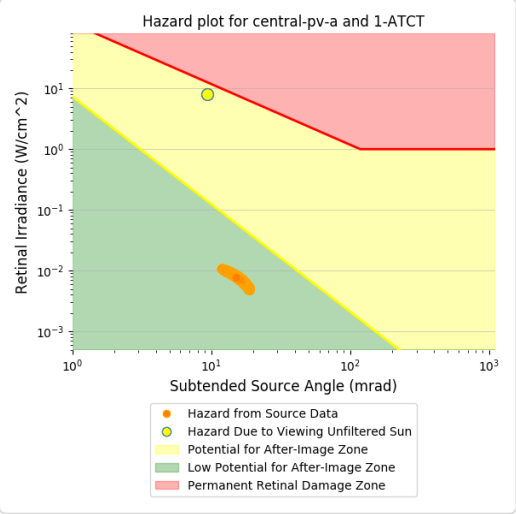
PV array is expected to produce the following glare for receptors at this location:

- 1,223 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.









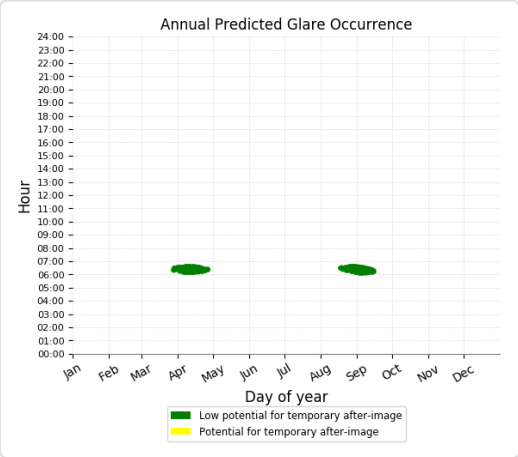
Eastern PV Array low potential for temporary after-image

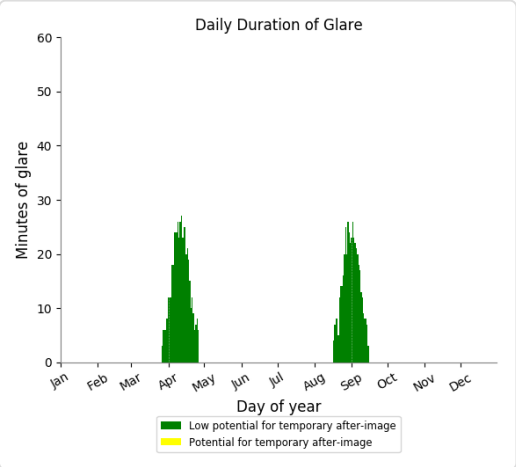
Component	Green glare (min)	Yellow glare (min)
FP: East Mid RWY 09	936	0
FP: East Mid RWY 27	0	0
FP: Nott City RWY 03	0	0
FP: Nott City RWY 09	0	0
FP: Nott City RWY 21	0	0
FP: Nott City RWY 27	0	0
OP: 1-ATCT	1	0

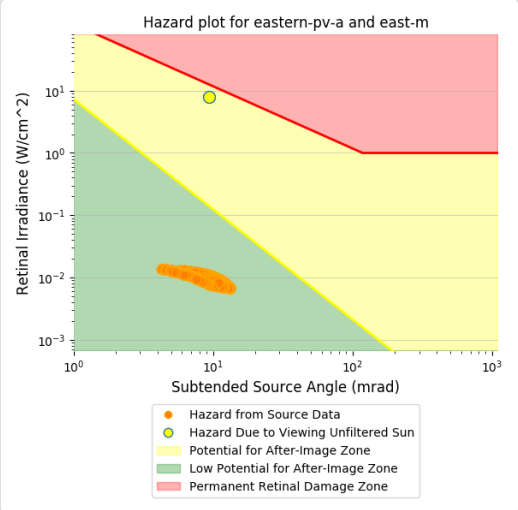
Eastern PV Array - Receptor (East Mid RWY 09)

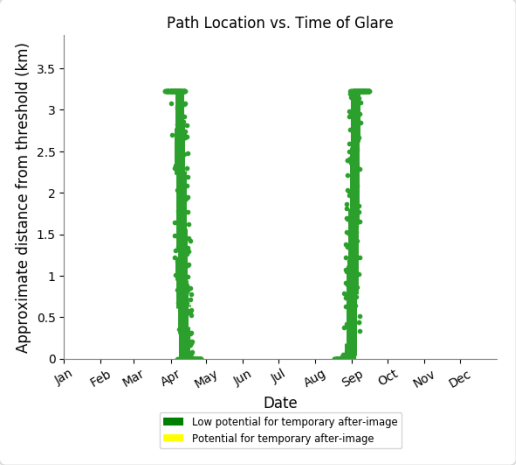
PV array is expected to produce the following glare for observers on this flight path:

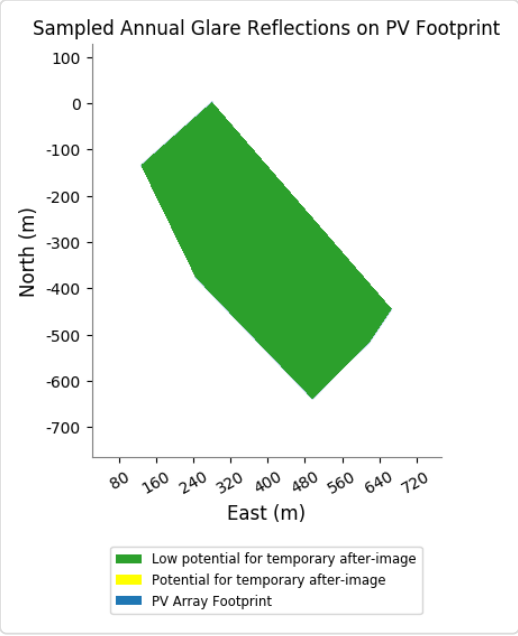
- 936 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.

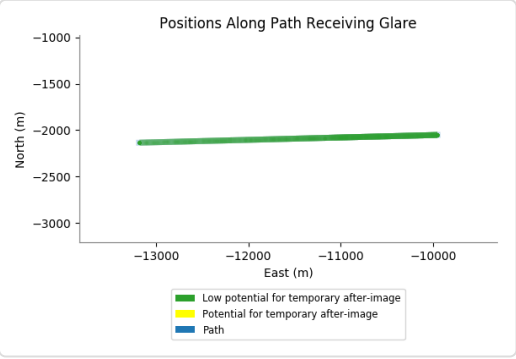












Eastern PV Array - Receptor (East Mid RWY 27)

No glare found

Eastern PV Array - Receptor (Nott City RWY 03)

No glare found

Eastern PV Array - Receptor (Nott City RWY 09)

No glare found

Eastern PV Array - Receptor (Nott City RWY 21)

No glare found

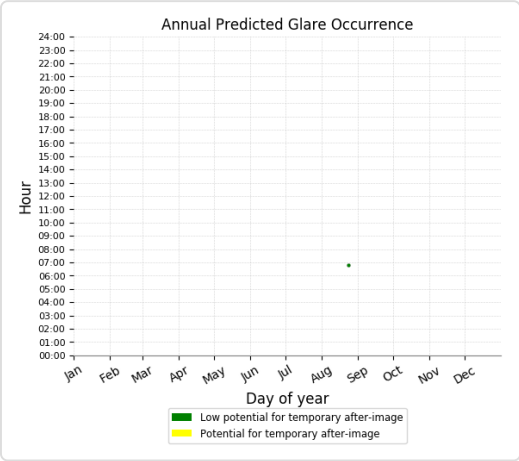
Eastern PV Array - Receptor (Nott City RWY 27)

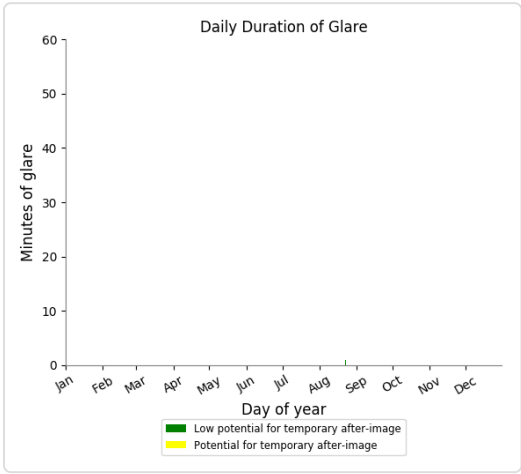
No glare found

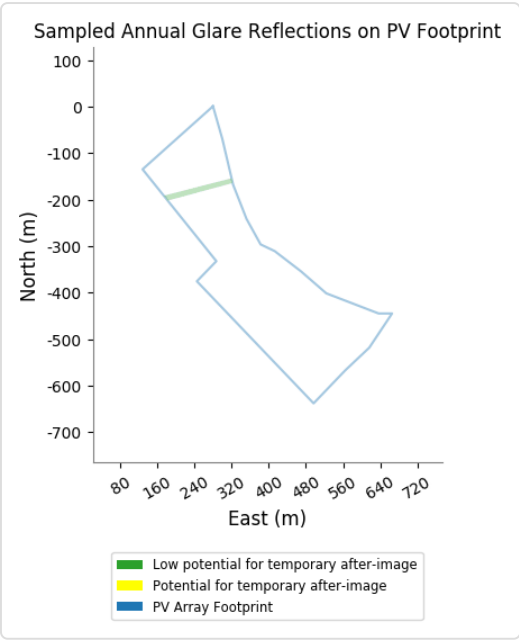
Eastern PV Array - OP Receptor (1-ATCT)

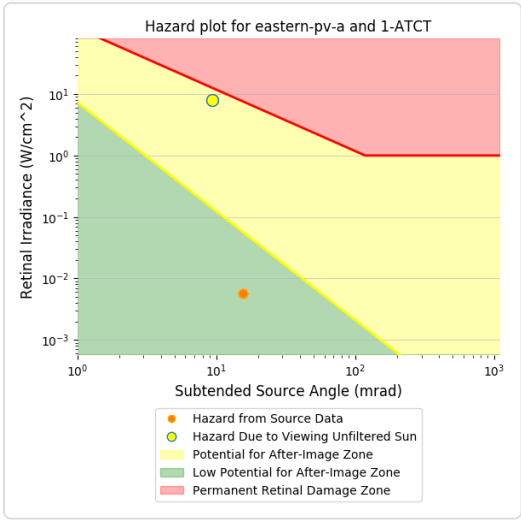
PV array is expected to produce the following glare for receptors at this location:

- 1 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.









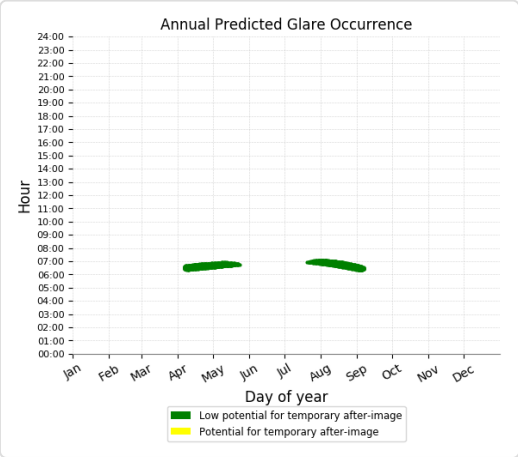
Southern PV Array low potential for temporary after-image

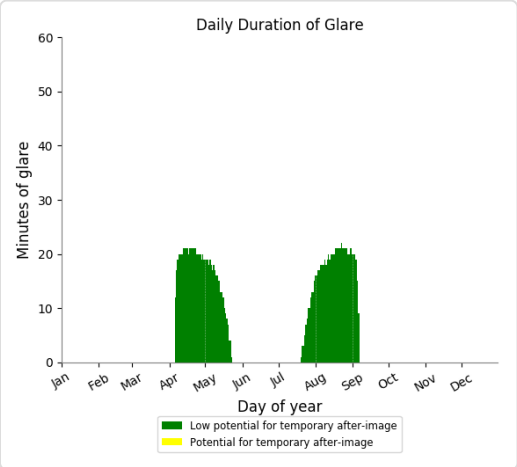
Component	Green glare (min)	Yellow glare (min)
FP: East Mid RWY 09	1213	0
FP: East Mid RWY 27	0	0
FP: Nott City RWY 03	0	0
FP: Nott City RWY 09	0	0
FP: Nott City RWY 21	0	0
FP: Nott City RWY 27	0	0
OP: 1-ATCT	1146	0

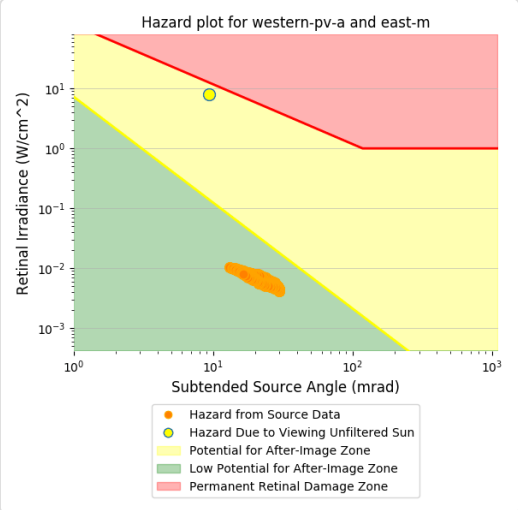
Southern PV Array - Receptor (East Mid RWY 09)

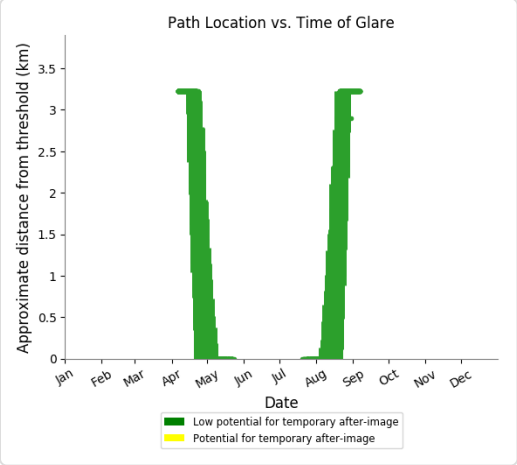
PV array is expected to produce the following glare for observers on this flight path:

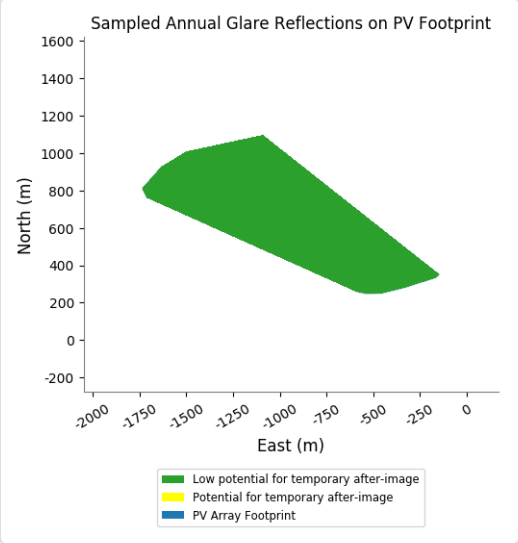
- 1,213 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.

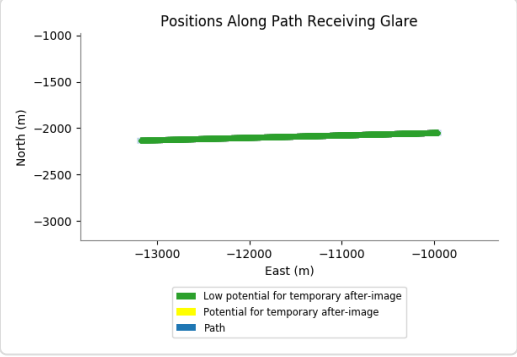












Southern PV Array - Receptor (East Mid RWY 27)

No glare found

Southern PV Array - Receptor (Nott City RWY 03)

No glare found

Southern PV Array - Receptor (Nott City RWY 09)

No glare found

Southern PV Array - Receptor (Nott City RWY 21)

No glare found

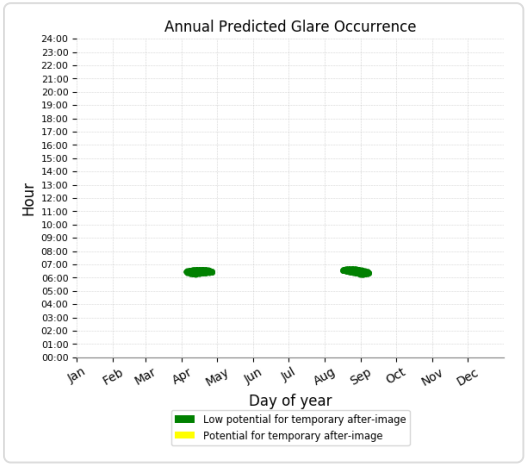
Southern PV Array - Receptor (Nott City RWY 27)

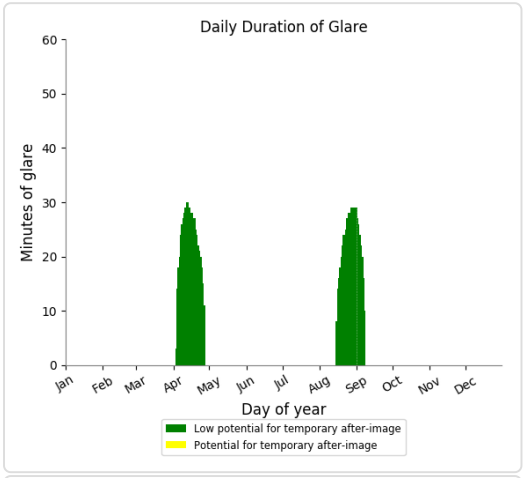
No glare found

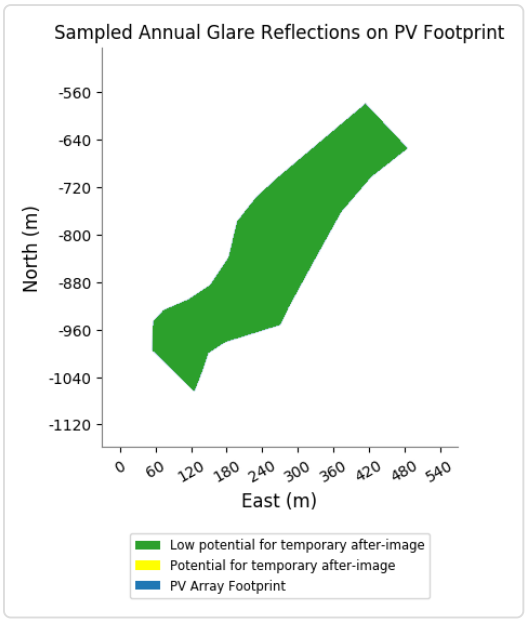
Southern PV Array - OP Receptor (1-ATCT)

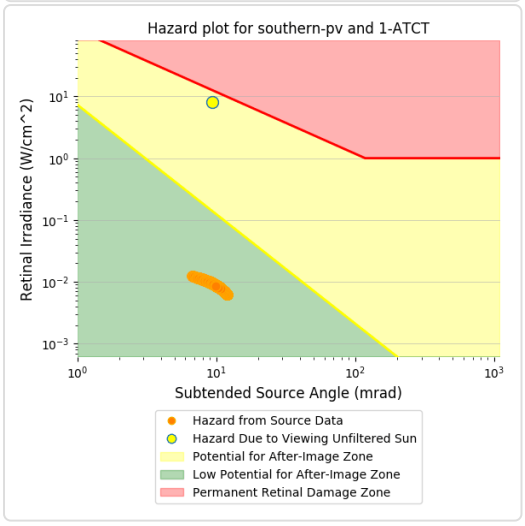
PV array is expected to produce the following glare for receptors at this location:

- 1,146 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.









Western PV Array low potential for temporary after-image

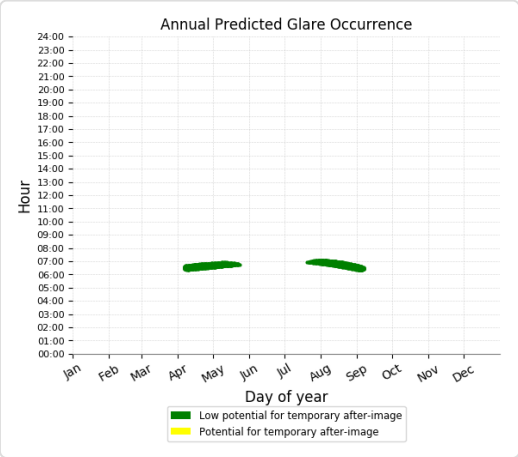
Component	Green glare (min)	Yellow glare (min)

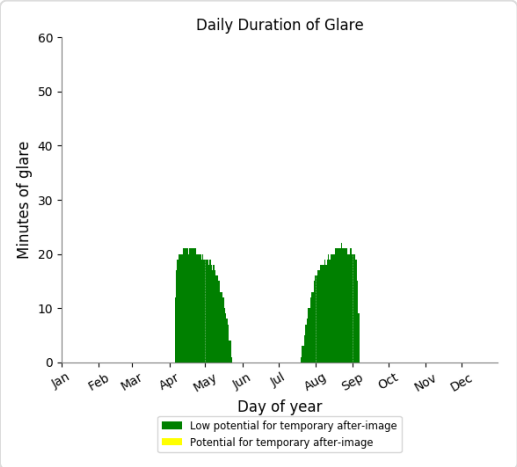
FP: East Mid RWY 09	1612	0
FP: East Mid RWY 27	0	0
FP: Nott City RWY 03	0	0
FP: Nott City RWY 09	0	0
FP: Nott City RWY 21	0	0
FP: Nott City RWY 27	0	0
OP: 1-ATCT	2136	0

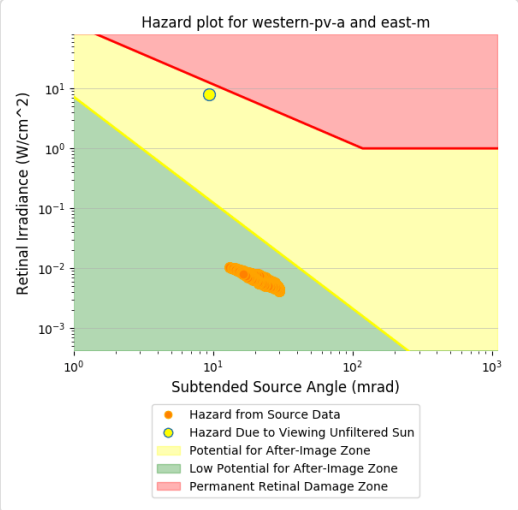
Western PV Array - Receptor (East Mid RWY 09)

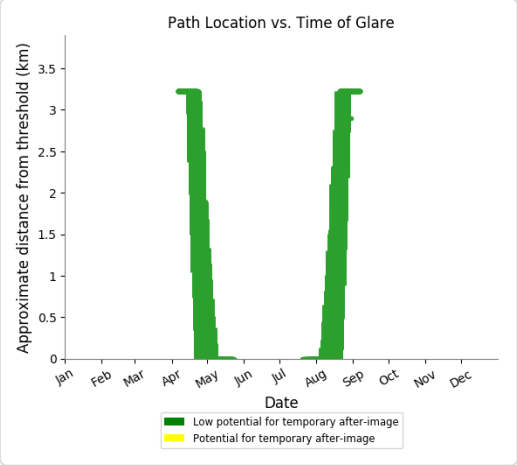
PV array is expected to produce the following glare for observers on this flight path:

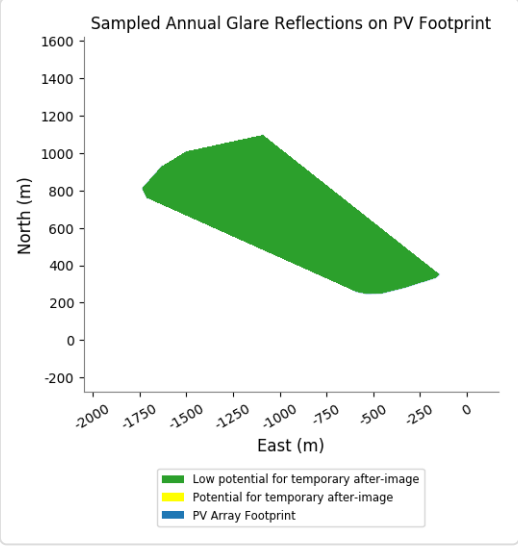
- 1,612 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.

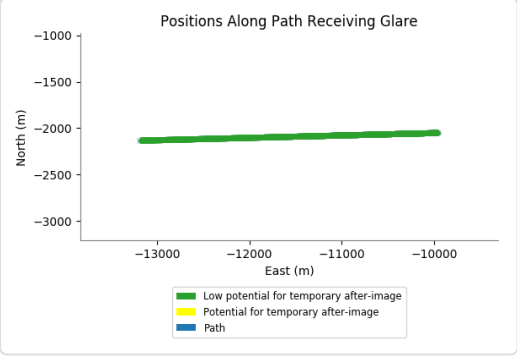












Western PV Array - Receptor (East Mid RWY 27)

No glare found

Western PV Array - Receptor (Nott City RWY 03)

No glare found

Western PV Array - Receptor (Nott City RWY 09)

No glare found

Western PV Array - Receptor (Nott City RWY 21)

No glare found

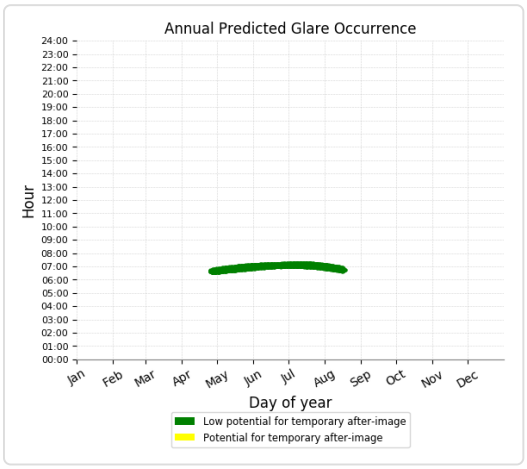
Western PV Array - Receptor (Nott City RWY 27)

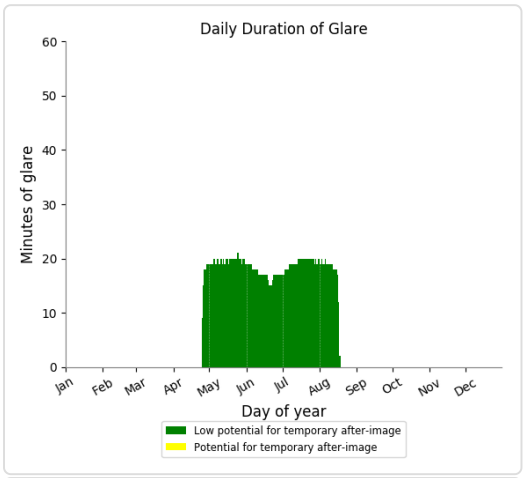
No glare found

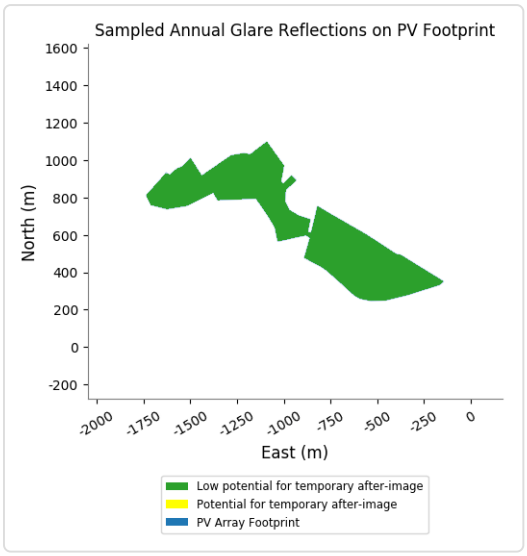
Western PV Array - OP Receptor (1-ATCT)

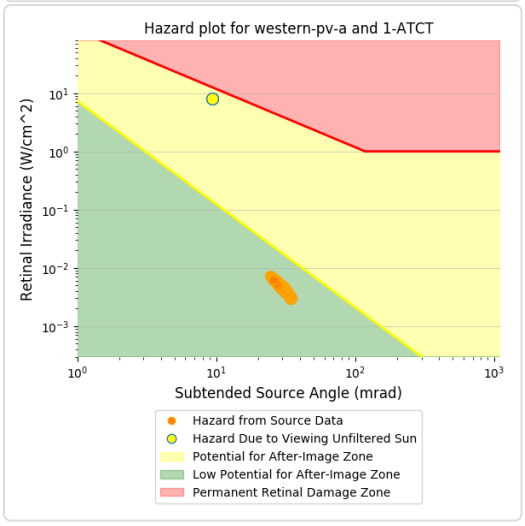
PV array is expected to produce the following glare for receptors at this location:

- 2,136 minutes of "green" glare with low potential to cause temporary after-image.
- 0 minutes of "yellow" glare with potential to cause temporary after-image.









Assumptions

- 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
- Detailed system geometry is not rigorously simulated.
- The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual values and results may vary.
- The system output calculation is a DNI-based approximation that assumes clear, sunny skies year-round. It should not be used in place of more rigorous modeling methods.
- Several V1 calculations utilize the PV array centroid, rather than the actual glare spot location, due to algorithm limitations. This may affect results for larg 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.)
- Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid. Actual ocular impact outcomes encompass a continuous, nc discrete, spectrum.
- 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.
- Refer to the **Help page** for detailed assumptions and limitations not listed here.