

Name: Kualakai - 2

Path type: Two-way

Observer view angle: 50.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.361924	-158.055349	155.26	5.00	160.26
2	21.361124	-158.054319	148.95	5.00	153.95
3	21.360365	-158.053525	138.32	5.00	143.32
4	21.359526	-158.052602	140.78	5.00	145.78
5	21.358646	-158.051766	140.91	5.00	145.91

Name: Kualakai - 3

Path type: Two-way

Observer view angle: 50.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.358466	-158.051594	139.44	5.00	144.44
2	21.357647	-158.051122	134.59	5.00	139.59
3	21.356528	-158.050478	125.14	5.00	130.14
4	21.355149	-158.049899	119.06	5.00	124.06
5	21.353670	-158.049491	111.60	5.00	116.60
6	21.352431	-158.049362	102.67	5.00	107.67

Name: Kualakai - 4

Path type: Two-way

Observer view angle: 50.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.352347	-158.049384	102.24	5.00	107.24
2	21.351248	-158.049384	95.16	5.00	100.16
3	21.349290	-158.049706	84.68	5.00	89.68
4	21.347391	-158.050199	78.74	5.00	83.74
5	21.345253	-158.051744	77.85	5.00	82.85
6	21.344313	-158.052667	75.37	5.00	80.37

Name: Kualakai - 5

Path type: Two-way

Observer view angle: 50.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.344193	-158.052796	74.68	5.00	79.68
2	21.343174	-158.053439	70.98	5.00	75.98
3	21.342295	-158.053697	68.90	5.00	73.90
4	21.341075	-158.053718	68.79	5.00	73.79
5	21.339097	-158.052860	59.09	5.00	64.09
6	21.336099	-158.051379	55.78	5.00	60.78

GLARE ANALYSIS RESULTS

Summary of Glare

PV Array Name	Tilt	Orient	"Green" Glare	"Yellow" Glare	Energy
	(°)	(°)	min	min	kWh
PV Area 1	15.0	180.0	1,237	0	-
PV Area 2-1	15.0	180.0	0	0	-
PV Area 2-2	15.0	180.0	840	0	-
PV Area 2-3	15.0	180.0	1,173	0	-
PV Area 3-1	15.0	180.0	1,216	0	-
PV Area 3-2	15.0	180.0	1,028	35	-
PV Area 3-3	15.0	180.0	472	0	-
PV Area 3-4	15.0	180.0	1,253	0	-
PV Area 4	15.0	180.0	1,746	0	-

Total annual glare received by each receptor

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
Farrington -1	1578	0
Farrington - 2	4785	0
H 1 - 1	0	0
H 1 - 2	104	0
H 1 - 3	2498	35
H 1 - 4	0	0
Kualakai - 1	0	0
Kualakai - 2	0	0
Kualakai - 3	0	0
Kualakai - 4	0	0
Kualakai - 5	0	0

Results for: PV Area 1

Receptor	Green Glare (min)	Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
Farrington -1	538	0
Farrington - 2	0	0
H 1 - 1	0	0
H 1 - 2	104	0
H 1 - 3	595	0
H 1 - 4	0	0
Kualakai - 1	0	0
Kualakai - 2	0	0
Kualakai - 3	0	0
Kualakai - 4	0	0
Kualakai - 5	0	0

Point Receptor: OP 1

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 3

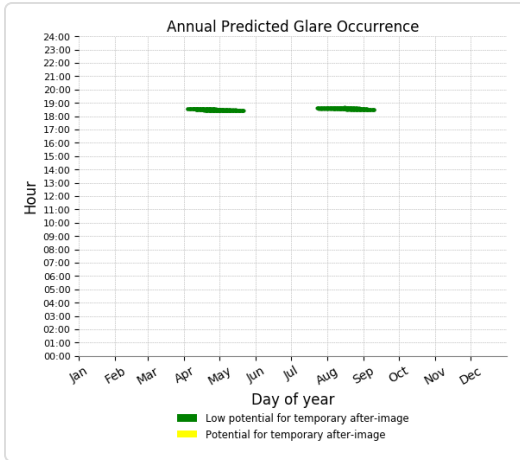
0 minutes of yellow glare

0 minutes of green glare

Route: Farrington -1

0 minutes of yellow glare

538 minutes of green glare



Route: Farrington - 2

0 minutes of yellow glare

0 minutes of green glare

Route: H 1 - 1

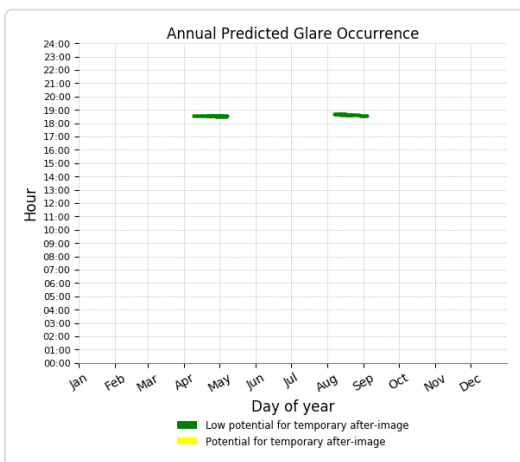
0 minutes of yellow glare

0 minutes of green glare

Route: H 1 - 2

0 minutes of yellow glare

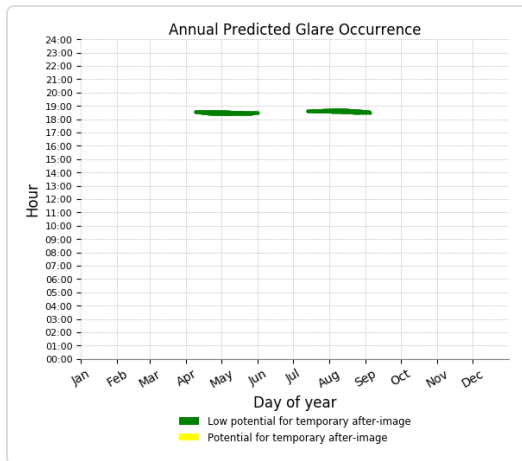
104 minutes of green glare



Route: H 1 - 3

0 minutes of yellow glare

595 minutes of green glare



Route: H 1 - 4

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 1

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 2

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 3

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 4

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 5

0 minutes of yellow glare

0 minutes of green glare

Results for: PV Area 2-1

Receptor	Green Glare (min)	Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
Farrington -1	0	0
Farrington - 2	0	0
H 1 - 1	0	0
H 1 - 2	0	0
H 1 - 3	0	0
H 1 - 4	0	0
Kualakai - 1	0	0
Kualakai - 2	0	0
Kualakai - 3	0	0
Kualakai - 4	0	0
Kualakai - 5	0	0

Point Receptor: OP 1

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare

0 minutes of green glare

Route: Farrington -1

0 minutes of yellow glare

0 minutes of green glare

Route: Farrington - 2

0 minutes of yellow glare

0 minutes of green glare

Route: H 1 - 1

0 minutes of yellow glare

0 minutes of green glare

Route: H 1 - 2

0 minutes of yellow glare

0 minutes of green glare

Route: H 1 - 3

0 minutes of yellow glare

0 minutes of green glare

Route: H 1 - 4

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 1

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 2

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 3

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 4

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 5

0 minutes of yellow glare

0 minutes of green glare

Results for: PV Area 2-2

Receptor	Green Glare (min)	Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
Farrington -1	312	0
Farrington - 2	305	0
H 1 - 1	0	0
H 1 - 2	0	0
H 1 - 3	223	0
H 1 - 4	0	0
Kualakai - 1	0	0
Kualakai - 2	0	0
Kualakai - 3	0	0
Kualakai - 4	0	0
Kualakai - 5	0	0

Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

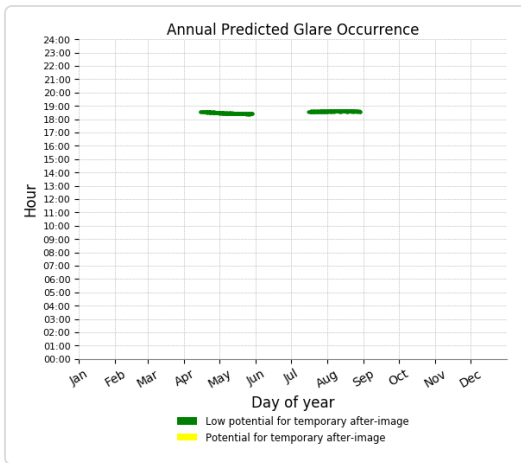
0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare
0 minutes of green glare

Route: Farrington -1

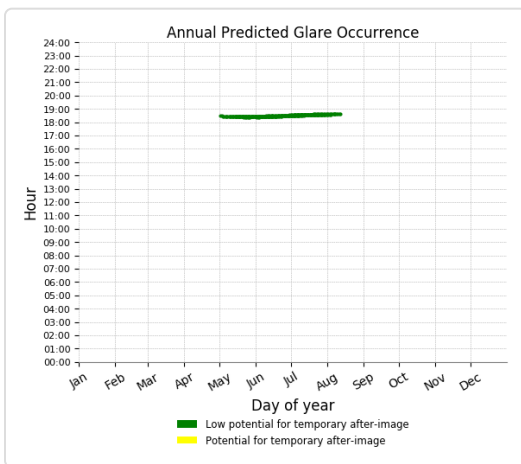
0 minutes of yellow glare
312 minutes of green glare



Route: Farrington - 2

0 minutes of yellow glare

305 minutes of green glare



Route: H 1 - 1

0 minutes of yellow glare

0 minutes of green glare

Route: H 1 - 2

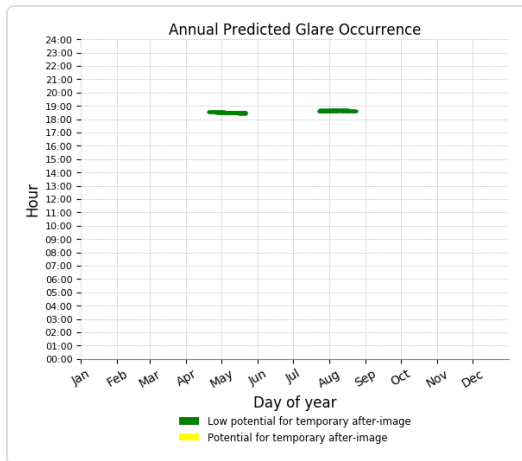
0 minutes of yellow glare

0 minutes of green glare

Route: H 1 - 3

0 minutes of yellow glare

223 minutes of green glare



Route: H 1 - 4

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 1

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 2

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 3

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 4

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 5

0 minutes of yellow glare
0 minutes of green glare

Results for: PV Area 2-3

Receptor	Green Glare (min)	Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
Farrington -1	412	0
Farrington - 2	404	0
H 1 - 1	0	0
H 1 - 2	0	0
H 1 - 3	357	0
H 1 - 4	0	0
Kualakai - 1	0	0
Kualakai - 2	0	0
Kualakai - 3	0	0
Kualakai - 4	0	0
Kualakai - 5	0	0

Point Receptor: OP 1

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 3

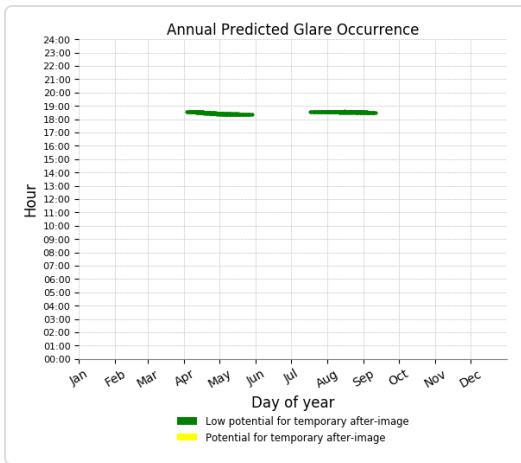
0 minutes of yellow glare

0 minutes of green glare

Route: Farrington -1

0 minutes of yellow glare

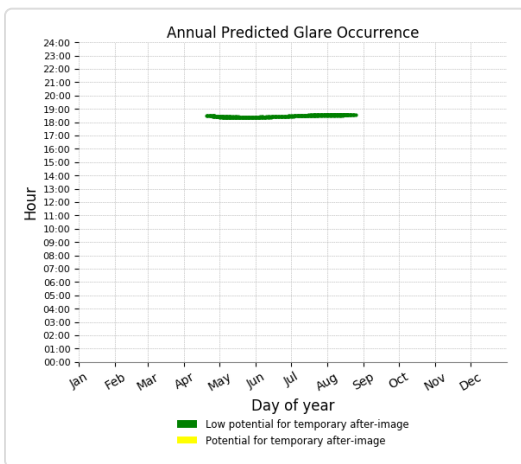
412 minutes of green glare



Route: Farrington - 2

0 minutes of yellow glare

404 minutes of green glare



Route: H 1 - 1

0 minutes of yellow glare

0 minutes of green glare

Route: H 1 - 2

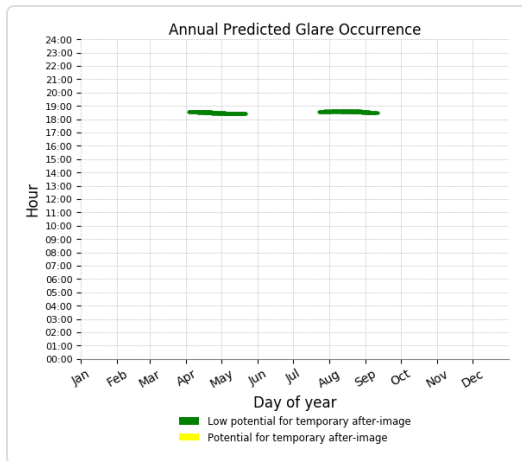
0 minutes of yellow glare

0 minutes of green glare

Route: H 1 - 3

0 minutes of yellow glare

357 minutes of green glare



Route: H 1 - 4

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 1

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 2

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 3

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 4

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 5

0 minutes of yellow glare
0 minutes of green glare

Results for: PV Area 3-1

Receptor	Green Glare (min)	Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
Farrington -1	191	0
Farrington - 2	751	0
H 1 - 1	0	0
H 1 - 2	0	0
H 1 - 3	274	0
H 1 - 4	0	0
Kualakai - 1	0	0
Kualakai - 2	0	0
Kualakai - 3	0	0
Kualakai - 4	0	0
Kualakai - 5	0	0

Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

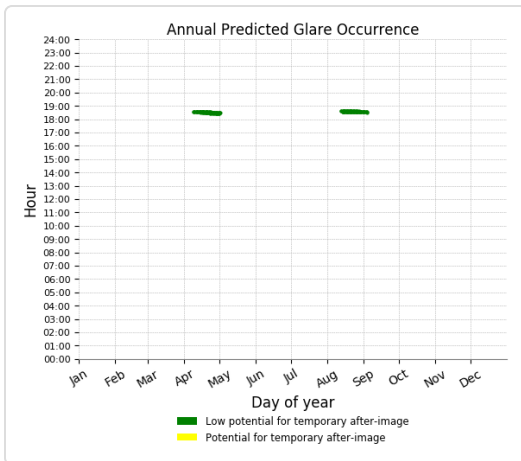
0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare
0 minutes of green glare

Route: Farrington -1

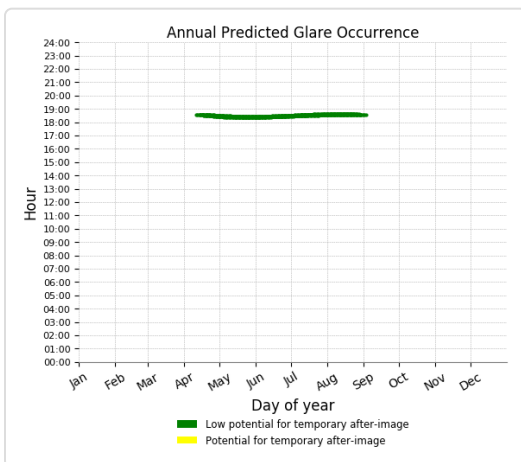
0 minutes of yellow glare
191 minutes of green glare



Route: Farrington - 2

0 minutes of yellow glare

751 minutes of green glare



Route: H 1 - 1

0 minutes of yellow glare

0 minutes of green glare

Route: H 1 - 2

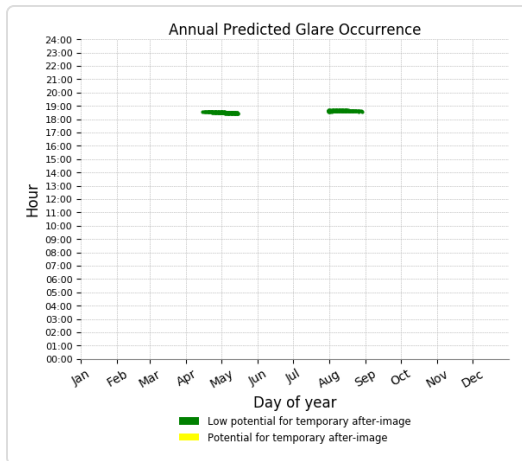
0 minutes of yellow glare

0 minutes of green glare

Route: H 1 - 3

0 minutes of yellow glare

274 minutes of green glare



Route: H 1 - 4

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 1

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 2

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 3

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 4

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 5

0 minutes of yellow glare
0 minutes of green glare

Results for: PV Area 3-2

Receptor	Green Glare (min)	Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
Farrington -1	123	0
Farrington - 2	614	0
H 1 - 1	0	0
H 1 - 2	0	0
H 1 - 3	291	35
H 1 - 4	0	0
Kualakai - 1	0	0
Kualakai - 2	0	0
Kualakai - 3	0	0
Kualakai - 4	0	0
Kualakai - 5	0	0

Point Receptor: OP 1

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare

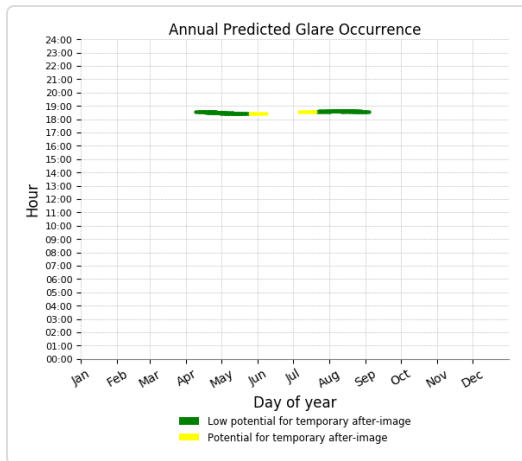
0 minutes of green glare

Route: Farrington -1

0 minutes of yellow glare

123 minutes of green glare

Route: Farringdon - 2



Route: H 1 - 4

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 1

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 2

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 3

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 4

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 5

0 minutes of yellow glare
0 minutes of green glare

Results for: PV Area 3-3

Receptor	Green Glare (min)	Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
Farrington -1	0	0
Farrington - 2	444	0
H 1 - 1	0	0
H 1 - 2	0	0
H 1 - 3	28	0
H 1 - 4	0	0
Kualakai - 1	0	0
Kualakai - 2	0	0
Kualakai - 3	0	0
Kualakai - 4	0	0
Kualakai - 5	0	0

Point Receptor: OP 1

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare

0 minutes of green glare

Route: Farrington -1

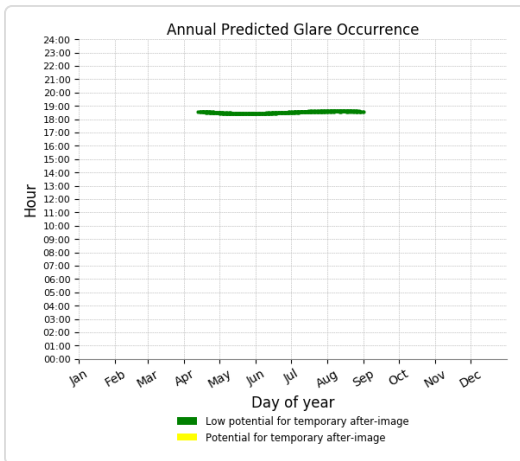
0 minutes of yellow glare

0 minutes of green glare

Route: Farrington - 2

0 minutes of yellow glare

444 minutes of green glare



Route: H 1 - 1

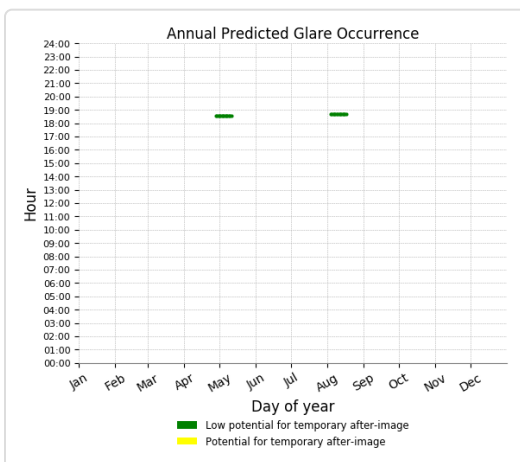
0 minutes of yellow glare
0 minutes of green glare

Route: H 1 - 2

0 minutes of yellow glare
0 minutes of green glare

Route: H 1 - 3

0 minutes of yellow glare
28 minutes of green glare



Route: H 1 - 4

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 1

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 2

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 3

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 4

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 5

0 minutes of yellow glare

0 minutes of green glare

Results for: PV Area 3-4

Receptor	Green Glare (min)	Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
Farrington -1	2	0
Farrington - 2	883	0
H 1 - 1	0	0
H 1 - 2	0	0
H 1 - 3	368	0
H 1 - 4	0	0
Kualakai - 1	0	0
Kualakai - 2	0	0
Kualakai - 3	0	0
Kualakai - 4	0	0
Kualakai - 5	0	0

Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

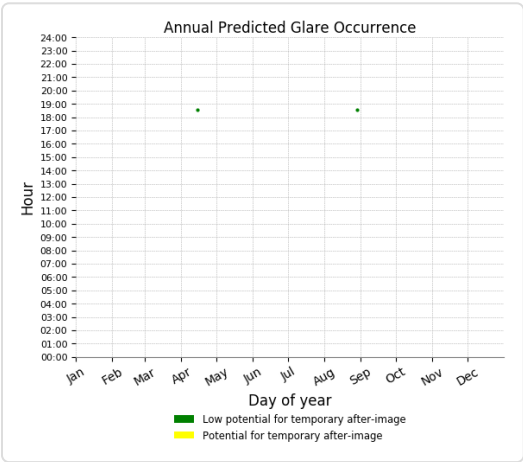
0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare
0 minutes of green glare

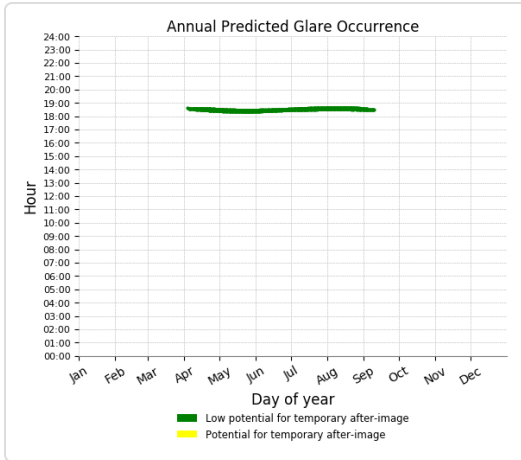
Route: Farrington -1

0 minutes of yellow glare
2 minutes of green glare



Route: Farrington - 2

0 minutes of yellow glare
883 minutes of green glare



Route: H 1 - 1

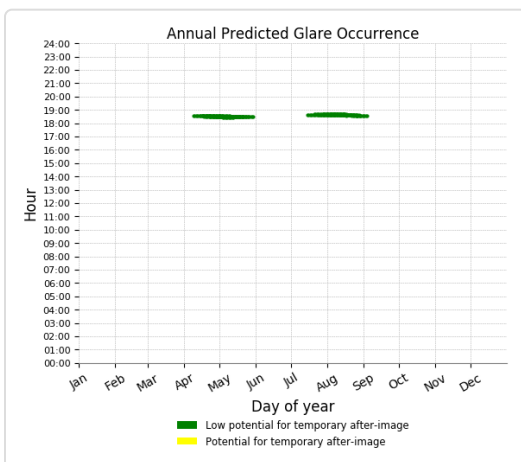
0 minutes of yellow glare
0 minutes of green glare

Route: H 1 - 2

0 minutes of yellow glare
0 minutes of green glare

Route: H 1 - 3

0 minutes of yellow glare
368 minutes of green glare



Route: H 1 - 4

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 1

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 2

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 3

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 4

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 5

0 minutes of yellow glare

0 minutes of green glare

Results for: PV Area 4

Receptor	Green Glare (min)	Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
Farrington -1	0	0
Farrington - 2	1384	0
H 1 - 1	0	0
H 1 - 2	0	0
H 1 - 3	362	0
H 1 - 4	0	0
Kualakai - 1	0	0
Kualakai - 2	0	0
Kualakai - 3	0	0
Kualakai - 4	0	0
Kualakai - 5	0	0

Point Receptor: OP 1

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare

0 minutes of green glare

Route: Farrington -1

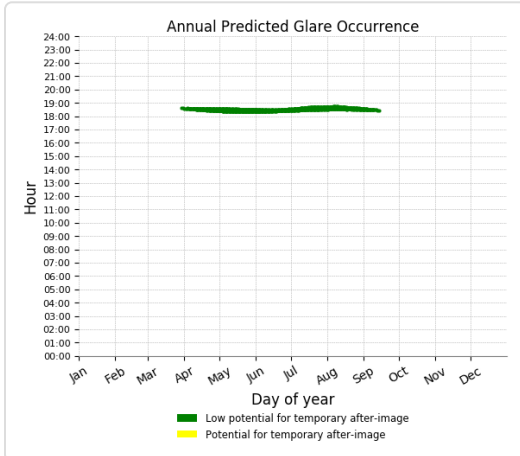
0 minutes of yellow glare

0 minutes of green glare

Route: Farrington - 2

0 minutes of yellow glare

1384 minutes of green glare



Route: H 1 - 1

0 minutes of yellow glare

0 minutes of green glare

Route: H 1 - 2

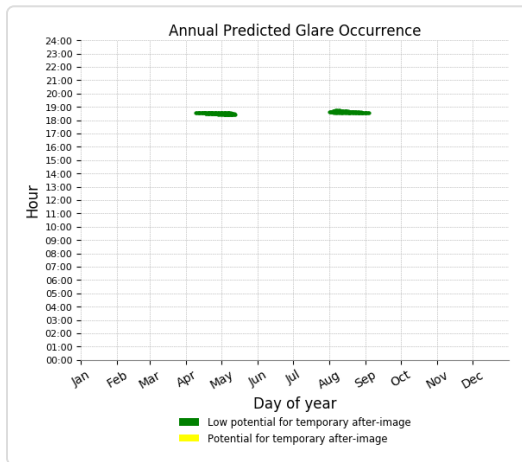
0 minutes of yellow glare

0 minutes of green glare

Route: H 1 - 3

0 minutes of yellow glare

362 minutes of green glare



Route: H 1 - 4

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 1

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 2

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 3

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 4

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 5

0 minutes of yellow glare

0 minutes of green glare

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.

"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.

Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.

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

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

The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size.

Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)

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

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

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

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

FORGESOLAR GLARE ANALYSIS

Project: **AES - Hawaii**

Site configuration: **West Oahu Solar - upper**

Analysis conducted by Josh Burdett (joshua.burdett@tetrattech.com) at 19:59 on 16 Dec, 2019.

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)	N/A	No flight paths analyzed
ATCT(s)	N/A	No ATCT receptors designated

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

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

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

SITE CONFIGURATION

Analysis Parameters

DNI: peaks at 1,000.0 W/m²
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: 34346.6258



PV Array(s)

Name: PV Area 1
Axis tracking: Fixed (no rotation)
Tilt: 15.0°
Orientation: 180.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.378202	-158.062098	414.48	7.60	422.08
2	21.377800	-158.062280	419.04	7.60	426.64
3	21.377602	-158.062377	415.86	7.60	423.46
4	21.377450	-158.062465	411.42	7.60	419.02
5	21.377213	-158.062374	398.76	7.60	406.36
6	21.376973	-158.061441	350.35	7.60	357.96
7	21.377008	-158.060918	333.62	7.60	341.22
8	21.377120	-158.060923	338.28	7.60	345.88
9	21.377490	-158.061106	356.91	7.60	364.51
10	21.377622	-158.061476	374.30	7.60	381.90
11	21.378147	-158.061891	404.33	7.60	411.93

Name: PV Area 2-1

Axis tracking: Fixed (no rotation)

Tilt: 15.0°

Orientation: 180.0°

Rated power: -

Panel material: Smooth glass with AR coating

Reflectivity: Vary with sun

Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.376881	-158.062833	410.48	7.60	418.08
2	21.376459	-158.063010	418.17	7.60	425.77
3	21.375907	-158.063270	403.44	7.60	411.04
4	21.375544	-158.063457	390.88	7.60	398.48
5	21.375315	-158.063565	394.11	7.60	401.71
6	21.375277	-158.063152	370.95	7.60	378.55
7	21.375227	-158.062736	356.59	7.60	364.19
8	21.375574	-158.062618	369.95	7.60	377.55
9	21.376031	-158.062454	383.79	7.60	391.39
10	21.376511	-158.062293	385.02	7.60	392.62
11	21.376713	-158.062218	382.76	7.60	390.36
12	21.376833	-158.062401	392.49	7.60	400.09

Name: PV Area 2-2

Axis tracking: Fixed (no rotation)

Tilt: 15.0°

Orientation: 180.0°

Rated power: -

Panel material: Smooth glass with AR coating

Reflectivity: Vary with sun

Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.376711	-158.062205	381.82	7.60	389.42
2	21.376361	-158.062326	386.07	7.60	393.67
3	21.375894	-158.062492	380.15	7.60	387.75
4	21.375450	-158.062645	364.88	7.60	372.48
5	21.375217	-158.062728	355.93	7.60	363.53
6	21.375152	-158.062331	344.64	7.60	352.24
7	21.375065	-158.061803	333.62	7.60	341.22
8	21.375484	-158.061666	342.96	7.60	350.56
9	21.375989	-158.061513	354.20	7.60	361.80
10	21.376499	-158.061365	347.02	7.60	354.62
11	21.376598	-158.061776	365.54	7.60	373.14

Name: PV Area 2-3

Axis tracking: Fixed (no rotation)

Tilt: 15.0°

Orientation: 180.0°

Rated power: -

Panel material: Smooth glass with AR coating

Reflectivity: Vary with sun

Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.376496	-158.061349	345.68	7.60	353.28
2	21.376129	-158.061451	353.34	7.60	360.94
3	21.375649	-158.061591	344.73	7.60	352.33
4	21.375267	-158.061711	337.77	7.60	345.37
5	21.375055	-158.061786	333.19	7.60	340.80
6	21.375025	-158.061175	318.48	7.60	326.08
7	21.375050	-158.060813	303.34	7.60	310.94
8	21.375095	-158.060542	290.44	7.60	298.04
9	21.375475	-158.060413	294.34	7.60	301.94
10	21.375724	-158.060362	297.35	7.60	304.95
11	21.376002	-158.060582	314.55	7.60	322.15
12	21.376299	-158.060797	321.82	7.60	329.42

Name: PV Area 3-1

Axis tracking: Fixed (no rotation)

Tilt: 15.0°

Orientation: 180.0°

Rated power: -

Panel material: Smooth glass with AR coating

Reflectivity: Vary with sun

Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.374960	-158.063771	403.94	7.60	411.54
2	21.374550	-158.064018	409.08	7.60	416.68
3	21.374006	-158.064372	405.79	7.60	413.39
4	21.373486	-158.063921	358.12	7.60	365.72
5	21.374071	-158.063321	356.56	7.60	364.16
6	21.374800	-158.062698	341.18	7.60	348.79
7	21.375030	-158.063702	401.45	7.60	409.05

Name: PV Area 3-2

Axis tracking: Fixed (no rotation)

Tilt: 15.0°

Orientation: 180.0°

Rated power: -

Panel material: Smooth glass with AR coating

Reflectivity: Vary with sun

Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.373471	-158.063900	356.53	7.60	364.13
2	21.373052	-158.063605	329.89	7.60	337.49
3	21.372872	-158.063063	308.33	7.60	315.93
4	21.373132	-158.062811	306.55	7.60	314.15
5	21.373511	-158.062468	302.42	7.60	310.02
6	21.373911	-158.062012	300.71	7.60	308.31
7	21.374650	-158.061711	322.58	7.60	330.18
8	21.374790	-158.062634	337.82	7.60	345.42
9	21.374361	-158.063010	346.18	7.60	353.78
10	21.373771	-158.063557	360.52	7.60	368.12
11	21.373431	-158.063927	356.09	7.60	363.69

Name: PV Area 3-3

Axis tracking: Fixed (no rotation)

Tilt: 15.0°

Orientation: 180.0°

Rated power: -

Panel material: Smooth glass with AR coating

Reflectivity: Vary with sun

Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.373971	-158.064423	405.46	7.60	413.06
2	21.373346	-158.064702	408.59	7.60	416.19
3	21.372987	-158.064917	407.08	7.60	414.68
4	21.372597	-158.065507	390.32	7.60	397.92
5	21.372397	-158.065474	370.08	7.60	377.68
6	21.372093	-158.064670	325.30	7.60	332.90
7	21.372627	-158.064343	352.86	7.60	360.46
8	21.373376	-158.063887	352.43	7.60	360.03

Name: PV Area 3-4

Axis tracking: Fixed (no rotation)

Tilt: 15.0°

Orientation: 180.0°

Rated power: -

Panel material: Smooth glass with AR coating

Reflectivity: Vary with sun

Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.373311	-158.063844	348.21	7.60	355.81
2	21.372912	-158.064117	354.61	7.60	362.22
3	21.372332	-158.064477	337.76	7.60	345.36
4	21.372073	-158.064616	321.88	7.60	329.48
5	21.371838	-158.064101	301.52	7.60	309.12
6	21.371713	-158.063763	289.80	7.60	297.40
7	21.371698	-158.063415	280.75	7.60	288.35
8	21.372113	-158.063200	288.24	7.60	295.85
9	21.372807	-158.063007	305.71	7.60	313.31
10	21.372967	-158.063495	325.17	7.60	332.77
11	21.373032	-158.063661	332.00	7.60	339.60
12	21.373232	-158.063774	341.54	7.60	349.14

Name: PV Area 4

Axis tracking: Fixed (no rotation)

Tilt: 15.0°

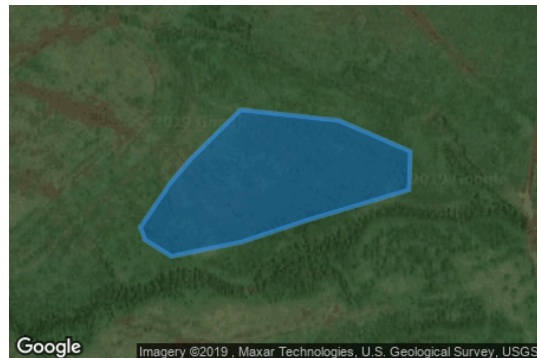
Orientation: 180.0°

Rated power: -

Panel material: Smooth glass with AR coating

Reflectivity: Vary with sun

Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.371341	-158.066427	397.82	7.60	405.42
2	21.371151	-158.066598	400.08	7.60	407.68
3	21.370776	-158.066875	379.77	7.60	387.37
4	21.370671	-158.066832	364.94	7.60	372.54
5	21.370531	-158.066590	351.04	7.60	358.64
6	21.370651	-158.065957	338.58	7.60	346.18
7	21.370836	-158.065356	317.01	7.60	324.61
8	21.371091	-158.064434	293.63	7.60	301.23
9	21.371416	-158.064423	295.80	7.60	303.40
10	21.371675	-158.065072	321.71	7.60	329.31
11	21.371765	-158.065963	374.69	7.60	382.29

Discrete Observation Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (ft)	Height (ft)
OP 1	1	21.338918	-158.055780	62.34	16.00
OP 2	2	21.365603	-158.072233	580.70	16.00
OP 3	3	21.386054	-158.033239	227.55	16.00

Route Receptor(s)

Name: Farrington -1

Path type: Two-way

Observer view angle: 50.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.374314	-158.038678	145.95	9.00	154.95
2	21.374270	-158.040953	161.53	9.00	170.53
3	21.374074	-158.041468	165.25	9.00	174.25
4	21.371476	-158.045244	172.88	9.00	181.88

Name: Farrington - 2

Path type: Two-way

Observer view angle: 50.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.371337	-158.045416	172.99	9.00	181.99
2	21.368939	-158.049107	172.07	9.00	181.07
3	21.366881	-158.052196	167.23	9.00	176.23
4	21.366321	-158.052604	164.96	9.00	173.96
5	21.362824	-158.054514	154.31	9.00	163.31
6	21.362164	-158.055179	155.55	9.00	164.55

Name: H 1 - 1

Path type: Two-way

Observer view angle: 50.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.383670	-158.032421	174.50	9.00	183.50
2	21.383101	-158.033311	183.18	9.00	192.18
3	21.382202	-158.034942	180.15	9.00	189.15
4	21.381033	-158.037012	192.95	9.00	201.95
5	21.379864	-158.039115	181.51	9.00	190.51

Name: H 1 - 2

Path type: Two-way

Observer view angle: 50.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.379784	-158.039212	180.23	9.00	189.23
2	21.378825	-158.040950	184.82	9.00	193.83
3	21.378086	-158.042849	176.17	9.00	185.17
4	21.377196	-158.045166	170.51	9.00	179.51
5	21.376093	-158.047863	197.59	9.00	206.59
6	21.375454	-158.049472	200.45	9.00	209.45

Name: H 1 - 3

Path type: Two-way

Observer view angle: 50.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.375384	-158.049558	200.81	9.00	209.81
2	21.374635	-158.050770	224.53	9.00	233.53
3	21.373785	-158.051961	218.02	9.00	227.02
4	21.372457	-158.053453	212.66	9.00	221.66
5	21.370868	-158.055212	204.08	9.00	213.08
6	21.369140	-158.057100	199.86	9.00	208.86

Name: H 1 - 4

Path type: Two-way

Observer view angle: 50.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.369060	-158.057143	198.86	9.00	207.86
2	21.366202	-158.060383	213.91	9.00	222.92
3	21.365253	-158.061435	206.63	9.00	215.63
4	21.364254	-158.062325	213.41	9.00	222.41

Name: Kualakai - 1

Path type: Two-way

Observer view angle: 50.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.366859	-158.060799	229.85	9.00	238.85
2	21.366040	-158.059962	204.96	9.00	213.96
3	21.365001	-158.058804	185.96	9.00	194.96
4	21.363982	-158.057624	172.93	9.00	181.93
5	21.362703	-158.056143	160.77	9.00	169.77
6	21.362083	-158.055499	157.30	9.00	166.30

Name: Kualakai - 2

Path type: Two-way

Observer view angle: 50.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.361924	-158.055349	155.26	9.00	164.27
2	21.361124	-158.054319	148.95	9.00	157.95
3	21.360365	-158.053525	138.32	9.00	147.32
4	21.359526	-158.052602	140.78	9.00	149.78
5	21.358646	-158.051766	140.91	9.00	149.91

Name: Kualakai - 3

Path type: Two-way

Observer view angle: 50.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.358466	-158.051594	139.44	9.00	148.44
2	21.357647	-158.051122	134.59	9.00	143.59
3	21.356528	-158.050478	125.14	9.00	134.14
4	21.355149	-158.049899	119.06	9.00	128.06
5	21.353670	-158.049491	111.60	9.00	120.60
6	21.352431	-158.049362	102.67	9.00	111.67

Name: Kualakai - 4

Path type: Two-way

Observer view angle: 50.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.352347	-158.049384	102.24	9.00	111.24
2	21.351248	-158.049384	95.16	9.00	104.16
3	21.349290	-158.049706	84.68	9.00	93.68
4	21.347391	-158.050199	78.74	9.00	87.74
5	21.345253	-158.051744	77.85	9.00	86.85
6	21.344313	-158.052667	75.37	9.00	84.37

Name: Kualakai - 5

Path type: Two-way

Observer view angle: 50.0°



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.344193	-158.052796	74.68	9.00	83.68
2	21.343174	-158.053439	70.98	9.00	79.98
3	21.342295	-158.053697	68.90	9.00	77.90
4	21.341075	-158.053718	68.79	9.00	77.79
5	21.339097	-158.052860	59.09	9.00	68.09
6	21.336099	-158.051379	55.78	9.00	64.78

GLARE ANALYSIS RESULTS

Summary of Glare

PV Array Name	Tilt	Orient	"Green" Glare	"Yellow" Glare	Energy
	(°)	(°)	min	min	kWh
PV Area 1	15.0	180.0	1,278	0	-
PV Area 2-1	15.0	180.0	0	0	-
PV Area 2-2	15.0	180.0	849	0	-
PV Area 2-3	15.0	180.0	1,215	0	-
PV Area 3-1	15.0	180.0	1,253	0	-
PV Area 3-2	15.0	180.0	1,042	50	-
PV Area 3-3	15.0	180.0	466	0	-
PV Area 3-4	15.0	180.0	1,289	0	-
PV Area 4	15.0	180.0	1,798	0	-

Total annual glare received by each receptor

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
Farrington -1	1608	0
Farrington - 2	4840	0
H 1 - 1	0	0
H 1 - 2	118	0
H 1 - 3	2624	50
H 1 - 4	0	0
Kualakai - 1	0	0
Kualakai - 2	0	0
Kualakai - 3	0	0
Kualakai - 4	0	0
Kualakai - 5	0	0

Results for: PV Area 1

Receptor	Green Glare (min)	Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
Farrington -1	542	0
Farrington - 2	0	0
H 1 - 1	0	0
H 1 - 2	118	0
H 1 - 3	618	0
H 1 - 4	0	0
Kualakai - 1	0	0
Kualakai - 2	0	0
Kualakai - 3	0	0
Kualakai - 4	0	0
Kualakai - 5	0	0

Point Receptor: OP 1

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 3

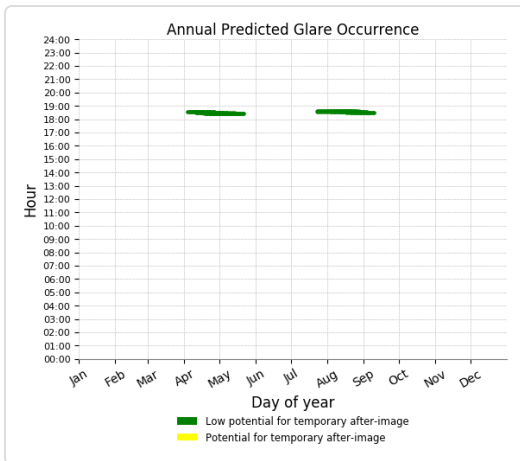
0 minutes of yellow glare

0 minutes of green glare

Route: Farrington -1

0 minutes of yellow glare

542 minutes of green glare



Route: Farrington - 2

0 minutes of yellow glare

0 minutes of green glare

Route: H 1 - 1

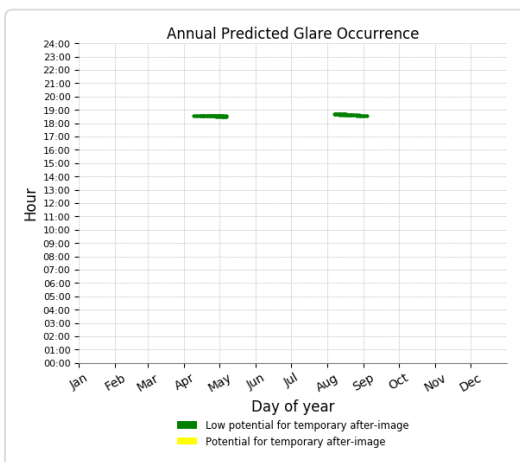
0 minutes of yellow glare

0 minutes of green glare

Route: H 1 - 2

0 minutes of yellow glare

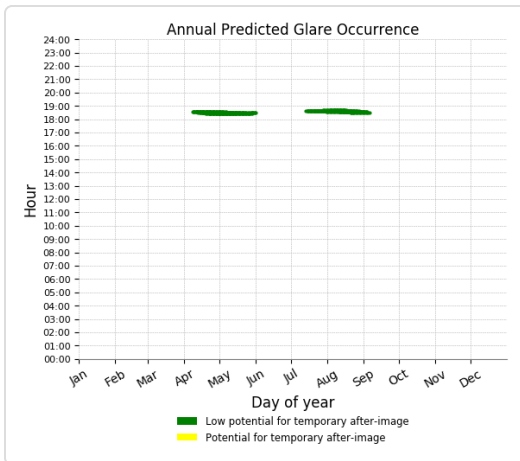
118 minutes of green glare



Route: H 1 - 3

0 minutes of yellow glare

618 minutes of green glare



Route: H 1 - 4

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 1

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 2

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 3

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 4

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 5

0 minutes of yellow glare
0 minutes of green glare

Results for: PV Area 2-1

Receptor	Green Glare (min)	Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
Farrington -1	0	0
Farrington - 2	0	0
H 1 - 1	0	0
H 1 - 2	0	0
H 1 - 3	0	0
H 1 - 4	0	0
Kualakai - 1	0	0
Kualakai - 2	0	0
Kualakai - 3	0	0
Kualakai - 4	0	0
Kualakai - 5	0	0

Point Receptor: OP 1

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare

0 minutes of green glare

Route: Farrington -1

0 minutes of yellow glare

0 minutes of green glare

Route: Farrington - 2

0 minutes of yellow glare

0 minutes of green glare

Route: H 1 - 1

0 minutes of yellow glare

0 minutes of green glare

Route: H 1 - 2

0 minutes of yellow glare

0 minutes of green glare

Route: H 1 - 3

0 minutes of yellow glare

0 minutes of green glare

Route: H 1 - 4

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 1

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 2

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 3

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 4

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 5

0 minutes of yellow glare

0 minutes of green glare

Results for: PV Area 2-2

Receptor	Green Glare (min)	Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
Farrington -1	318	0
Farrington - 2	299	0
H 1 - 1	0	0
H 1 - 2	0	0
H 1 - 3	232	0
H 1 - 4	0	0
Kualakai - 1	0	0
Kualakai - 2	0	0
Kualakai - 3	0	0
Kualakai - 4	0	0
Kualakai - 5	0	0

Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

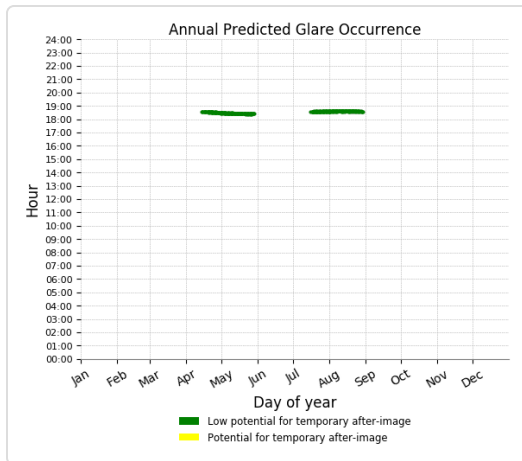
0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare
0 minutes of green glare

Route: Farrington -1

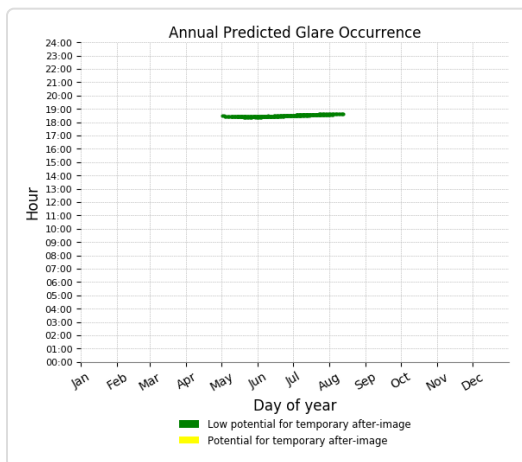
0 minutes of yellow glare
318 minutes of green glare



Route: Farrington - 2

0 minutes of yellow glare

299 minutes of green glare



Route: H 1 - 1

0 minutes of yellow glare

0 minutes of green glare

Route: H 1 - 2

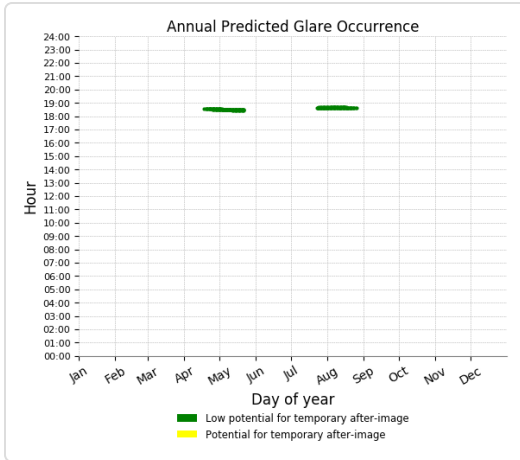
0 minutes of yellow glare

0 minutes of green glare

Route: H 1 - 3

0 minutes of yellow glare

232 minutes of green glare



Route: H 1 - 4

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 1

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 2

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 3

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 4

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 5

0 minutes of yellow glare
0 minutes of green glare

Results for: PV Area 2-3

Receptor	Green Glare (min)	Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
Farrington -1	421	0
Farrington - 2	413	0
H 1 - 1	0	0
H 1 - 2	0	0
H 1 - 3	381	0
H 1 - 4	0	0
Kualakai - 1	0	0
Kualakai - 2	0	0
Kualakai - 3	0	0
Kualakai - 4	0	0
Kualakai - 5	0	0

Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

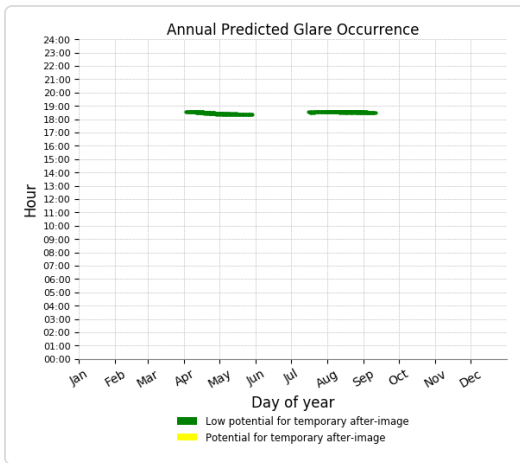
0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare
0 minutes of green glare

Route: Farrington -1

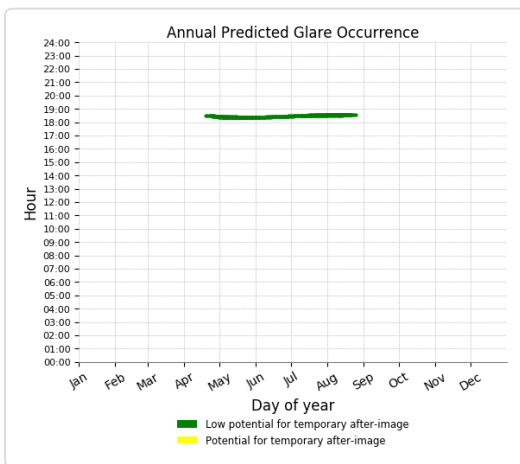
0 minutes of yellow glare
421 minutes of green glare



Route: Farrington - 2

0 minutes of yellow glare

413 minutes of green glare



Route: H 1 - 1

0 minutes of yellow glare

0 minutes of green glare

Route: H 1 - 2

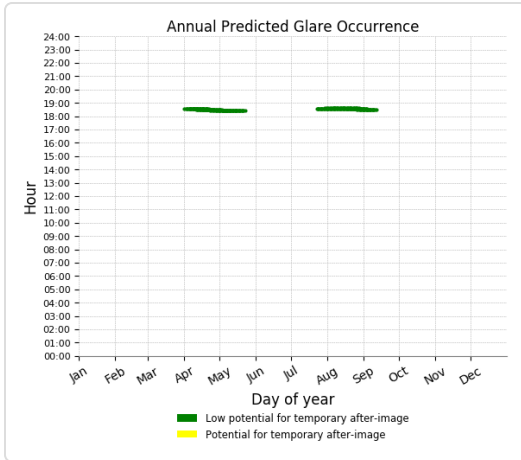
0 minutes of yellow glare

0 minutes of green glare

Route: H 1 - 3

0 minutes of yellow glare

381 minutes of green glare



Route: H 1 - 4

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 1

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 2

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 3

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 4

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 5

0 minutes of yellow glare
0 minutes of green glare

Results for: PV Area 3-1

Receptor	Green Glare (min)	Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
Farrington -1	198	0
Farrington - 2	770	0
H 1 - 1	0	0
H 1 - 2	0	0
H 1 - 3	285	0
H 1 - 4	0	0
Kualakai - 1	0	0
Kualakai - 2	0	0
Kualakai - 3	0	0
Kualakai - 4	0	0
Kualakai - 5	0	0

Point Receptor: OP 1

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 3

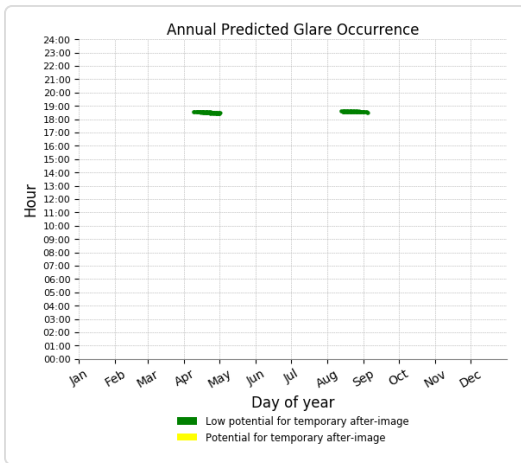
0 minutes of yellow glare

0 minutes of green glare

Route: Farrington -1

0 minutes of yellow glare

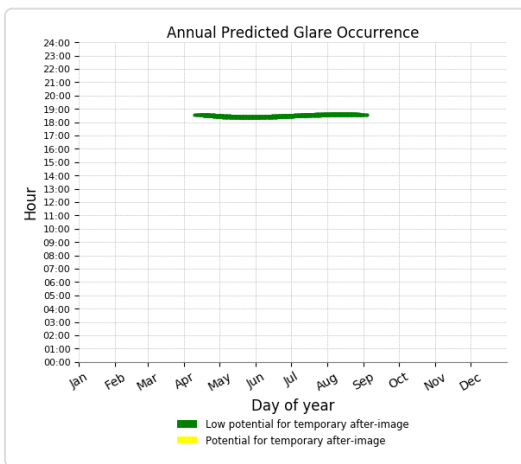
198 minutes of green glare



Route: Farrington - 2

0 minutes of yellow glare

770 minutes of green glare



Route: H 1 - 1

0 minutes of yellow glare

0 minutes of green glare

Route: H 1 - 2

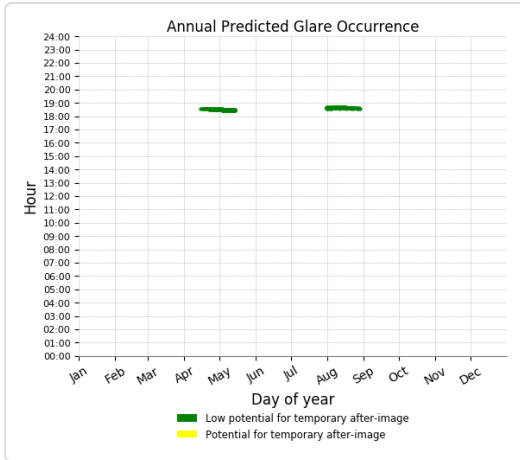
0 minutes of yellow glare

0 minutes of green glare

Route: H 1 - 3

0 minutes of yellow glare

285 minutes of green glare



Route: H 1 - 4

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 1

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 2

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 3

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 4

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 5

0 minutes of yellow glare
0 minutes of green glare

Results for: PV Area 3-2

Receptor	Green Glare (min)	Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
Farrington -1	125	0
Farrington - 2	614	0
H 1 - 1	0	0
H 1 - 2	0	0
H 1 - 3	303	50
H 1 - 4	0	0
Kualakai - 1	0	0
Kualakai - 2	0	0
Kualakai - 3	0	0
Kualakai - 4	0	0
Kualakai - 5	0	0

Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

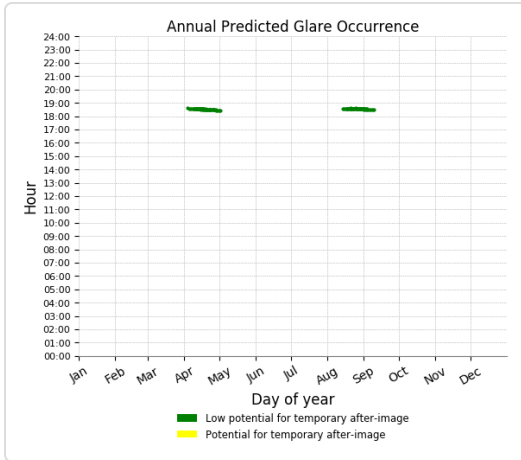
0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare
0 minutes of green glare

Route: Farrington -1

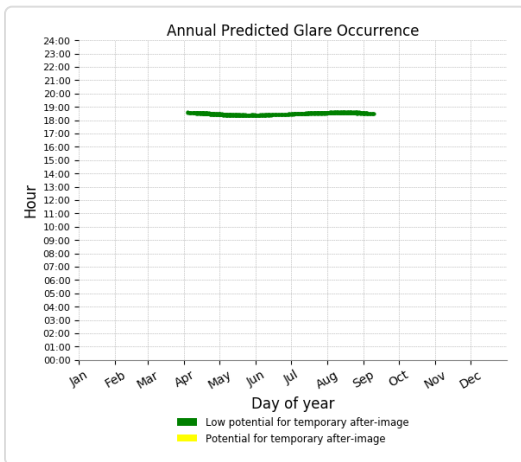
0 minutes of yellow glare
125 minutes of green glare



Route: Farrington - 2

0 minutes of yellow glare

614 minutes of green glare



Route: H 1 - 1

0 minutes of yellow glare

0 minutes of green glare

Route: H 1 - 2

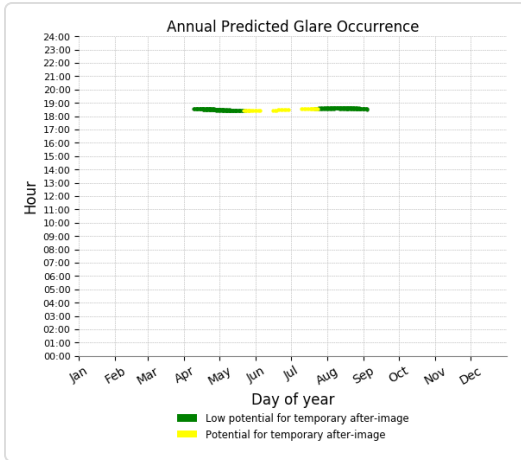
0 minutes of yellow glare

0 minutes of green glare

Route: H 1 - 3

50 minutes of yellow glare

303 minutes of green glare



Route: H 1 - 4

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 1

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 2

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 3

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 4

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 5

0 minutes of yellow glare
0 minutes of green glare

Results for: PV Area 3-3

Receptor	Green Glare (min)	Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
Farrington -1	0	0
Farrington - 2	442	0
H 1 - 1	0	0
H 1 - 2	0	0
H 1 - 3	24	0
H 1 - 4	0	0
Kualakai - 1	0	0
Kualakai - 2	0	0
Kualakai - 3	0	0
Kualakai - 4	0	0
Kualakai - 5	0	0

Point Receptor: OP 1

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare

0 minutes of green glare

Route: Farrington -1

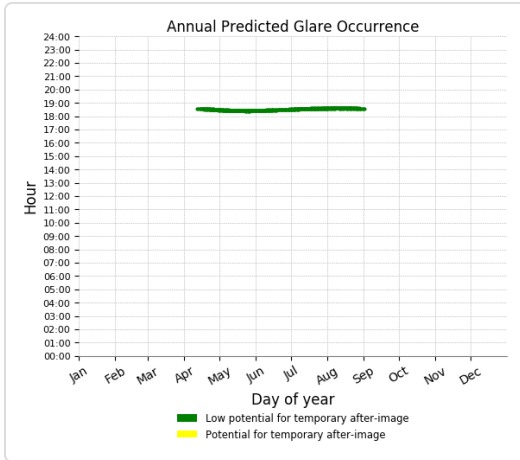
0 minutes of yellow glare

0 minutes of green glare

Route: Farrington - 2

0 minutes of yellow glare

442 minutes of green glare



Route: H 1 - 1

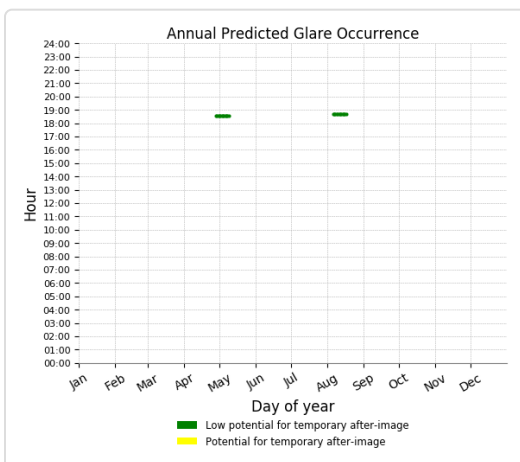
0 minutes of yellow glare
0 minutes of green glare

Route: H 1 - 2

0 minutes of yellow glare
0 minutes of green glare

Route: H 1 - 3

0 minutes of yellow glare
24 minutes of green glare



Route: H 1 - 4

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 1

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 2

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 3

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 4

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 5

0 minutes of yellow glare

0 minutes of green glare

Results for: PV Area 3-4

Receptor	Green Glare (min)	Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
Farrington -1	4	0
Farrington - 2	892	0
H 1 - 1	0	0
H 1 - 2	0	0
H 1 - 3	393	0
H 1 - 4	0	0
Kualakai - 1	0	0
Kualakai - 2	0	0
Kualakai - 3	0	0
Kualakai - 4	0	0
Kualakai - 5	0	0

Point Receptor: OP 1

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 2

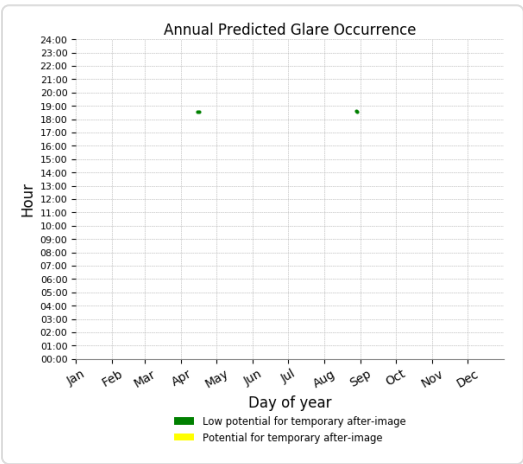
0 minutes of yellow glare
0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare
0 minutes of green glare

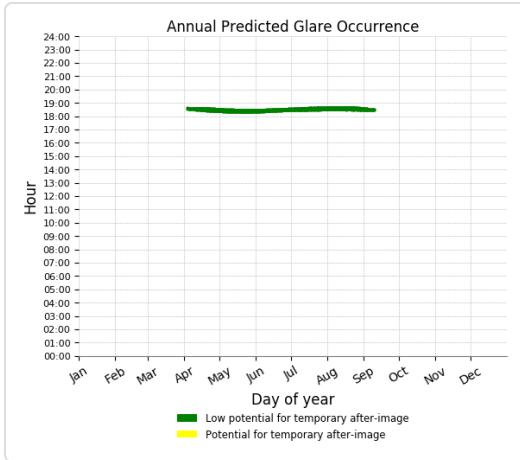
Route: Farrington -1

0 minutes of yellow glare
4 minutes of green glare



Route: Farrington - 2

0 minutes of yellow glare
892 minutes of green glare



Route: H 1 - 1

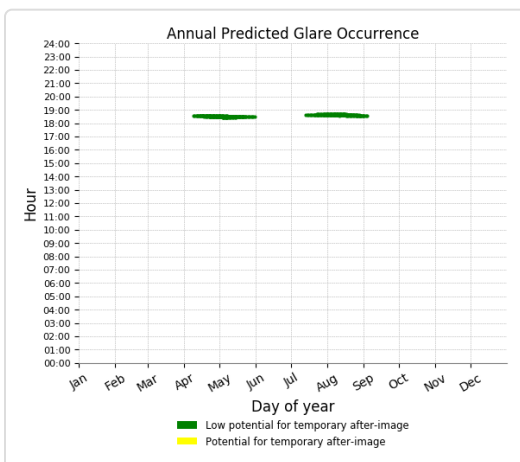
0 minutes of yellow glare
0 minutes of green glare

Route: H 1 - 2

0 minutes of yellow glare
0 minutes of green glare

Route: H 1 - 3

0 minutes of yellow glare
393 minutes of green glare



Route: H 1 - 4

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 1

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 2

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 3

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 4

0 minutes of yellow glare

0 minutes of green glare

Route: Kualakai - 5

0 minutes of yellow glare

0 minutes of green glare

Results for: PV Area 4

Receptor	Green Glare (min)	Yellow Glare (min)
OP 1	0	0
OP 2	0	0
OP 3	0	0
Farrington -1	0	0
Farrington - 2	1410	0
H 1 - 1	0	0
H 1 - 2	0	0
H 1 - 3	388	0
H 1 - 4	0	0
Kualakai - 1	0	0
Kualakai - 2	0	0
Kualakai - 3	0	0
Kualakai - 4	0	0
Kualakai - 5	0	0

Point Receptor: OP 1

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 2

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: OP 3

0 minutes of yellow glare

0 minutes of green glare

Route: Farrington -1

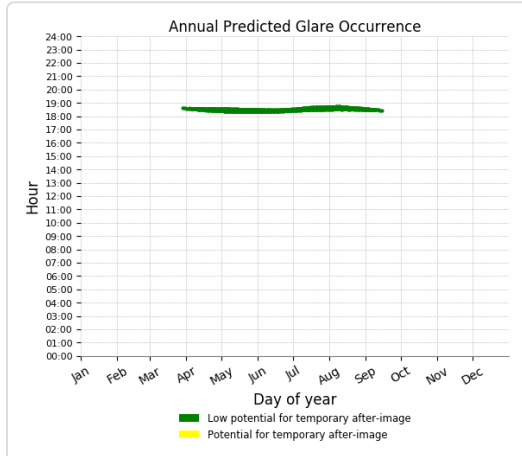
0 minutes of yellow glare

0 minutes of green glare

Route: Farrington - 2

0 minutes of yellow glare

1410 minutes of green glare



Route: H 1 - 1

0 minutes of yellow glare

0 minutes of green glare

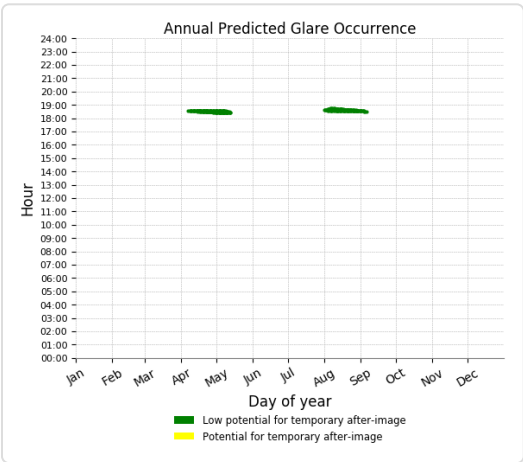
Route: H 1 - 2

0 minutes of yellow glare

0 minutes of green glare

Route: H 1 - 3

0 minutes of yellow glare
388 minutes of green glare



Route: H 1 - 4

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 1

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 2

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 3

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 4

0 minutes of yellow glare
0 minutes of green glare

Route: Kualakai - 5

0 minutes of yellow glare
0 minutes of green glare

Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.

"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.

Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.

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

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

The subtended source angle (glare spot size) is constrained by the PV array footprint size. Partitioning large arrays into smaller sections will reduce the maximum potential subtended angle, potentially impacting results if actual glare spots are larger than the sub-array size.

Additional analyses of the combined area of adjacent sub-arrays can provide more information on potential glare hazards. (See previous point on related limitations.)

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

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

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

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



FORGESOLAR GLARE ANALYSIS

Project: **AES - Hawaii**

Site configuration: **West Oahu - FAA**

Analysis conducted by Josh Burdett (joshua.burdett@tetrattech.com) at 16:43 on 21 Jan, 2020.

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)	FAIL	Receptor(s) marked as ATCT receive green and/or yellow glare

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

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

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

SITE CONFIGURATION

Analysis Parameters

DNI: peaks at 1,000.0 W/m²
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: 34872.6258



PV Array(s)

Name: PV Area 1
Axis tracking: Fixed (no rotation)
Tilt: 15.0°
Orientation: 180.0°
Rated power: -
Panel material: Smooth glass with AR coating
Reflectivity: Vary with sun
Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.378202	-158.062098	414.48	7.60	422.08
2	21.377800	-158.062280	419.04	7.60	426.64
3	21.377602	-158.062377	415.86	7.60	423.46
4	21.377450	-158.062465	411.42	7.60	419.02
5	21.377213	-158.062374	398.76	7.60	406.36
6	21.376973	-158.061441	350.35	7.60	357.96
7	21.377008	-158.060918	333.62	7.60	341.22
8	21.377120	-158.060923	338.28	7.60	345.88
9	21.377490	-158.061106	356.91	7.60	364.51
10	21.377622	-158.061476	374.30	7.60	381.90
11	21.378147	-158.061891	404.33	7.60	411.93

Name: PV Area 2-1

Axis tracking: Fixed (no rotation)

Tilt: 15.0°

Orientation: 180.0°

Rated power: -

Panel material: Smooth glass with AR coating

Reflectivity: Vary with sun

Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.376881	-158.062833	410.48	7.60	418.08
2	21.376459	-158.063010	418.17	7.60	425.77
3	21.375907	-158.063270	403.44	7.60	411.04
4	21.375544	-158.063457	390.88	7.60	398.48
5	21.375315	-158.063565	394.11	7.60	401.71
6	21.375277	-158.063152	370.95	7.60	378.55
7	21.375227	-158.062736	356.59	7.60	364.19
8	21.375574	-158.062618	369.95	7.60	377.55
9	21.376031	-158.062454	383.79	7.60	391.39
10	21.376511	-158.062293	385.02	7.60	392.62
11	21.376713	-158.062218	382.76	7.60	390.36
12	21.376833	-158.062401	392.49	7.60	400.09

Name: PV Area 2-2

Axis tracking: Fixed (no rotation)

Tilt: 15.0°

Orientation: 180.0°

Rated power: -

Panel material: Smooth glass with AR coating

Reflectivity: Vary with sun

Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.376711	-158.062205	381.82	7.60	389.42
2	21.376361	-158.062326	386.07	7.60	393.67
3	21.375894	-158.062492	380.15	7.60	387.75
4	21.375450	-158.062645	364.88	7.60	372.48
5	21.375217	-158.062728	355.93	7.60	363.53
6	21.375152	-158.062331	344.64	7.60	352.24
7	21.375065	-158.061803	333.62	7.60	341.22
8	21.375484	-158.061666	342.96	7.60	350.56
9	21.375989	-158.061513	354.20	7.60	361.80
10	21.376499	-158.061365	347.02	7.60	354.62
11	21.376598	-158.061776	365.54	7.60	373.14

Name: PV Area 2-3

Axis tracking: Fixed (no rotation)

Tilt: 15.0°

Orientation: 180.0°

Rated power: -

Panel material: Smooth glass with AR coating

Reflectivity: Vary with sun

Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.376496	-158.061349	345.68	7.60	353.28
2	21.376129	-158.061451	353.34	7.60	360.94
3	21.375649	-158.061591	344.73	7.60	352.33
4	21.375267	-158.061711	337.77	7.60	345.37
5	21.375055	-158.061786	333.19	7.60	340.80
6	21.375025	-158.061175	318.48	7.60	326.08
7	21.375050	-158.060813	303.34	7.60	310.94
8	21.375095	-158.060542	290.44	7.60	298.04
9	21.375475	-158.060413	294.34	7.60	301.94
10	21.375724	-158.060362	297.35	7.60	304.95
11	21.376002	-158.060582	314.55	7.60	322.15
12	21.376299	-158.060797	321.82	7.60	329.42

Name: PV Area 3-1

Axis tracking: Fixed (no rotation)

Tilt: 15.0°

Orientation: 180.0°

Rated power: -

Panel material: Smooth glass with AR coating

Reflectivity: Vary with sun

Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.374960	-158.063771	403.94	7.60	411.54
2	21.374550	-158.064018	409.08	7.60	416.68
3	21.374006	-158.064372	405.79	7.60	413.39
4	21.373486	-158.063921	358.12	7.60	365.72
5	21.374071	-158.063321	356.56	7.60	364.16
6	21.374800	-158.062698	341.18	7.60	348.79
7	21.375030	-158.063702	401.45	7.60	409.05

Name: PV Area 3-2

Axis tracking: Fixed (no rotation)

Tilt: 15.0°

Orientation: 180.0°

Rated power: -

Panel material: Smooth glass with AR coating

Reflectivity: Vary with sun

Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.373471	-158.063900	356.53	7.60	364.13
2	21.373052	-158.063605	329.89	7.60	337.49
3	21.372872	-158.063063	308.33	7.60	315.93
4	21.373132	-158.062811	306.55	7.60	314.15
5	21.373511	-158.062468	302.42	7.60	310.02
6	21.373911	-158.062012	300.71	7.60	308.31
7	21.374650	-158.061711	322.58	7.60	330.18
8	21.374790	-158.062634	337.82	7.60	345.42
9	21.374361	-158.063010	346.18	7.60	353.78
10	21.373771	-158.063557	360.52	7.60	368.12
11	21.373431	-158.063927	356.09	7.60	363.69

Name: PV Area 3-3

Axis tracking: Fixed (no rotation)

Tilt: 15.0°

Orientation: 180.0°

Rated power: -

Panel material: Smooth glass with AR coating

Reflectivity: Vary with sun

Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.373971	-158.064423	405.46	7.60	413.06
2	21.373346	-158.064702	408.59	7.60	416.19
3	21.372987	-158.064917	407.08	7.60	414.68
4	21.372597	-158.065507	390.32	7.60	397.92
5	21.372397	-158.065474	370.08	7.60	377.68
6	21.372093	-158.064670	325.30	7.60	332.90
7	21.372627	-158.064343	352.86	7.60	360.46
8	21.373376	-158.063887	352.43	7.60	360.03

Name: PV Area 3-4

Axis tracking: Fixed (no rotation)

Tilt: 15.0°

Orientation: 180.0°

Rated power: -

Panel material: Smooth glass with AR coating

Reflectivity: Vary with sun

Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.373311	-158.063844	348.21	7.60	355.81
2	21.372912	-158.064117	354.61	7.60	362.22
3	21.372332	-158.064477	337.76	7.60	345.36
4	21.372073	-158.064616	321.88	7.60	329.48
5	21.371838	-158.064101	301.52	7.60	309.12
6	21.371713	-158.063763	289.80	7.60	297.40
7	21.371698	-158.063415	280.75	7.60	288.35
8	21.372113	-158.063200	288.24	7.60	295.85
9	21.372807	-158.063007	305.71	7.60	313.31
10	21.372967	-158.063495	325.17	7.60	332.77
11	21.373032	-158.063661	332.00	7.60	339.60
12	21.373232	-158.063774	341.54	7.60	349.14

Name: PV Area 4

Axis tracking: Fixed (no rotation)

Tilt: 15.0°

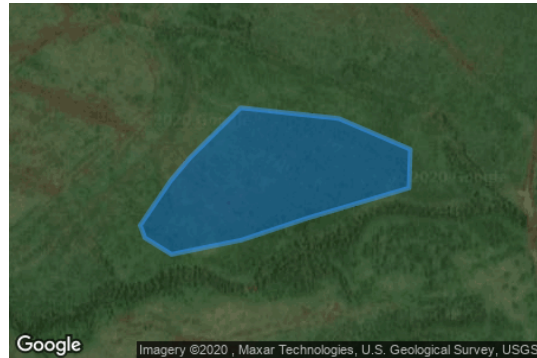
Orientation: 180.0°

Rated power: -

Panel material: Smooth glass with AR coating

Reflectivity: Vary with sun

Slope error: correlate with material



Vertex	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
1	21.371341	-158.066427	397.82	7.60	405.42
2	21.371151	-158.066598	400.08	7.60	407.68
3	21.370776	-158.066875	379.77	7.60	387.37
4	21.370671	-158.066832	364.94	7.60	372.54
5	21.370531	-158.066590	351.04	7.60	358.64
6	21.370651	-158.065957	338.58	7.60	346.18
7	21.370836	-158.065356	317.01	7.60	324.61
8	21.371091	-158.064434	293.63	7.60	301.23
9	21.371416	-158.064423	295.80	7.60	303.40
10	21.371675	-158.065072	321.71	7.60	329.31
11	21.371765	-158.065963	374.69	7.60	382.29

Flight Path Receptor(s)

Name: HHI RWY 24

Description:

Threshold height: 50 ft

Direction: 248.0°

Glide slope: 3.0°

Pilot view restricted? Yes

Vertical view: 30.0°

Azimuthal view: 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	21.484137	-158.030623	836.65	50.00	886.65
Two-mile	21.494967	-158.001780	962.56	477.54	1440.10

Name: HHI RWY 6

Description:

Threshold height: 50 ft

Direction: 68.0°

Glide slope: 3.0°

Pilot view restricted? Yes

Vertical view: 30.0°

Azimuthal view: 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	21.479376	-158.043476	816.49	50.00	866.49
Two-mile	21.468545	-158.072317	1132.87	287.08	1419.95

Name: HNL RWY 04L

Description:

Threshold height: 50 ft

Direction: 53.0°

Glide slope: 3.0°

Pilot view restricted? Yes

Vertical view: 30.0°

Azimuthal view: 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	21.318627	-157.922958	6.56	50.00	56.56
Two-mile	21.301227	-157.947774	-24.77	634.79	610.02

Name: HNL RWY 04R

Description:

Threshold height: 71 ft

Direction: 53.0°

Glide slope: 3.0°

Pilot view restricted? Yes

Vertical view: 30.0°

Azimuthal view: 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	21.314206	-157.926770	3.28	71.00	74.28
Two-mile	21.296806	-157.951585	-81.63	709.37	627.74

Name: HNL RWY 08R

Description:

Threshold height: 96 ft

Direction: 90.0°

Glide slope: 3.25°

Pilot view restricted? Yes

Vertical view: 30.0°

Azimuthal view: 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	21.306817	-157.945391	3.15	96.00	99.15
Two-mile	21.306817	-157.976461	-12.57	711.39	698.82

Name: HNL RWY 22L

Description:

Threshold height: 80 ft

Direction: 233.0°

Glide slope: 3.44°

Pilot view restricted? Yes

Vertical view: 30.0°

Azimuthal view: 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	21.328555	-157.906434	3.28	80.00	83.28
Two-mile	21.345955	-157.881617	98.61	619.49	718.10

Name: HNL RWY 22R

Description:

Threshold height: 50 ft

Direction: 233.0°

Glide slope: 3.0°

Pilot view restricted? Yes

Vertical view: 30.0°

Azimuthal view: 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	21.329580	-157.907432	6.32	50.00	56.33
Two-mile	21.346980	-157.882614	113.79	495.99	609.78

Name: HNL RWY 26L

Description:

Threshold height: 75 ft

Direction: 270.0°

Glide slope: 3.0°

Pilot view restricted? Yes

Vertical view: 30.0°

Azimuthal view: 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	21.306822	-157.911122	3.08	75.00	78.09
Two-mile	21.306827	-157.880052	8.34	623.20	631.54

Name: JRF RWY 04L

Description:

Threshold height: 35 ft

Direction: 55.0°

Glide slope: 3.0°

Pilot view restricted? Yes

Vertical view: 30.0°

Azimuthal view: 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	21.301104	-158.080872	13.12	35.00	48.13
Two-mile	21.284521	-158.106322	-24.50	626.08	601.58

Name: JRF RWY 04R

Description:

Threshold height: 55 ft

Direction: 55.0°

Glide slope: 3.0°

Pilot view restricted? Yes

Vertical view: 30.0°

Azimuthal view: 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	21.299691	-158.079822	13.11	55.00	68.11
Two-mile	21.283107	-158.105272	-28.50	650.06	621.56

Name: JRF RWY 11

Description:

Threshold height: 48 ft

Direction: 118.0°

Glide slope: 3.0°

Pilot view restricted? Yes

Vertical view: 30.0°

Azimuthal view: 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	21.311555	-158.083631	35.84	48.00	83.84
Two-mile	21.325129	-158.111066	16.69	620.60	637.30

Name: JRF RWY 22L

Description:

Threshold height: 32 ft

Direction: 235.0°

Glide slope: 3.0°

Pilot view restricted? Yes

Vertical view: 30.0°

Azimuthal view: 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	21.312291	-158.060624	26.25	32.00	58.25
Two-mile	21.328874	-158.035172	31.89	579.82	611.70

Name: JRF RWY 22R

Description:

Threshold height: 33 ft

Direction: 235.0°

Glide slope: 3.0°

Pilot view restricted? Yes

Vertical view: 30.0°

Azimuthal view: 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	21.313722	-158.061641	29.53	33.00	62.53
Two-mile	21.330305	-158.036189	32.81	583.17	615.99

Name: JRF RWY 29

Description:

Threshold height: 52 ft

Direction: 298.0°

Glide slope: 3.0°

Pilot view restricted? Yes

Vertical view: 30.0°

Azimuthal view: 50.0°



Point	Latitude (°)	Longitude (°)	Ground elevation (ft)	Height above ground (ft)	Total elevation (ft)
Threshold	21.302899	-158.066468	9.84	52.00	61.85
Two-mile	21.289326	-158.039035	-38.09	653.40	615.30

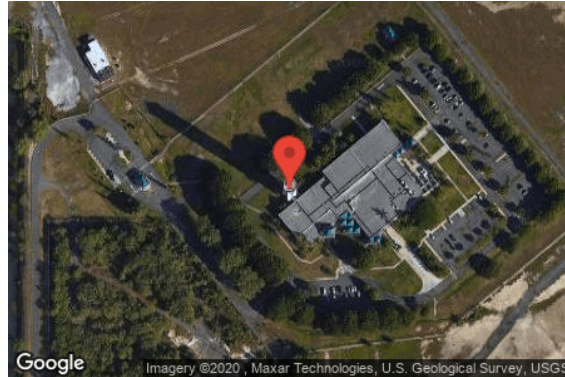
Discrete Observation Receptors

Name	ID	Latitude (°)	Longitude (°)	Elevation (ft)	Height (ft)
1-ATCT	1	21.310381	-158.070840	29.53	50.00
2-ATCT	2	21.320915	-157.927214	6.77	50.00

Map image of 1-ATCT



Map image of 2-ATCT



GLARE ANALYSIS RESULTS

Summary of Glare

PV Array Name	Tilt	Orient	"Green" Glare	"Yellow" Glare	Energy
	(°)	(°)	min	min	kWh
PV Area 1	15.0	180.0	602	0	-
PV Area 2-1	15.0	180.0	266	0	-
PV Area 2-2	15.0	180.0	212	0	-
PV Area 2-3	15.0	180.0	417	0	-
PV Area 3-1	15.0	180.0	660	0	-
PV Area 3-2	15.0	180.0	451	0	-
PV Area 3-3	15.0	180.0	567	0	-
PV Area 3-4	15.0	180.0	623	0	-
PV Area 4	15.0	180.0	813	0	-

Total annual glare received by each receptor

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
HHI RWY 24	0	0
HHI RWY 6	0	0

Receptor	Annual Green Glare (min)	Annual Yellow Glare (min)
HNL RWY 04L	0	0
HNL RWY 04R	0	0
HNL RWY 08R	0	0
HNL RWY 22L	847	0
HNL RWY 22R	866	0
HNL RWY 26L	2149	0
JRF RWY 04L	0	0
JRF RWY 04R	0	0
JRF RWY 11	0	0
JRF RWY 22L	0	0
JRF RWY 22R	0	0
JRF RWY 29	0	0
1-ATCT	0	0
2-ATCT	749	0

Results for: PV Area 1

Receptor	Green Glare (min)	Yellow Glare (min)
HHI RWY 24	0	0
HHI RWY 6	0	0
HNL RWY 04L	0	0
HNL RWY 04R	0	0
HNL RWY 08R	0	0
HNL RWY 22L	93	0
HNL RWY 22R	112	0
HNL RWY 26L	346	0
JRF RWY 04L	0	0
JRF RWY 04R	0	0
JRF RWY 11	0	0
JRF RWY 22L	0	0
JRF RWY 22R	0	0
JRF RWY 29	0	0
1-ATCT	0	0
2-ATCT	51	0

Flight Path: HHI RWY 24

0 minutes of yellow glare

0 minutes of green glare

Flight Path: HHI RWY 6

0 minutes of yellow glare
0 minutes of green glare

Flight Path: HNL RWY 04L

0 minutes of yellow glare
0 minutes of green glare

Flight Path: HNL RWY 04R

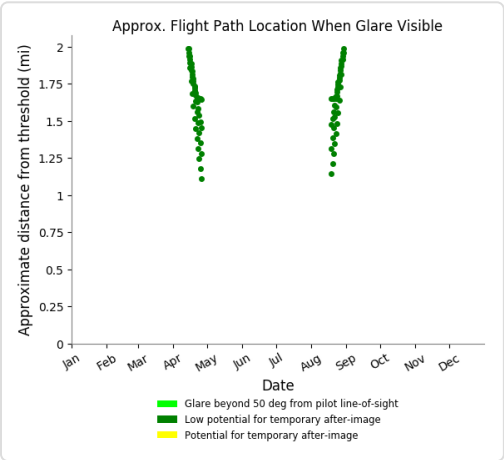
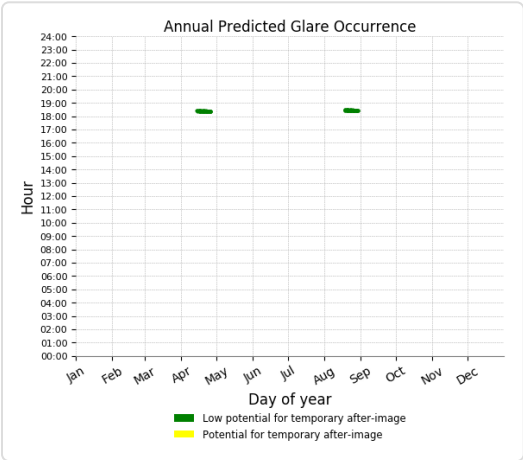
0 minutes of yellow glare
0 minutes of green glare

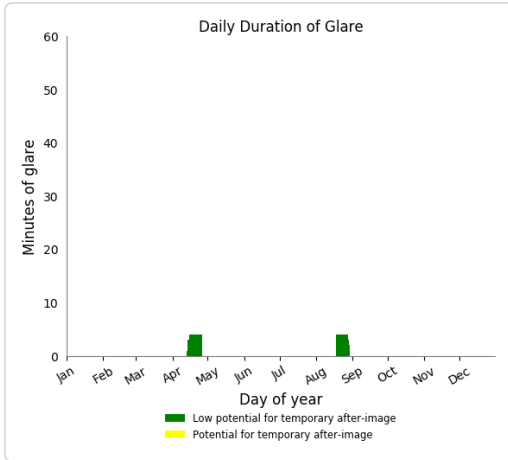
Flight Path: HNL RWY 08R

0 minutes of yellow glare
0 minutes of green glare

Flight Path: HNL RWY 22L

0 minutes of yellow glare
93 minutes of green glare

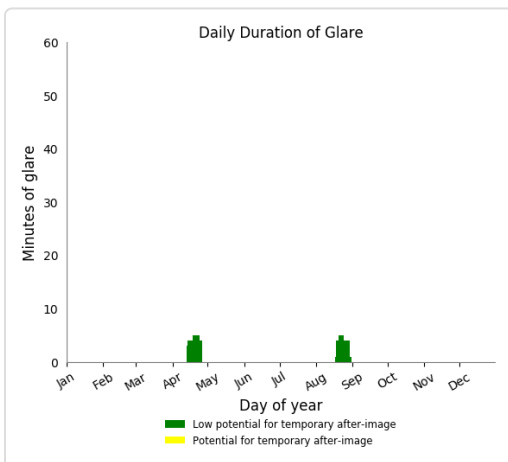
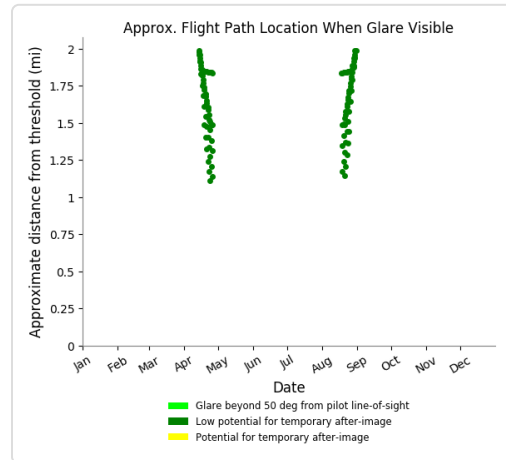
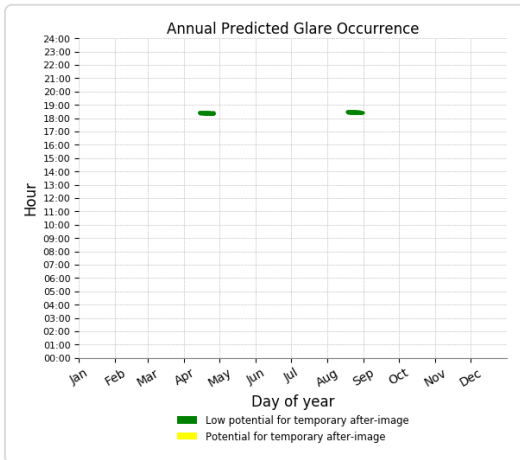




Flight Path: HNL RWY 22R

0 minutes of yellow glare

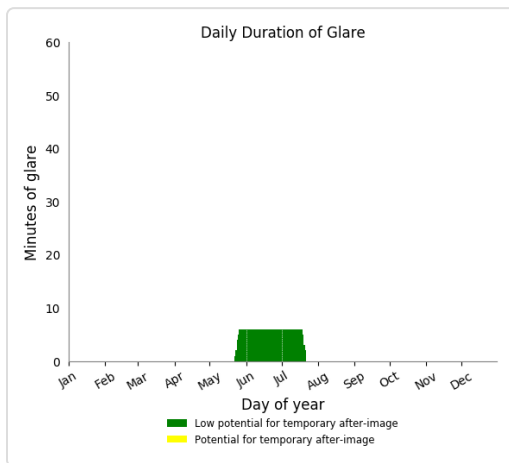
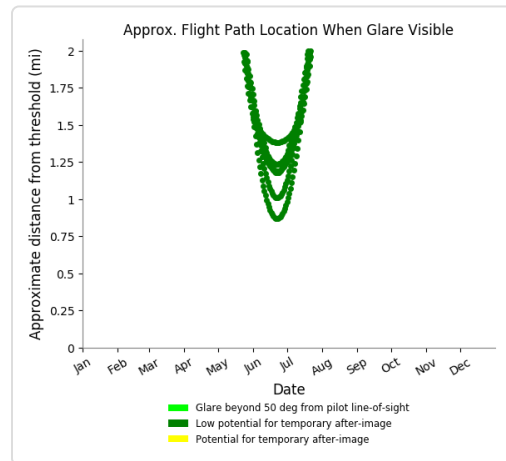
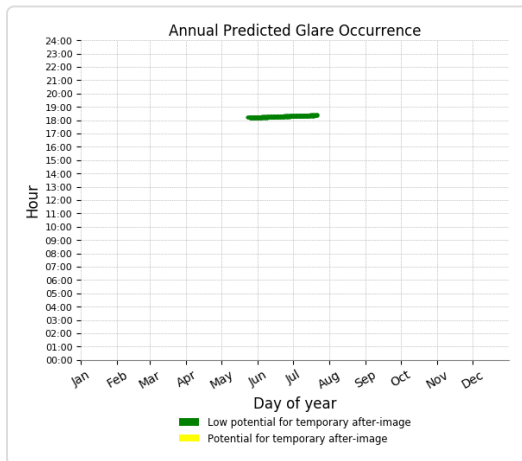
112 minutes of green glare



Flight Path: HNL RWY 26L

0 minutes of yellow glare

346 minutes of green glare



Flight Path: JRF RWY 04L

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 04R

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 11

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 22L

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 22R

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 29

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: 1-ATCT

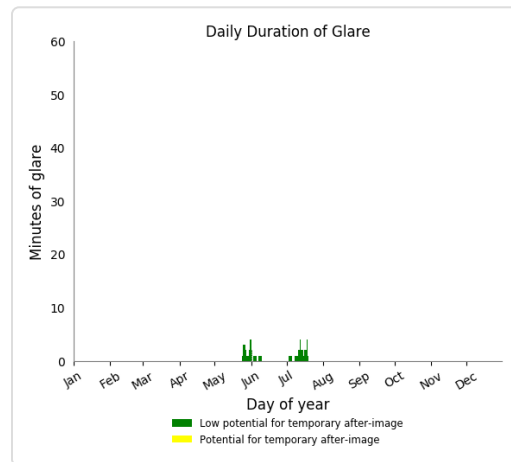
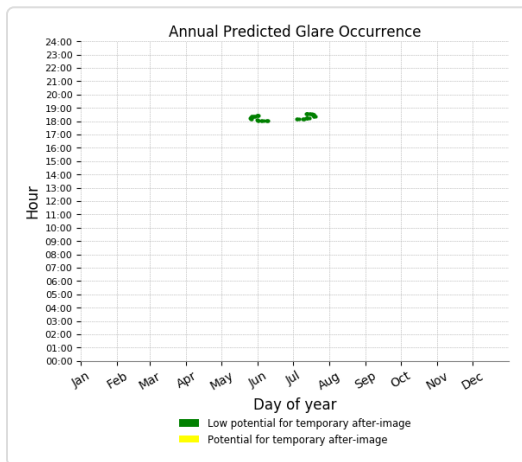
0 minutes of yellow glare

0 minutes of green glare

Point Receptor: 2-ATCT

0 minutes of yellow glare

51 minutes of green glare



Results for: PV Area 2-1

Receptor	Green Glare (min)	Yellow Glare (min)
HHI RWY 24	0	0
HHI RWY 6	0	0
HNL RWY 04L	0	0
HNL RWY 04R	0	0
HNL RWY 08R	0	0
HNL RWY 22L	31	0
HNL RWY 22R	29	0
HNL RWY 26L	151	0

Receptor	Green Glare (min)	Yellow Glare (min)
JRF RWY 04L	0	0
JRF RWY 04R	0	0
JRF RWY 11	0	0
JRF RWY 22L	0	0
JRF RWY 22R	0	0
JRF RWY 29	0	0
1-ATCT	0	0
2-ATCT	55	0

Flight Path: HHI RWY 24

0 minutes of yellow glare

0 minutes of green glare

Flight Path: HHI RWY 6

0 minutes of yellow glare

0 minutes of green glare

Flight Path: HNL RWY 04L

0 minutes of yellow glare

0 minutes of green glare

Flight Path: HNL RWY 04R

0 minutes of yellow glare

0 minutes of green glare

Flight Path: HNL RWY 08R

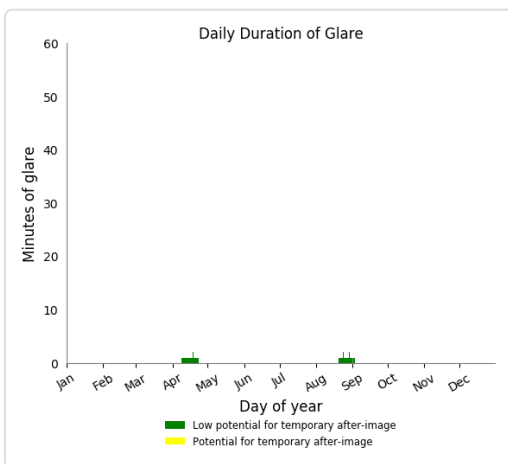
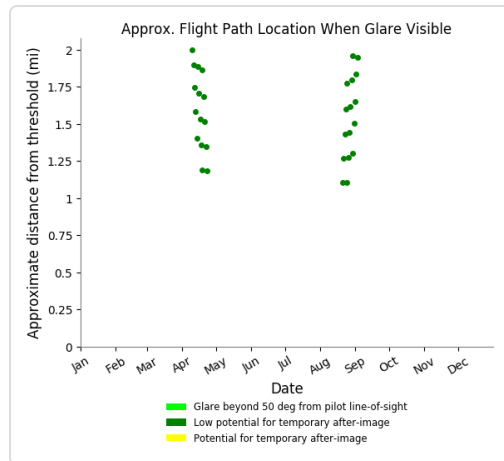
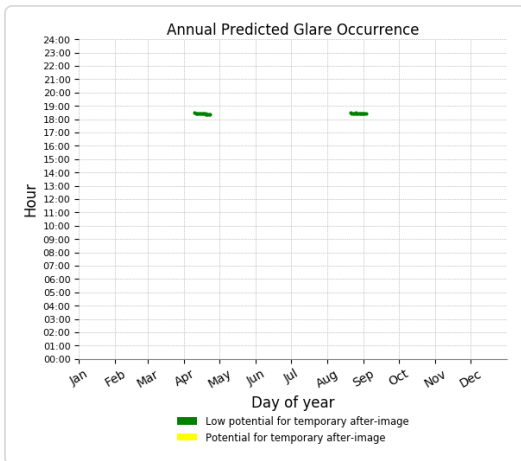
0 minutes of yellow glare

0 minutes of green glare

Flight Path: HNL RWY 22L

0 minutes of yellow glare

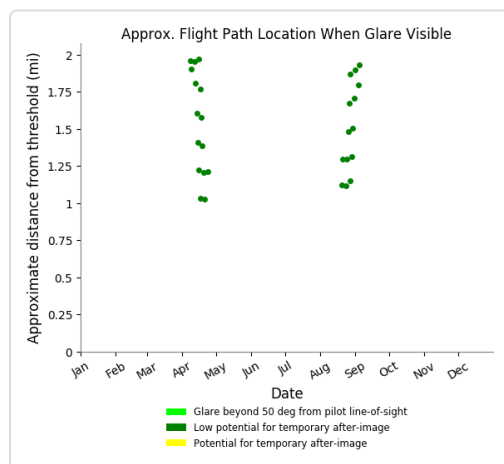
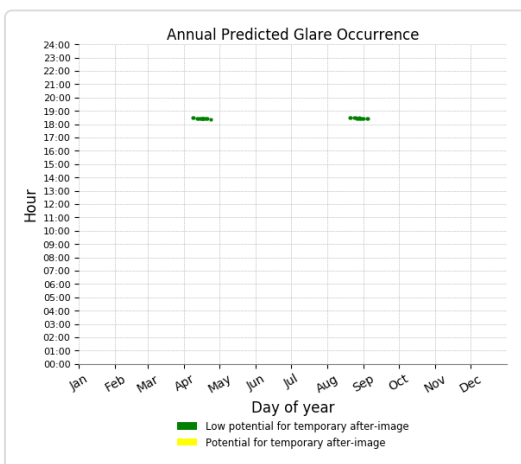
31 minutes of green glare

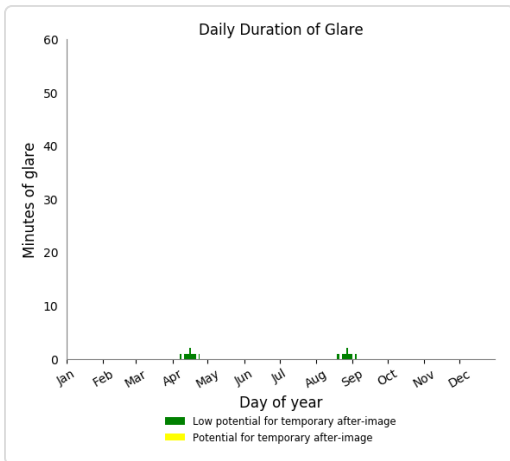


Flight Path: HNL RWY 22R

0 minutes of yellow glare

29 minutes of green glare

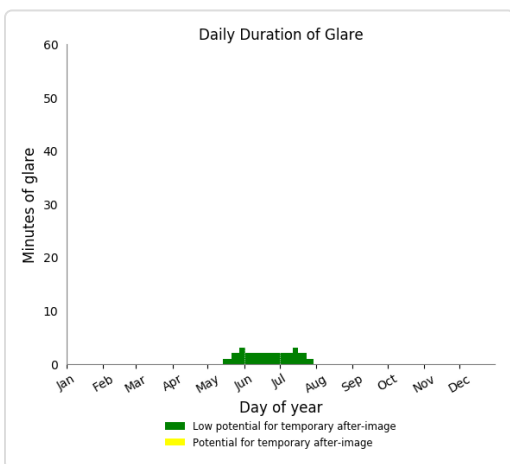
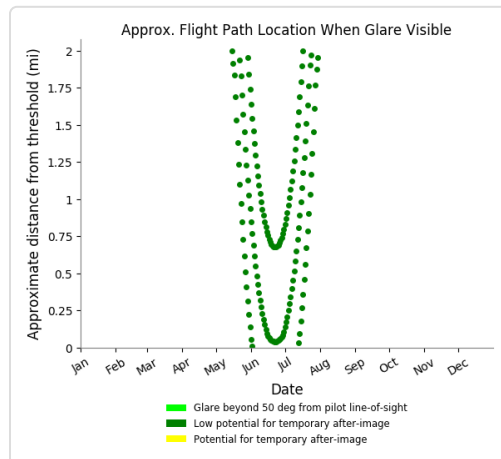
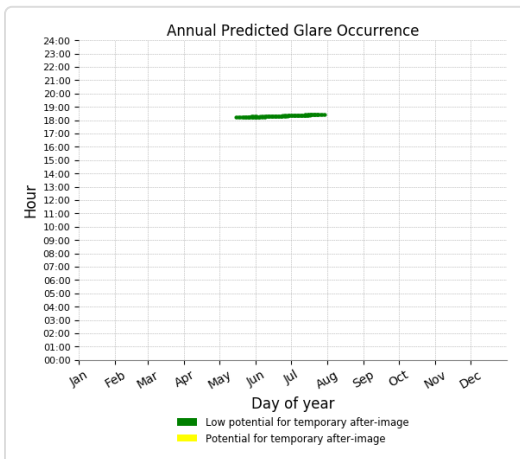




Flight Path: HNL RWY 26L

0 minutes of yellow glare

151 minutes of green glare



Flight Path: JRF RWY 04L

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 04R

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 11

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 22L

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 22R

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 29

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: 1-ATCT

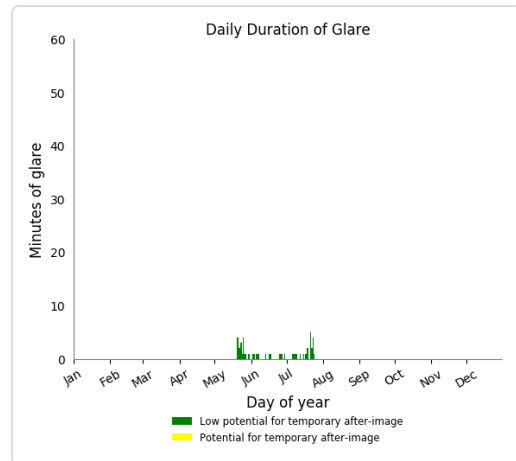
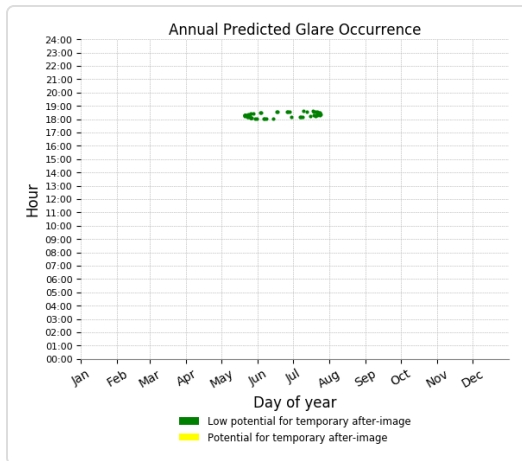
0 minutes of yellow glare

0 minutes of green glare

Point Receptor: 2-ATCT

0 minutes of yellow glare

55 minutes of green glare



Results for: PV Area 2-2

Receptor	Green Glare (min)	Yellow Glare (min)
HHI RWY 24	0	0
HHI RWY 6	0	0
HNL RWY 04L	0	0
HNL RWY 04R	0	0
HNL RWY 08R	0	0
HNL RWY 22L	33	0
HNL RWY 22R	32	0
HNL RWY 26L	82	0
JRF RWY 04L	0	0
JRF RWY 04R	0	0
JRF RWY 11	0	0
JRF RWY 22L	0	0
JRF RWY 22R	0	0
JRF RWY 29	0	0
1-ATCT	0	0
2-ATCT	65	0

Flight Path: HHI RWY 24

0 minutes of yellow glare

0 minutes of green glare

Flight Path: HHI RWY 6

0 minutes of yellow glare

0 minutes of green glare

Flight Path: HNL RWY 04L

0 minutes of yellow glare
0 minutes of green glare

Flight Path: HNL RWY 04R

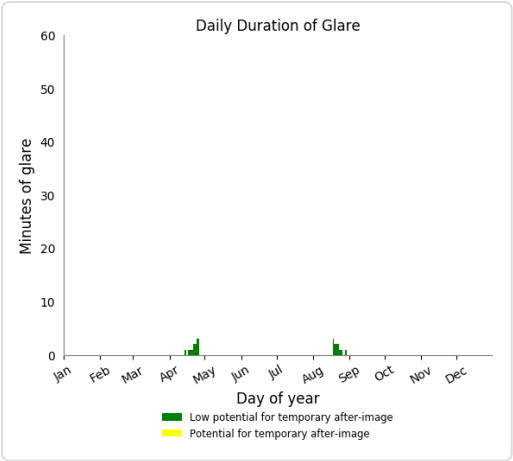
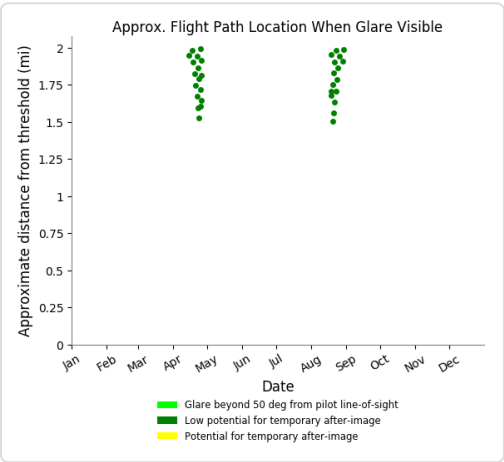
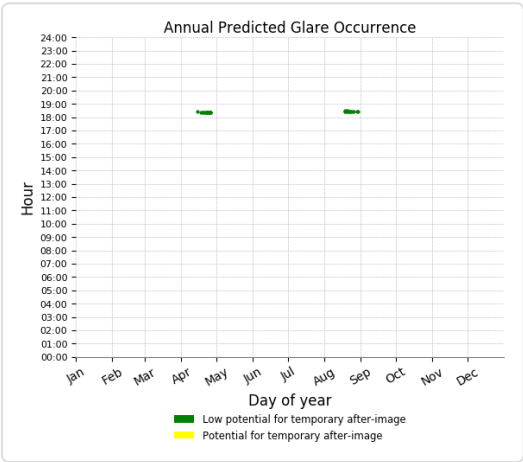
0 minutes of yellow glare
0 minutes of green glare

Flight Path: HNL RWY 08R

0 minutes of yellow glare
0 minutes of green glare

Flight Path: HNL RWY 22L

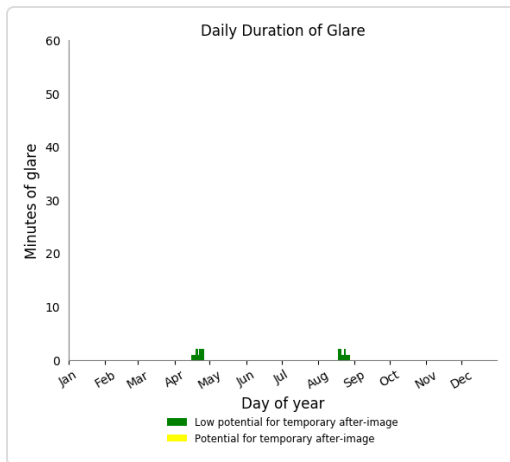
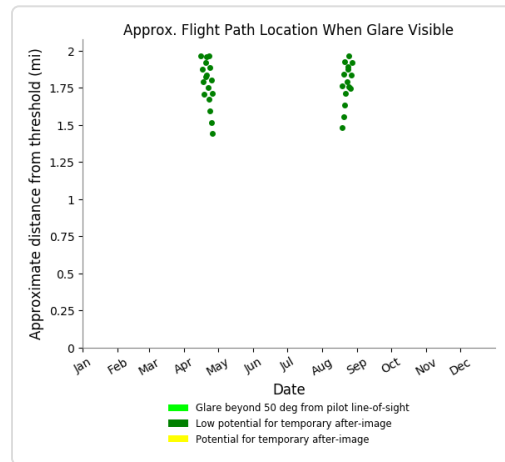
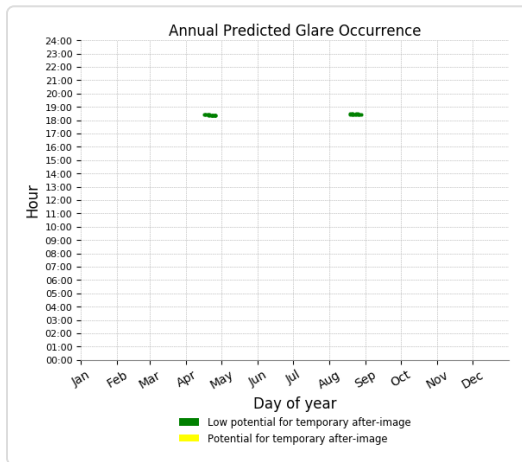
0 minutes of yellow glare
33 minutes of green glare



Flight Path: HNL RWY 22R

0 minutes of yellow glare

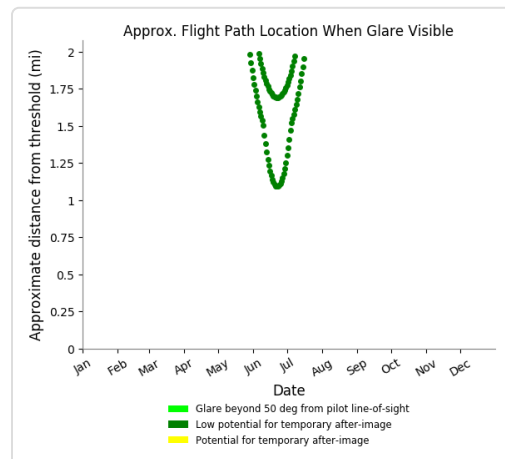
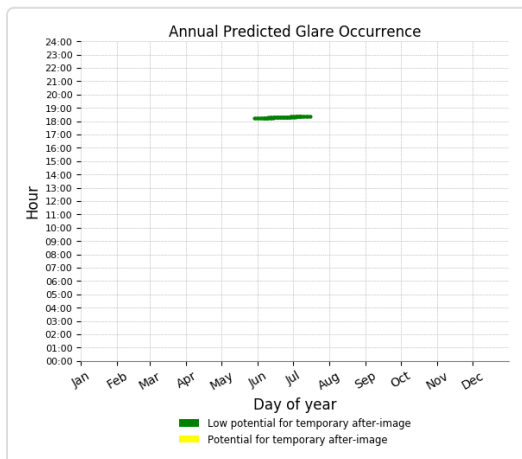
32 minutes of green glare

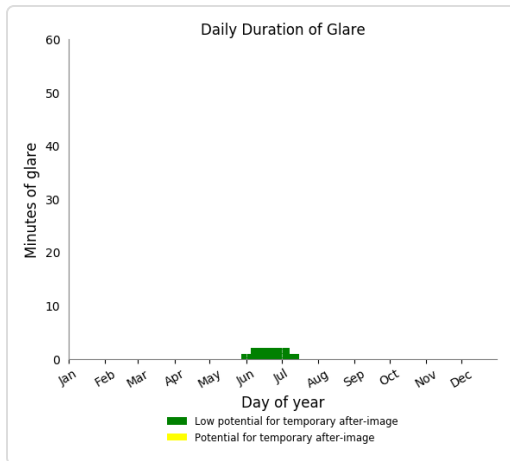


Flight Path: HNL RWY 26L

0 minutes of yellow glare

82 minutes of green glare





Flight Path: JRF RWY 04L

0 minutes of yellow glare
0 minutes of green glare

Flight Path: JRF RWY 04R

0 minutes of yellow glare
0 minutes of green glare

Flight Path: JRF RWY 11

0 minutes of yellow glare
0 minutes of green glare

Flight Path: JRF RWY 22L

0 minutes of yellow glare
0 minutes of green glare

Flight Path: JRF RWY 22R

0 minutes of yellow glare
0 minutes of green glare

Flight Path: JRF RWY 29

0 minutes of yellow glare
0 minutes of green glare

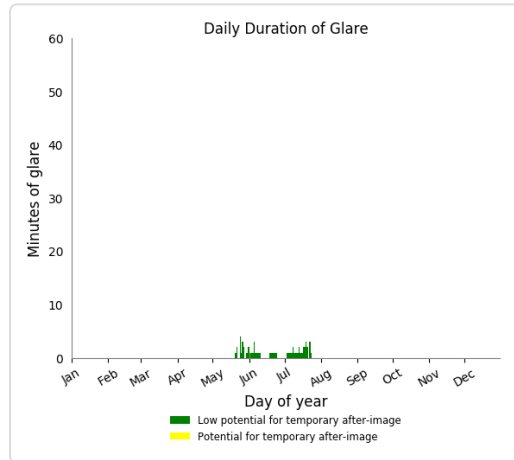
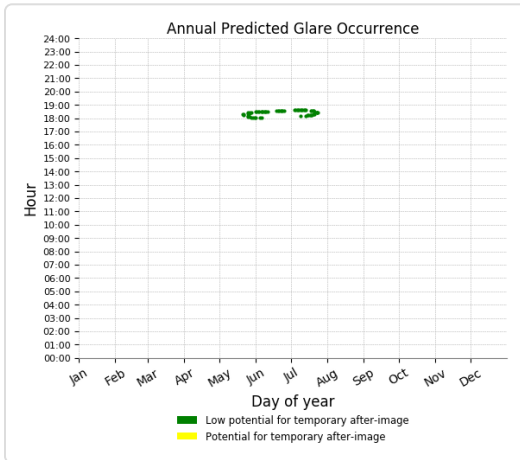
Point Receptor: 1-ATCT

0 minutes of yellow glare
0 minutes of green glare

Point Receptor: 2-ATCT

0 minutes of yellow glare

65 minutes of green glare



Results for: PV Area 2-3

Receptor	Green Glare (min)	Yellow Glare (min)
HHI RWY 24	0	0
HHI RWY 6	0	0
HNL RWY 04L	0	0
HNL RWY 04R	0	0
HNL RWY 08R	0	0
HNL RWY 22L	72	0
HNL RWY 22R	75	0
HNL RWY 26L	224	0
JRF RWY 04L	0	0
JRF RWY 04R	0	0
JRF RWY 11	0	0
JRF RWY 22L	0	0
JRF RWY 22R	0	0
JRF RWY 29	0	0
1-ATCT	0	0
2-ATCT	46	0

Flight Path: HHI RWY 24

0 minutes of yellow glare

0 minutes of green glare

Flight Path: HHI RWY 6

0 minutes of yellow glare
0 minutes of green glare

Flight Path: HNL RWY 04L

0 minutes of yellow glare
0 minutes of green glare

Flight Path: HNL RWY 04R

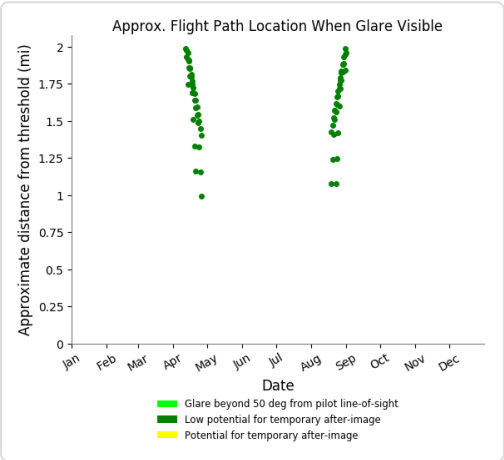
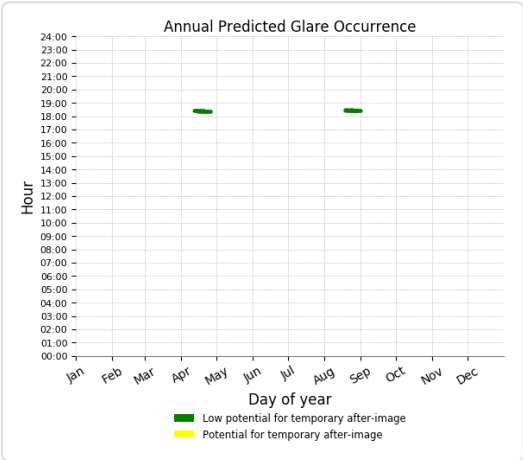
0 minutes of yellow glare
0 minutes of green glare

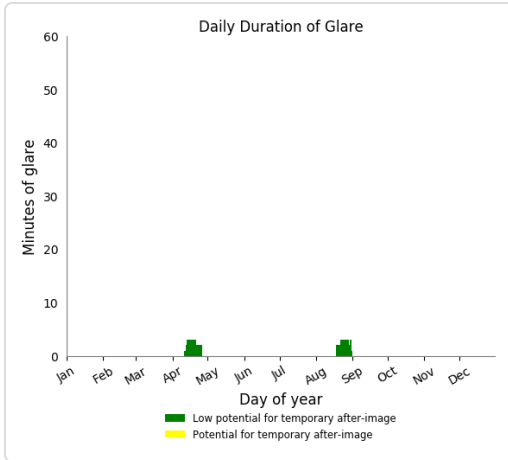
Flight Path: HNL RWY 08R

0 minutes of yellow glare
0 minutes of green glare

Flight Path: HNL RWY 22L

0 minutes of yellow glare
72 minutes of green glare

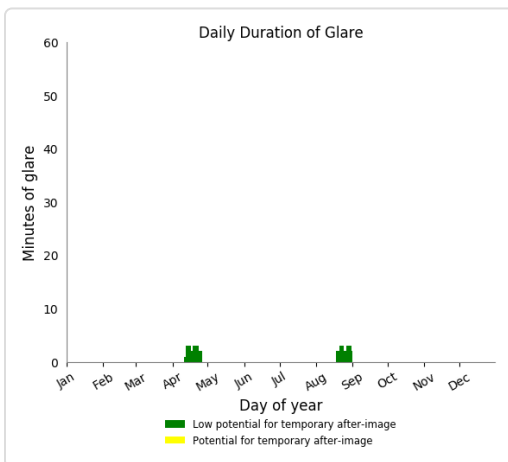
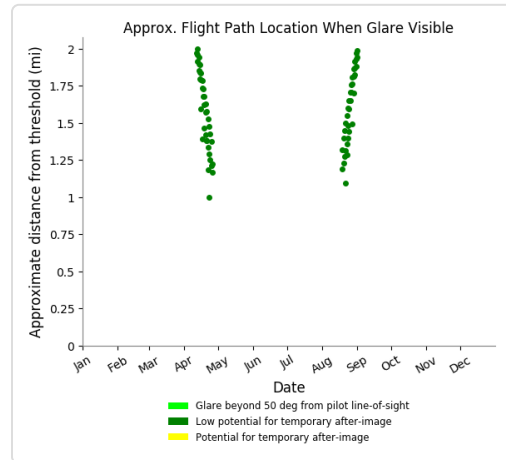
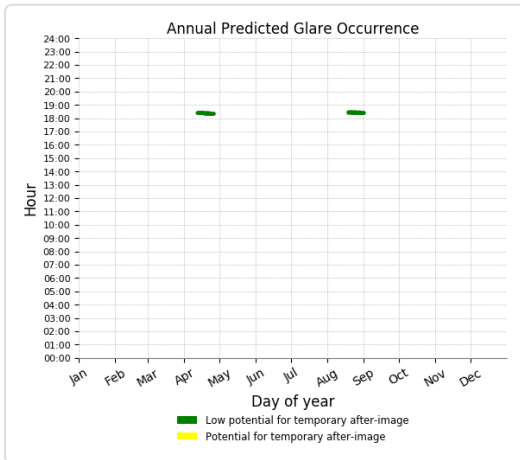




Flight Path: HNL RWY 22R

0 minutes of yellow glare

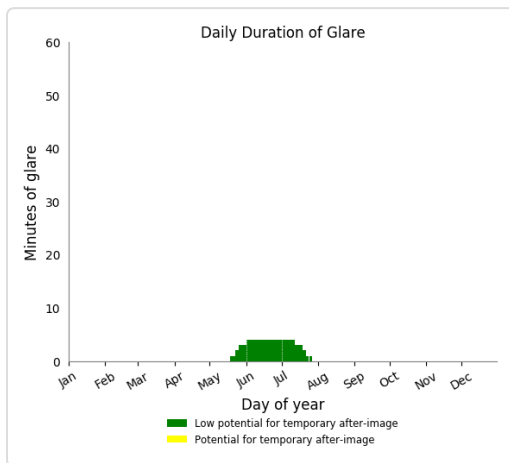
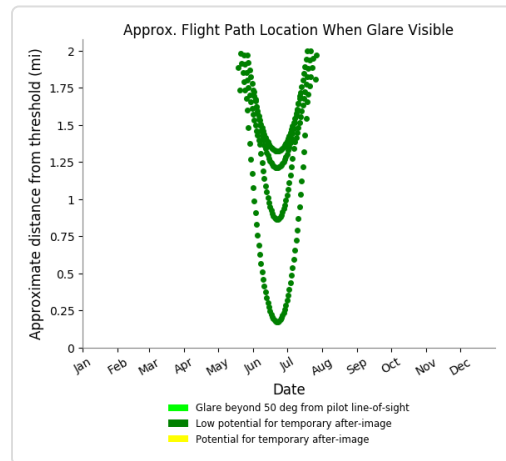
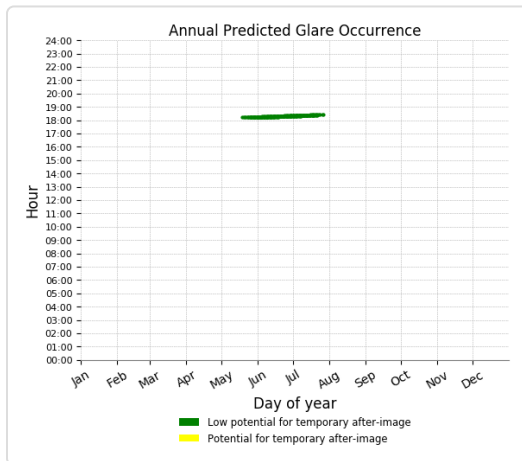
75 minutes of green glare



Flight Path: HNL RWY 26L

0 minutes of yellow glare

224 minutes of green glare



Flight Path: JRF RWY 04L

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 04R

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 11

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 22L

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 22R

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 29

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: 1-ATCT

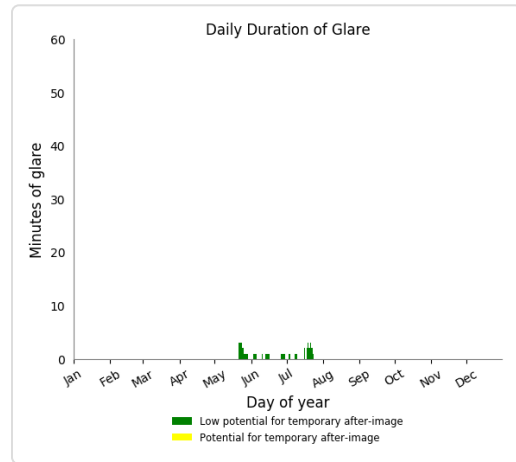
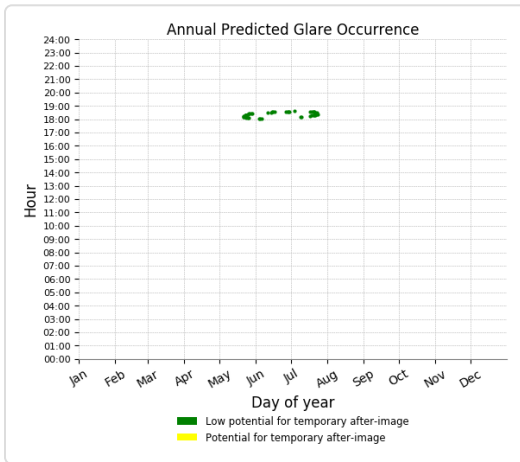
0 minutes of yellow glare

0 minutes of green glare

Point Receptor: 2-ATCT

0 minutes of yellow glare

46 minutes of green glare



Results for: PV Area 3-1

Receptor	Green Glare (min)	Yellow Glare (min)
HHI RWY 24	0	0
HHI RWY 6	0	0
HNL RWY 04L	0	0
HNL RWY 04R	0	0
HNL RWY 08R	0	0
HNL RWY 22L	132	0
HNL RWY 22R	133	0
HNL RWY 26L	292	0

Receptor	Green Glare (min)	Yellow Glare (min)
JRF RWY 04L	0	0
JRF RWY 04R	0	0
JRF RWY 11	0	0
JRF RWY 22L	0	0
JRF RWY 22R	0	0
JRF RWY 29	0	0
1-ATCT	0	0
2-ATCT	103	0

Flight Path: HHI RWY 24

0 minutes of yellow glare

0 minutes of green glare

Flight Path: HHI RWY 6

0 minutes of yellow glare

0 minutes of green glare

Flight Path: HNL RWY 04L

0 minutes of yellow glare

0 minutes of green glare

Flight Path: HNL RWY 04R

0 minutes of yellow glare

0 minutes of green glare

Flight Path: HNL RWY 08R

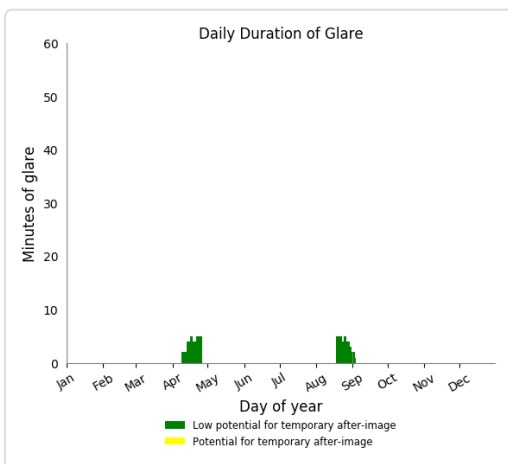
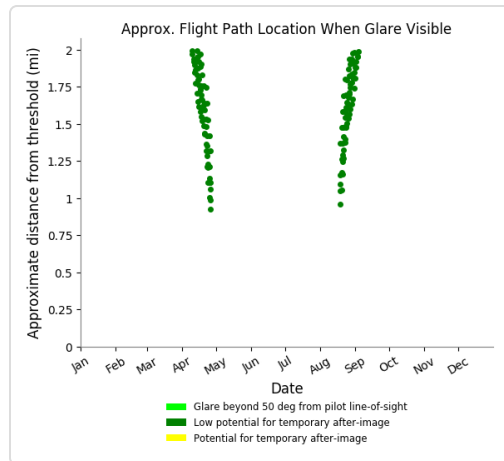
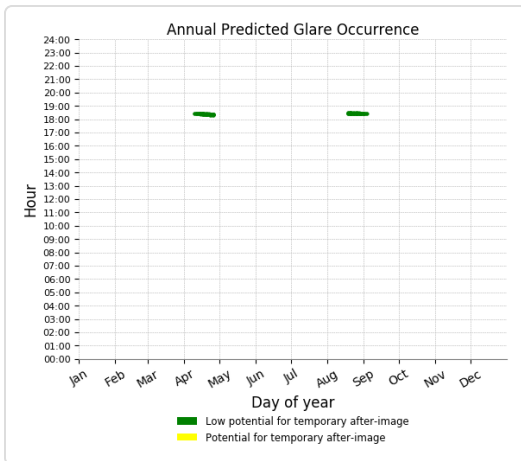
0 minutes of yellow glare

0 minutes of green glare

Flight Path: HNL RWY 22L

0 minutes of yellow glare

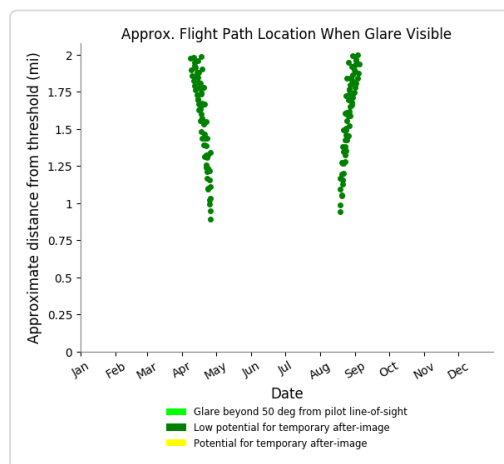
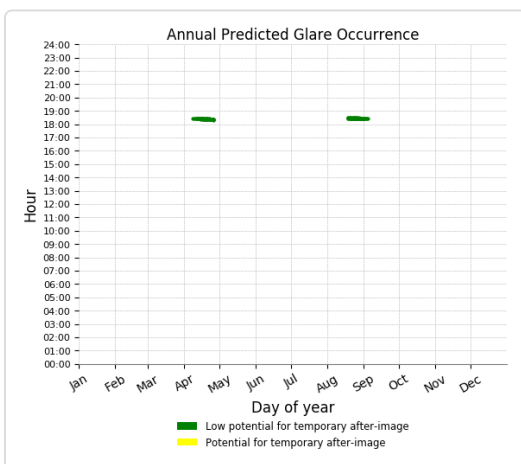
132 minutes of green glare

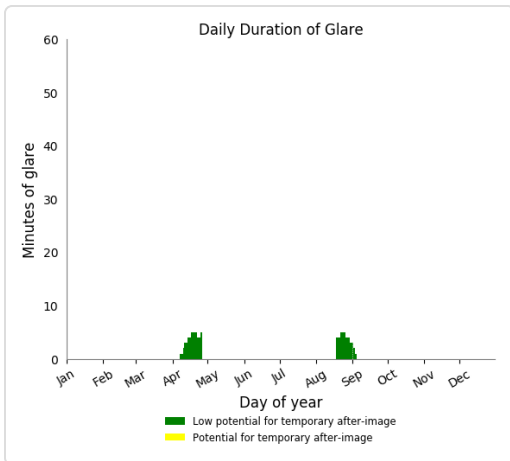


Flight Path: HNL RWY 22R

0 minutes of yellow glare

133 minutes of green glare

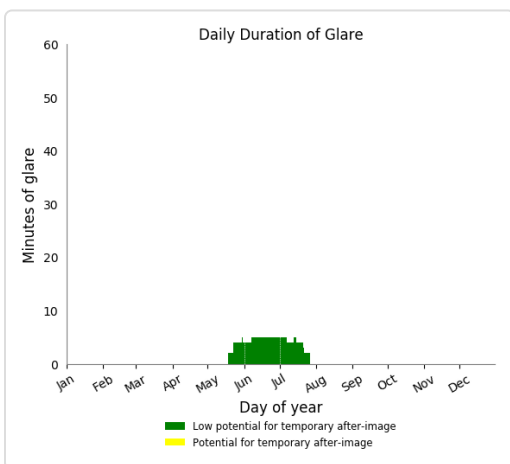
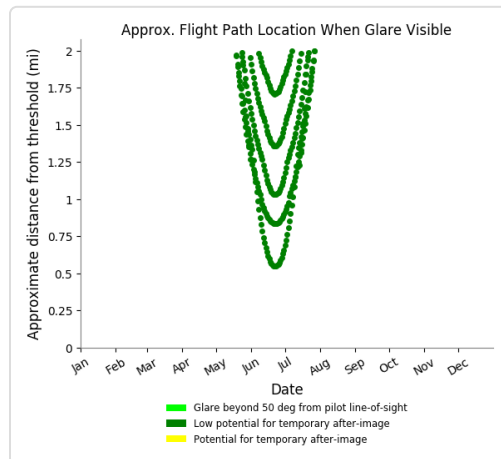
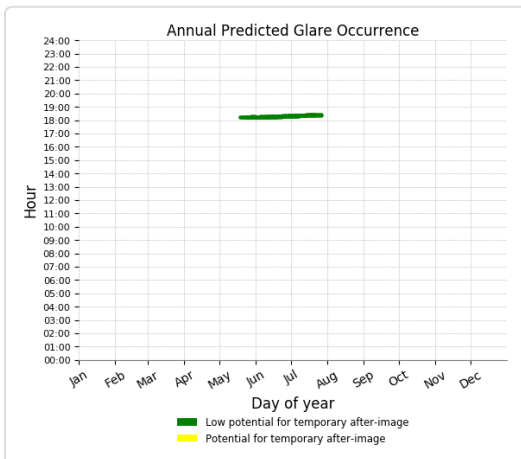




Flight Path: HNL RWY 26L

0 minutes of yellow glare

292 minutes of green glare



Flight Path: JRF RWY 04L

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 04R

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 11

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 22L

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 22R

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 29

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: 1-ATCT

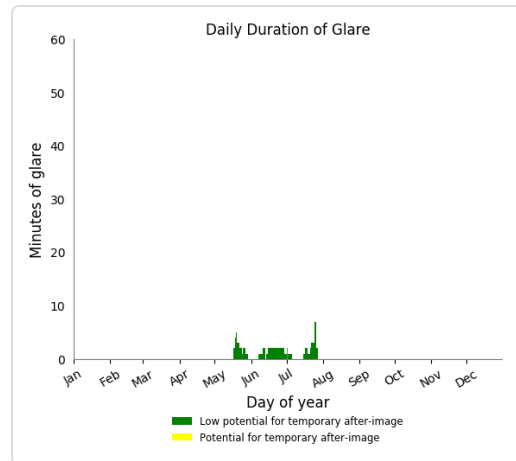
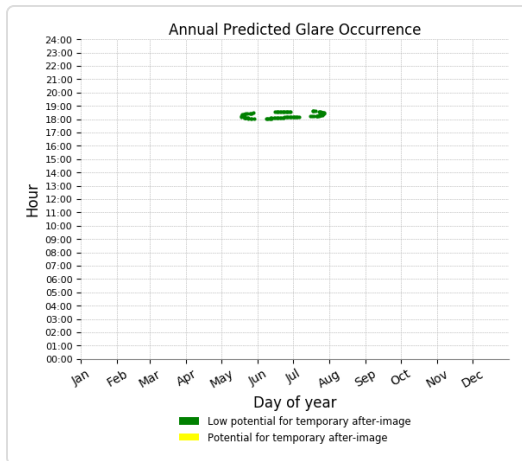
0 minutes of yellow glare

0 minutes of green glare

Point Receptor: 2-ATCT

0 minutes of yellow glare

103 minutes of green glare



Results for: PV Area 3-2

Receptor	Green Glare (min)	Yellow Glare (min)
HHI RWY 24	0	0
HHI RWY 6	0	0
HNL RWY 04L	0	0
HNL RWY 04R	0	0
HNL RWY 08R	0	0
HNL RWY 22L	80	0
HNL RWY 22R	81	0
HNL RWY 26L	193	0
JRF RWY 04L	0	0
JRF RWY 04R	0	0
JRF RWY 11	0	0
JRF RWY 22L	0	0
JRF RWY 22R	0	0
JRF RWY 29	0	0
1-ATCT	0	0
2-ATCT	97	0

Flight Path: HHI RWY 24

0 minutes of yellow glare

0 minutes of green glare

Flight Path: HHI RWY 6

0 minutes of yellow glare

0 minutes of green glare

Flight Path: HNL RWY 04L

0 minutes of yellow glare
0 minutes of green glare

Flight Path: HNL RWY 04R

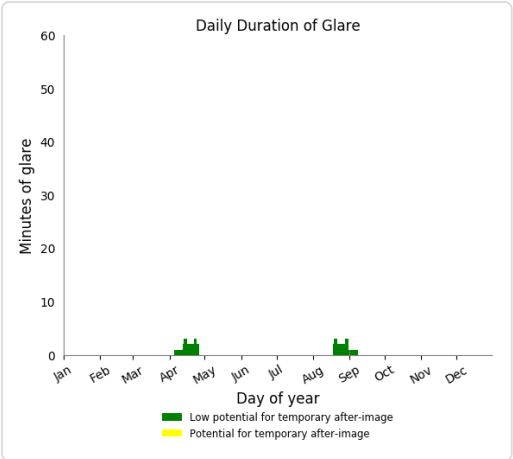
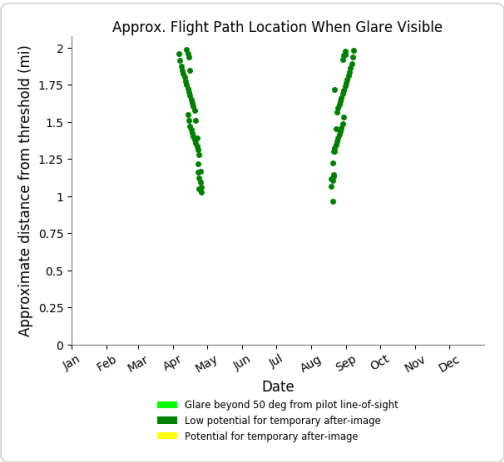
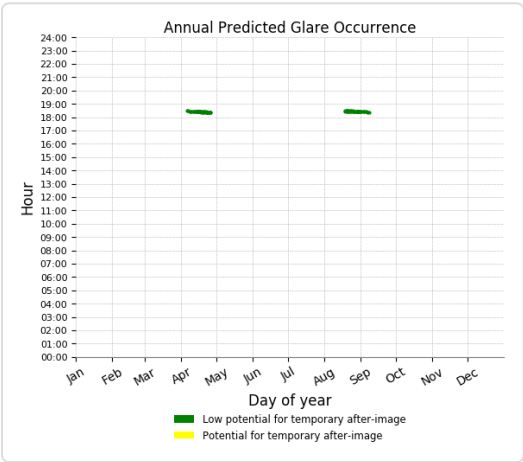
0 minutes of yellow glare
0 minutes of green glare

Flight Path: HNL RWY 08R

0 minutes of yellow glare
0 minutes of green glare

Flight Path: HNL RWY 22L

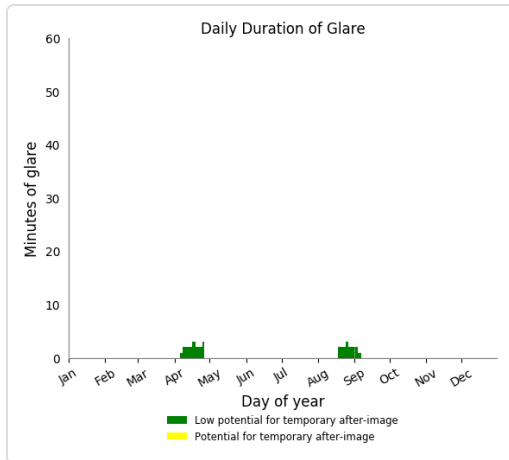
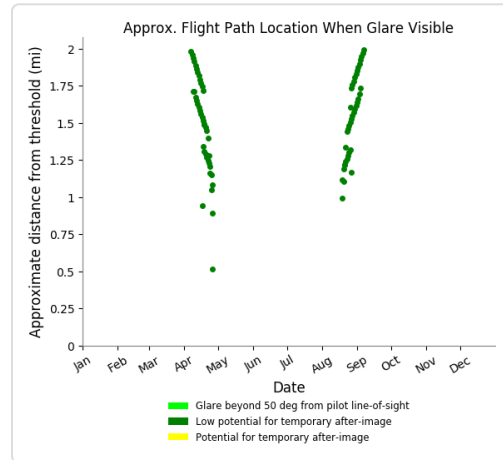
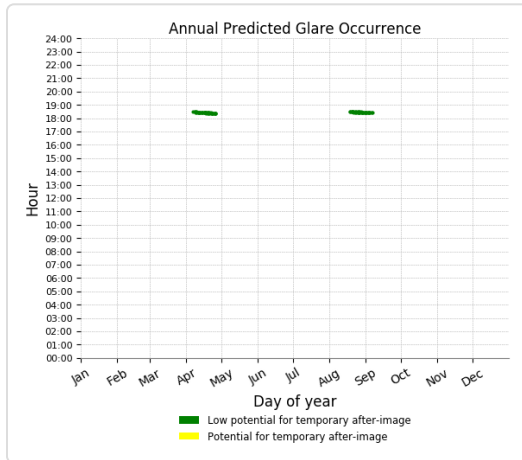
0 minutes of yellow glare
80 minutes of green glare



Flight Path: HNL RWY 22R

0 minutes of yellow glare

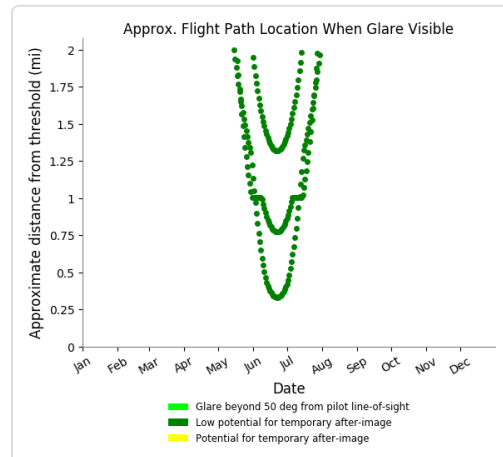
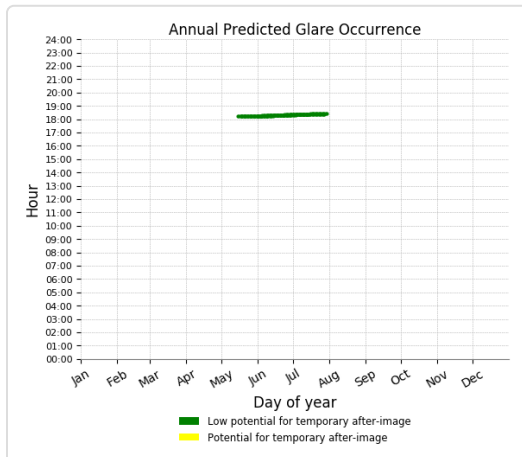
81 minutes of green glare

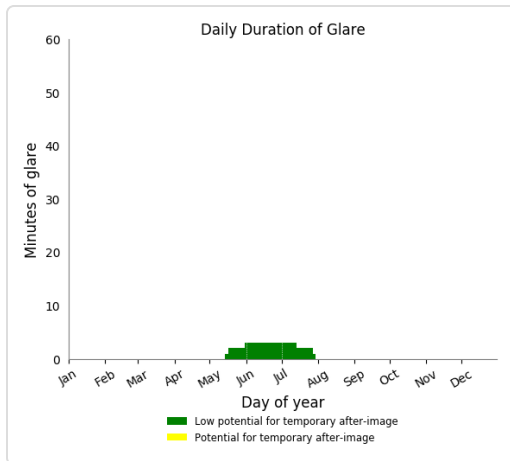


Flight Path: HNL RWY 26L

0 minutes of yellow glare

193 minutes of green glare





Flight Path: JRF RWY 04L

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 04R

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 11

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 22L

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 22R

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 29

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: 1-ATCT

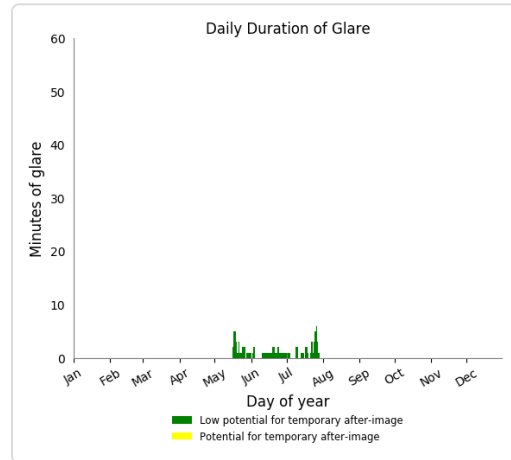
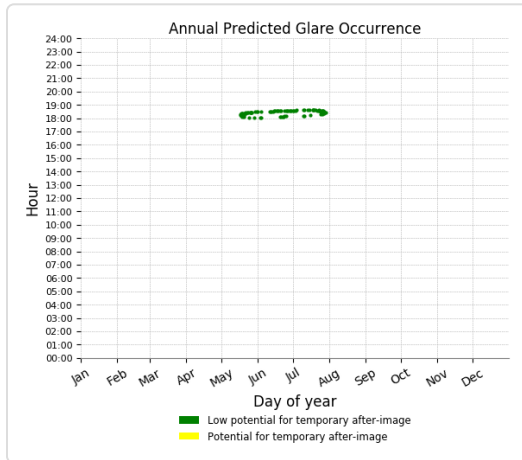
0 minutes of yellow glare

0 minutes of green glare

Point Receptor: 2-ATCT

0 minutes of yellow glare

97 minutes of green glare



Results for: PV Area 3-3

Receptor	Green Glare (min)	Yellow Glare (min)
HHI RWY 24	0	0
HHI RWY 6	0	0
HNL RWY 04L	0	0
HNL RWY 04R	0	0
HNL RWY 08R	0	0
HNL RWY 22L	108	0
HNL RWY 22R	110	0
HNL RWY 26L	284	0
JRF RWY 04L	0	0
JRF RWY 04R	0	0
JRF RWY 11	0	0
JRF RWY 22L	0	0
JRF RWY 22R	0	0
JRF RWY 29	0	0
1-ATCT	0	0
2-ATCT	65	0

Flight Path: HHI RWY 24

0 minutes of yellow glare

0 minutes of green glare

Flight Path: HHI RWY 6

0 minutes of yellow glare
0 minutes of green glare

Flight Path: HNL RWY 04L

0 minutes of yellow glare
0 minutes of green glare

Flight Path: HNL RWY 04R

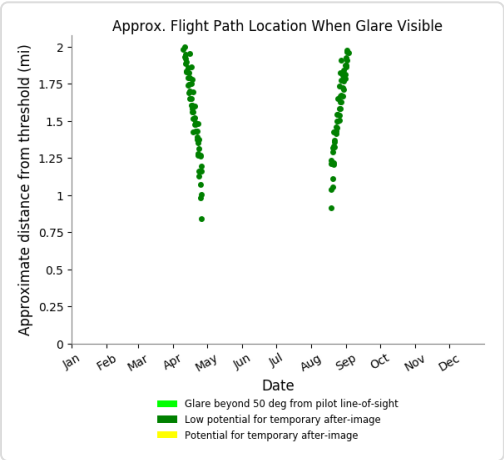
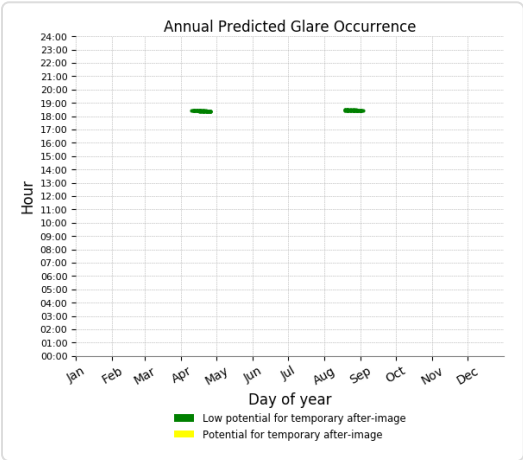
0 minutes of yellow glare
0 minutes of green glare

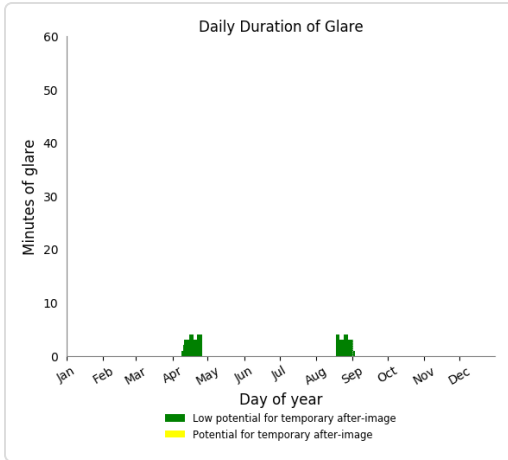
Flight Path: HNL RWY 08R

0 minutes of yellow glare
0 minutes of green glare

Flight Path: HNL RWY 22L

0 minutes of yellow glare
108 minutes of green glare

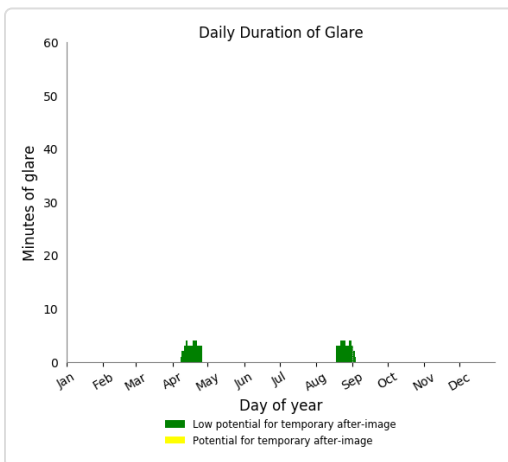
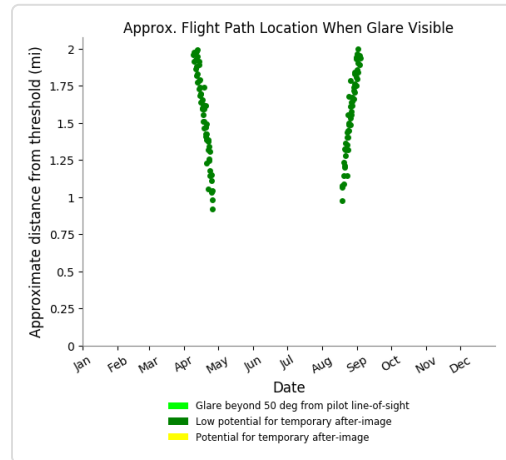
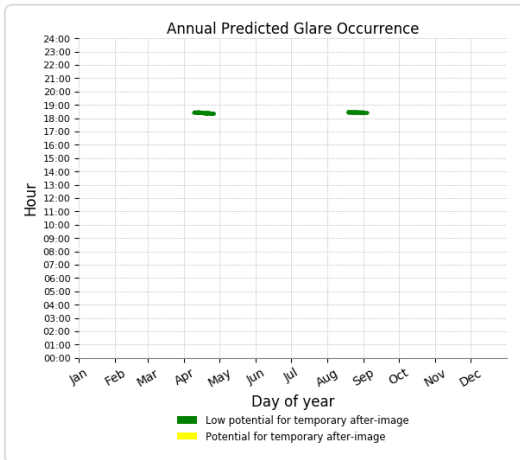




Flight Path: HNL RWY 22R

0 minutes of yellow glare

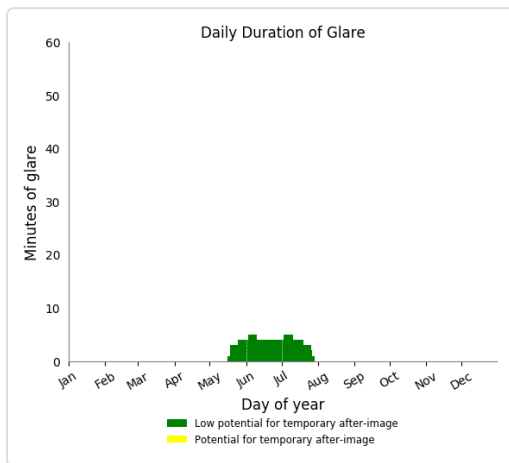
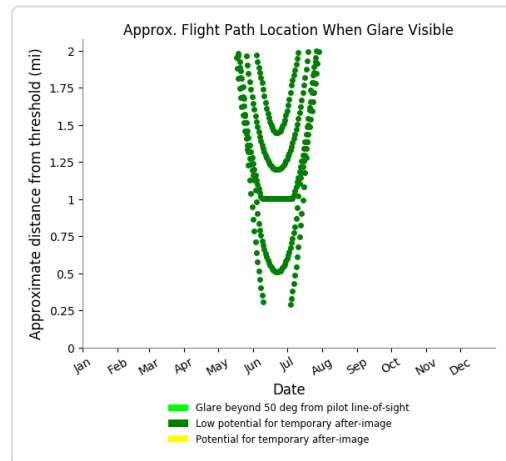
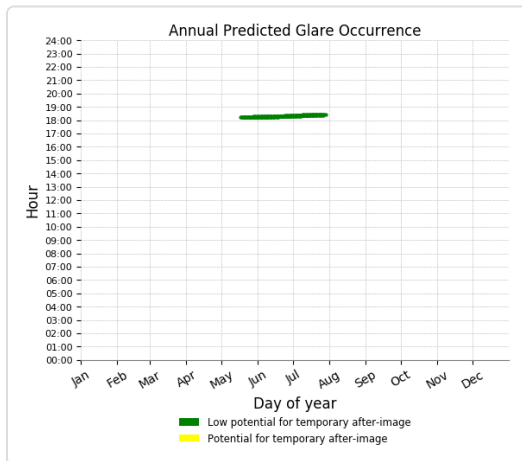
110 minutes of green glare



Flight Path: HNL RWY 26L

0 minutes of yellow glare

284 minutes of green glare



Flight Path: JRF RWY 04L

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 04R

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 11

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 22L

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 22R

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 29

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: 1-ATCT

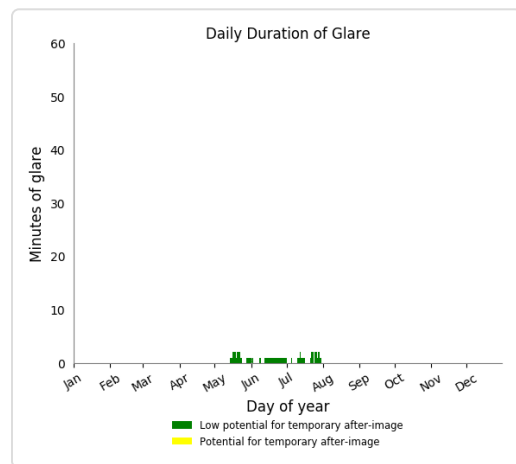
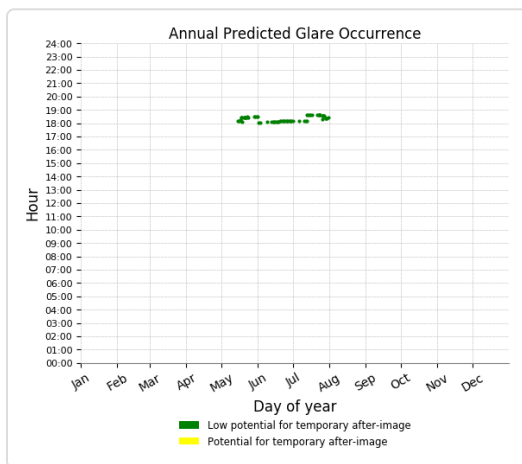
0 minutes of yellow glare

0 minutes of green glare

Point Receptor: 2-ATCT

0 minutes of yellow glare

65 minutes of green glare



Results for: PV Area 3-4

Receptor	Green Glare (min)	Yellow Glare (min)
HHI RWY 24	0	0
HHI RWY 6	0	0
HNL RWY 04L	0	0
HNL RWY 04R	0	0
HNL RWY 08R	0	0
HNL RWY 22L	142	0
HNL RWY 22R	135	0
HNL RWY 26L	266	0

Receptor	Green Glare (min)	Yellow Glare (min)
JRF RWY 04L	0	0
JRF RWY 04R	0	0
JRF RWY 11	0	0
JRF RWY 22L	0	0
JRF RWY 22R	0	0
JRF RWY 29	0	0
1-ATCT	0	0
2-ATCT	80	0

Flight Path: HHI RWY 24

0 minutes of yellow glare

0 minutes of green glare

Flight Path: HHI RWY 6

0 minutes of yellow glare

0 minutes of green glare

Flight Path: HNL RWY 04L

0 minutes of yellow glare

0 minutes of green glare

Flight Path: HNL RWY 04R

0 minutes of yellow glare

0 minutes of green glare

Flight Path: HNL RWY 08R

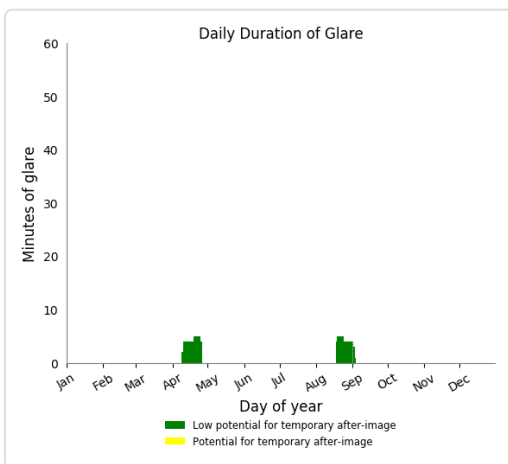
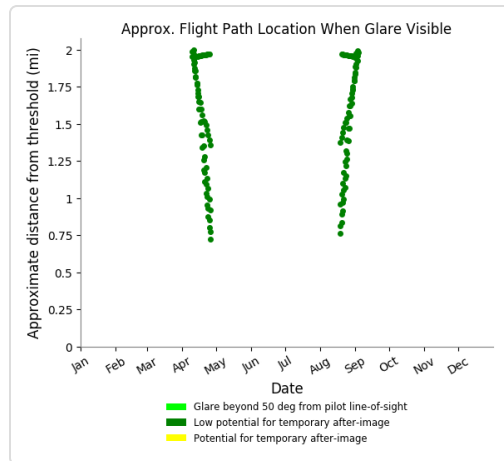
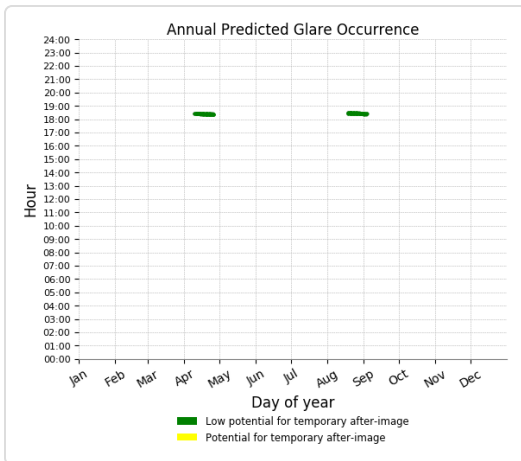
0 minutes of yellow glare

0 minutes of green glare

Flight Path: HNL RWY 22L

0 minutes of yellow glare

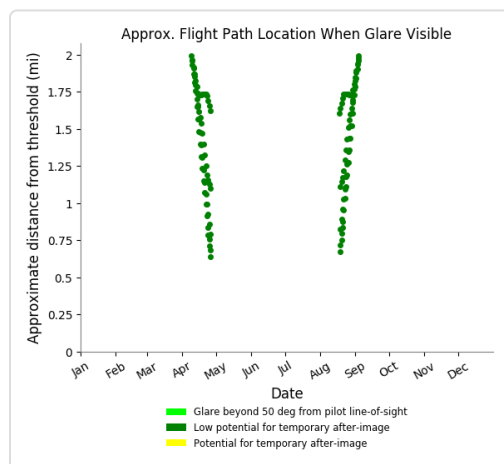
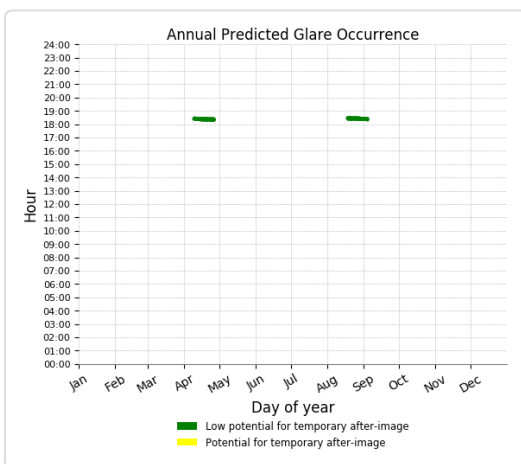
142 minutes of green glare

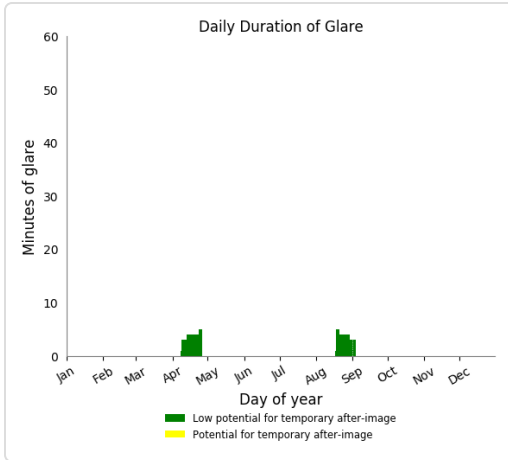


Flight Path: HNL RWY 22R

0 minutes of yellow glare

135 minutes of green glare

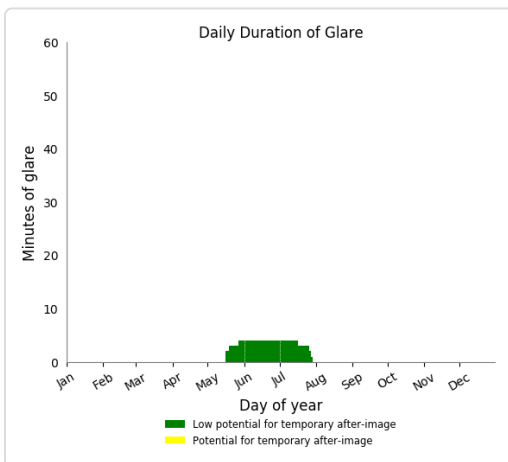
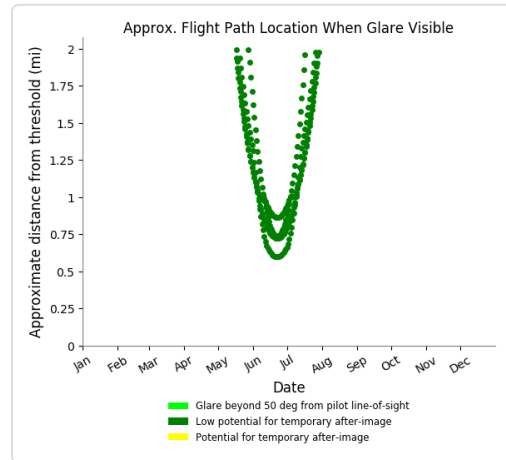
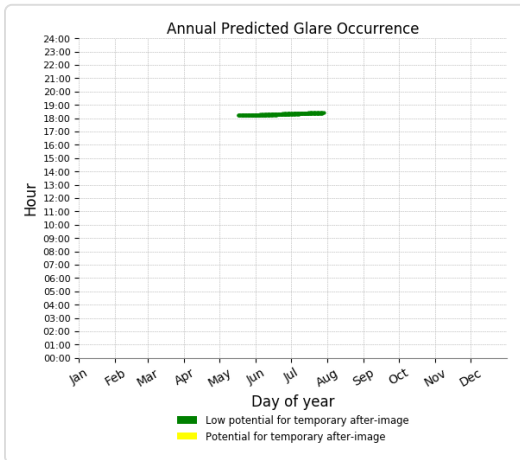




Flight Path: HNL RWY 26L

0 minutes of yellow glare

266 minutes of green glare



Flight Path: JRF RWY 04L

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 04R

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 11

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 22L

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 22R

0 minutes of yellow glare

0 minutes of green glare

Flight Path: JRF RWY 29

0 minutes of yellow glare

0 minutes of green glare

Point Receptor: 1-ATCT

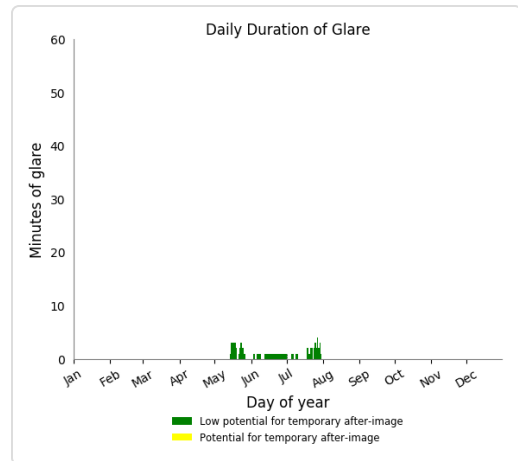
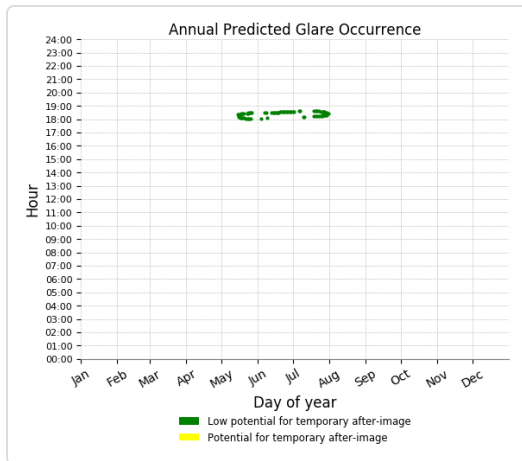
0 minutes of yellow glare

0 minutes of green glare

Point Receptor: 2-ATCT

0 minutes of yellow glare

80 minutes of green glare



Results for: PV Area 4

Receptor	Green Glare (min)	Yellow Glare (min)
HHI RWY 24	0	0
HHI RWY 6	0	0
HNL RWY 04L	0	0
HNL RWY 04R	0	0
HNL RWY 08R	0	0
HNL RWY 22L	156	0
HNL RWY 22R	159	0
HNL RWY 26L	311	0
JRF RWY 04L	0	0
JRF RWY 04R	0	0
JRF RWY 11	0	0
JRF RWY 22L	0	0
JRF RWY 22R	0	0
JRF RWY 29	0	0
1-ATCT	0	0
2-ATCT	187	0

Flight Path: HHI RWY 24

0 minutes of yellow glare

0 minutes of green glare

Flight Path: HHI RWY 6

0 minutes of yellow glare

0 minutes of green glare

Flight Path: HNL RWY 04L

0 minutes of yellow glare
0 minutes of green glare

Flight Path: HNL RWY 04R

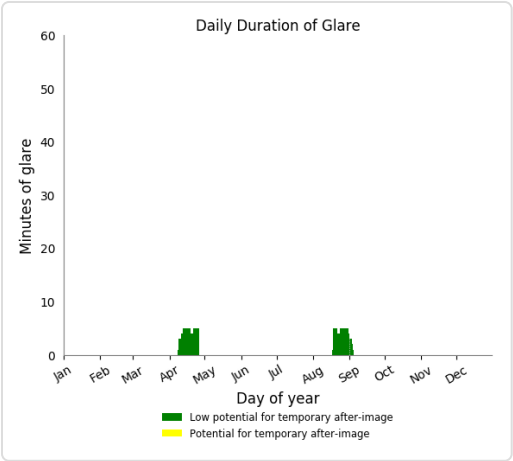
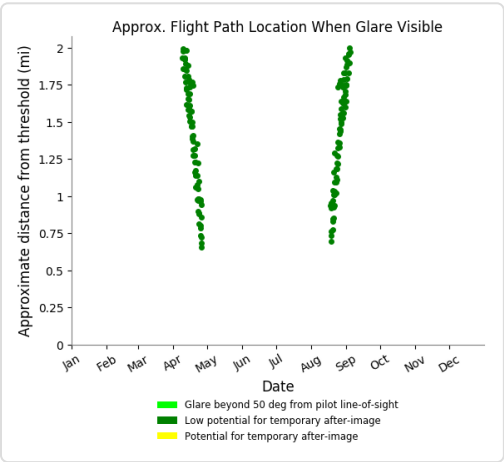
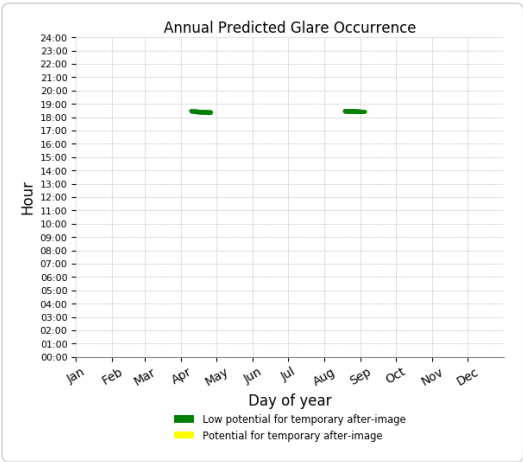
0 minutes of yellow glare
0 minutes of green glare

Flight Path: HNL RWY 08R

0 minutes of yellow glare
0 minutes of green glare

Flight Path: HNL RWY 22L

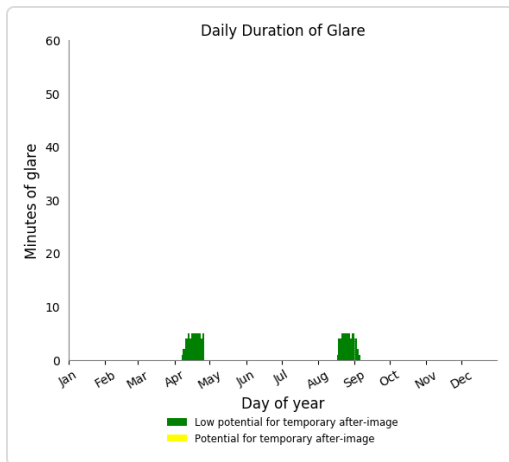
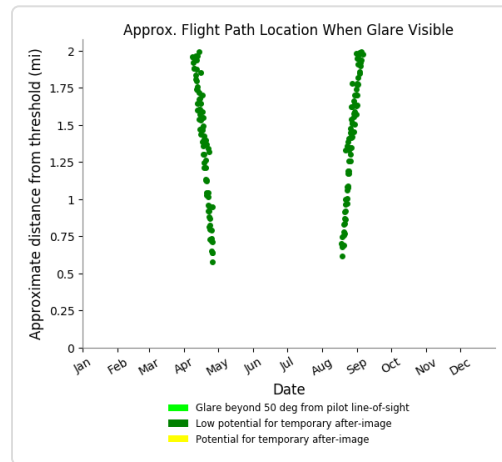
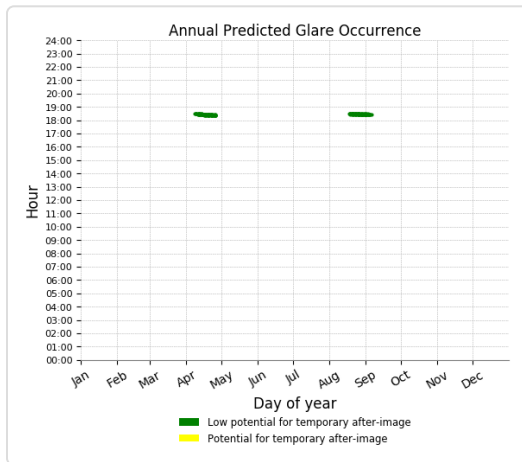
0 minutes of yellow glare
156 minutes of green glare



Flight Path: HNL RWY 22R

0 minutes of yellow glare

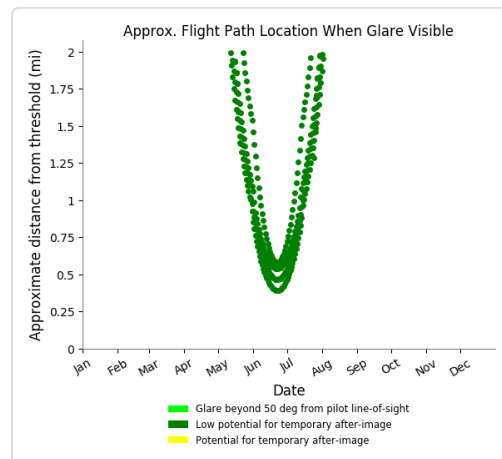
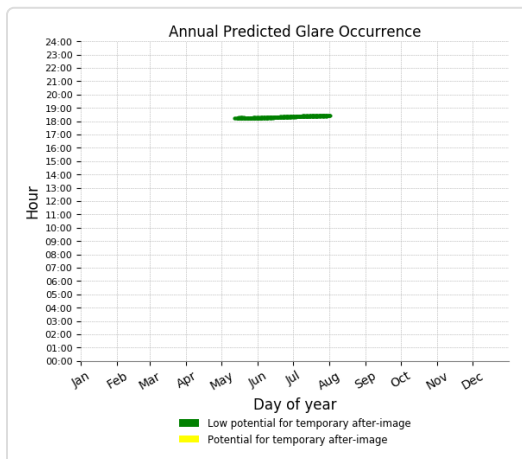
159 minutes of green glare



Flight Path: HNL RWY 26L

0 minutes of yellow glare

311 minutes of green glare

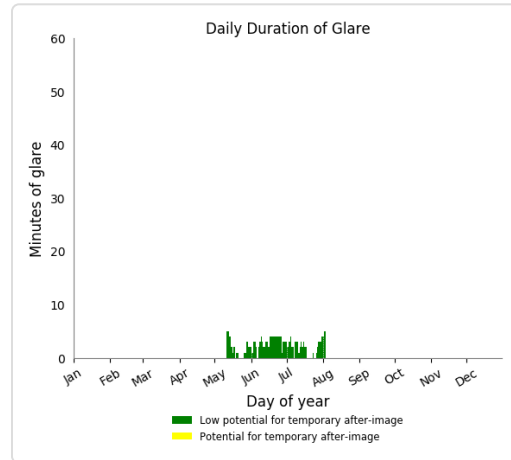
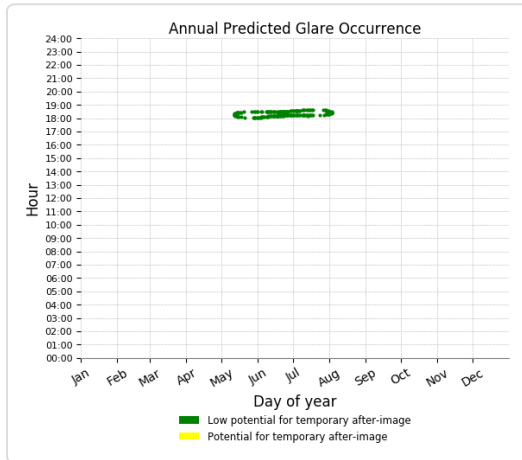


0 minutes of yellow glare
0 minutes of green glare

Point Receptor: 2-ATCT

0 minutes of yellow glare

187 minutes of green glare



Assumptions

"Green" glare is glare with low potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.

"Yellow" glare is glare with potential to cause an after-image (flash blindness) when observed prior to a typical blink response time.

Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.

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

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

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

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

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

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

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