

Waiawa Solar Project

Clearway Energy Group, LLC
Honolulu County, Hawaii

Glint & Glare Analysis

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KS Exhibit 17



Table of Contents

Summary	1
Methodology	3
Data	4
Results	23
Conclusion	26



Summary

Clearway Energy Group, LLC is proposing to construct a solar array in Honolulu County, Hawaii (*Figure 1*). The Federal Aviation Administration (FAA) only requires Glint and Glare analysis for solar arrays on airports that receive federally obligated funding. The Waiawa solar array is not on an airport that receives federally obligated funding. Capitol Airspace expanded the analysis area to a 7 mile radius to include the nearest public airport receiving federally obligated funds – Daniel K. Inouye International Airport (PHNL) at 6.49 miles from the Waiawa solar project. Additionally, using this expanded analysis area, Wheeler Army Airfield (PHHI) is included in the analysis area at 4.88 miles away from the Waiawa solar project. On behalf of Clearway Energy Group, LLC, Capitol Airspace performed a Glint and Glare Analysis utilizing the Solar Glare Hazard Analysis Tool (SGHAT) in order to identify any potential impacts on Daniel K. Inouye International Airport and Wheeler Army Airfield operations. Specifically, this analysis considered the impact on aircraft approaching to land on Runways 08L/26R, 08R/26L, 04R/22L, 04L/22R, 08W/26W, and 04W/22W at Daniel K. Inouye International Airport and on Runways 06/24 at Wheeler Army Airfield. Since Daniel K. Inouye International Airport and Wheeler Army Airfield are both controlled airports, this analysis also considered the potential for impact on air traffic personnel working in the air traffic control towers (ATCT). Additionally, this analysis considered impact on residents and vehicles on Route 1, Route 2, Route 3, Route 4, Route 5, Route 6, Route 7, and Route 8.

The results of the study show that there is no predicted glare from the solar array for aircraft making approaches to Runways 08L/26R, 08R/26L, 04R/22L, 04L/22R, 08W/26W, and 04W/22W at the Daniel K. Inouye International Airport and to Runway 06/24 at Wheeler Army Airfield. In addition to modeling the effects of glare on approaching aircraft, the SGHAT model assessed the impact of potential glare on the Daniel K. Inouye International Airport ATCT and the Wheeler Army Airfield ATCT. FAA standards do not allow for any glare in the ATCT. The results of the study show that the proposed solar array will not create glare in the ATCT at either airport. These results conform to, and are in accordance with, the FAA's interim policy for Solar Energy System Projects on Federally Obligated Airports.

There was also no predicted glare for residents with an estimated single story viewing height of 8 feet or a second story viewing height of 16 feet. There is also no predicted glare from the solar array along Route 1, Route 2, Route 3, Route 4, Route 5, Route 6, Route 7, or Route 8 for cars with an estimated viewing height of 4 feet and for large trucks with an estimated viewing height of 8 feet. Capitol Airspace has applied FAA's glint and glare standards to vehicular operations due to the absence of non-aviation regulatory guidelines.



Figure 1: Location of Waiauwa solar project in proximity to Daniel K. Inouye International Airport and Wheeler Army Airfield



Methodology

The results of this analysis conform to, and are in accordance with, the FAA's interim policy for Solar Energy System Projects on Federally Obligated Airports.¹ The FAA adopted this interim policy in order to enhance safety by providing standards for measuring ocular impact of proposed solar energy systems on pilots and air traffic controllers. In cooperation with the Department of Energy (DOE), the FAA developed and validated the Sandia National Laboratories' "*Solar Glare Hazard Analysis Tool*" (SGHAT), now licensed through ForgeSolar. The FAA requires the use of the SGHAT to demonstrate compliance with the standards for measuring ocular impact.

In order for the FAA to approve a revised airport layout plan depicting a solar installation and/or issue a determination of no hazard, the airport sponsor is required to show that the solar installation meets the standards set forth in the interim policy. The interim policy states that a project:

1. Must not have a potential for glint or glare in the existing or planned ATCT cab, (Green, Yellow, or Red) and
2. Must not have a potential for glare (Yellow or Red) along the final approach path for any existing landing threshold or future landing thresholds (including any planned interim phases of the landing thresholds) as shown on the current FAA-approved Airport Layout Plan (ALP). An airport may have a "low potential for after image" (Green) within these areas. The final approach path is defined as two (2) miles from fifty (50) feet above the landing threshold using a standard three (3) degree glidepath.
3. Ocular impact must be analyzed over the entire calendar year in one (1) minute intervals from when the sun rises above the horizon until the sun sets below the horizon.

SGHAT Assumptions:

1. Times associated with glare are denoted in Standard time. For Daylight Savings, add one hour.
2. Glare analyses do not account for physical obstructions between reflectors and receptors. This includes buildings, tree cover, and geographic obstructions.
3. The glare hazard determination relies on several approximations including observer eye characteristics, angle of view, and typical blink response time. Actual values may differ.
4. Hazard zone boundaries shown in the Glare Hazard plot are an approximation and visual aid. Actual ocular impact outcomes encompass a continuous, not discrete, spectrum.

Capitol Airspace utilized the SGHAT based guidance provided in User's Manual v.3. Solar array specifications were provided by Clearway Energy Group, LLC. The Waiawa solar project array is a single axis tracking solar array. Flight path data was developed by reviewing airport's specific operations before entering it into the SGHAT tool. Each flight path has configurable parameters and observation points. One of the configurable inputs allows for limiting the downward and azimuthal angles of view from the flight path to simulate a pilot's view out the window of the cockpit. Clearway Energy Group, LLC specified that the analysis be conducted from the FAA's approved default settings in the SGHAT tool which utilizes the view from the pilot's perspective.

¹ 78 FR 63276, 10/23/2013



Data

Solar Array

Clearway Energy Group, LLC provided the data for the array ([Figure 2](#)), based on the input parameters defined in the SGHAT User's Manual v.3.

The data for the Waiawa Solar array are as follows:



[Figure 2: Waiawa Solar array overview](#)



Parameter	Value
Axis tracking:	Single-axis rotation
Tracking axis orientation:	180.0°
Tracking axis tilt:	0.0°
Max tracking angle:	60.0°
Resting angle:	2.0°
Panel material:	Smooth glass with AR coating
Reflectivity:	Vary with sun
Slope error:	Correlate with material

Table 1: Waiawa Solar Array Inputs

ID	Latitude	Longitude	Ground Elevation (feet)	Height Above Ground (feet)	Total Elevation
1	21.427095	-157.972597	448.8	15	463.8
2	21.426655	-157.968461	527.14	15	542.14
3	21.423181	-157.967634	401.3	15	416.3
4	21.421389	-157.969075	498.39	15	513.39
5	21.41928	-157.969872	453.46	15	468.46
6	21.416205	-157.970777	397.38	15	412.38
7	21.415763	-157.971204	393.94	15	408.94
8	21.415757	-157.973402	356.11	15	371.11
9	21.414282	-157.973383	309.03	15	324.03
10	21.414295	-157.973574	303.18	15	318.18
11	21.41541	-157.9742	374.17	15	389.17
12	21.417093	-157.974596	387.84	15	402.85
13	21.417082	-157.974064	389.55	15	404.55
14	21.41798	-157.974058	395.56	15	410.56
15	21.421071	-157.971815	441.39	15	456.39
16	21.421687	-157.972217	442.93	15	457.93
17	21.424434	-157.971699	478.46	15	493.46
18	21.424229	-157.972193	454.27	15	469.27
19	21.423491	-157.972341	449.77	15	464.77
20	21.422307	-157.9733	394.04	15	409.04
21	21.42024	-157.973825	378.21	15	393.21
22	21.420012	-157.974212	368.03	15	383.03
23	21.420013	-157.974591	355.65	15	370.65
24	21.42071	-157.974554	360.8	15	375.8
25	21.423614	-157.97392	460.27	15	475.27
26	21.426096	-157.973197	479.62	15	494.62

Table 2: Waiawa Solar Array Vertices



Runway 04R/22L – Daniel K. Inouye International Airport

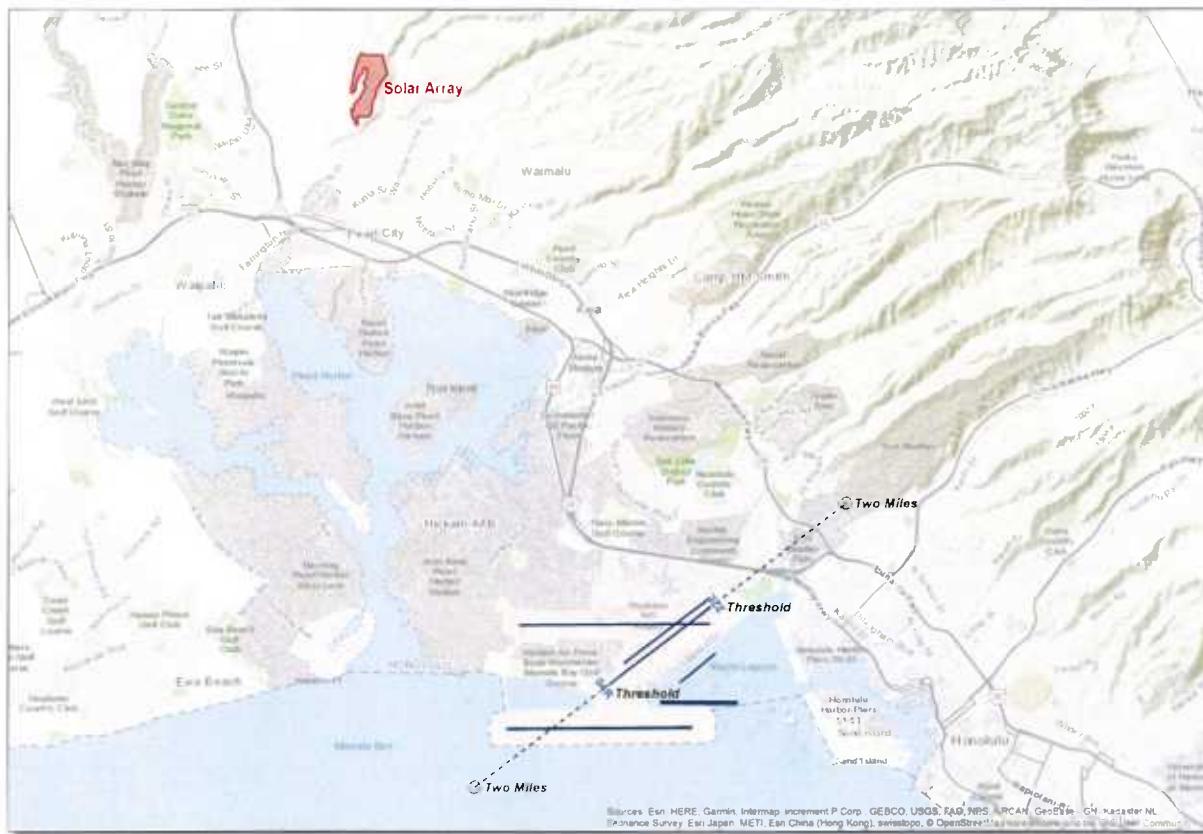


Figure 3: Runway 04R/22L SGHAT flight path and Waiawa Solar project

Parameter	Runway 04R	Runway 22L
Threshold height (ft)	50.0	50.0
Direction (deg)	53	233
Glide slope (deg)	3.0	3.0
Consider pilot visibility from cockpit	Yes	Yes

Table 3: Runway 04R/22L flight path and viewing parameters

Runway	Observation Point	Latitude	Longitude	Ground Elevation (feet)	Height above ground (feet)	Total Elevation (feet)
04R	Threshold	21.313921	-157.927155	8.00	50.00	58.00
	Two-mile	21.296521	-157.951970	-91.08	702.54	611.46
22L	Threshold	21.328829	-157.906018	8.30	50.00	58.30
	Two-mile	21.346229	-157.881200	110.54	501.22	611.76

Table 4: Runway 04R/22L flight path observation points



Runway 04L/22R – Daniel K. Inouye International Airport

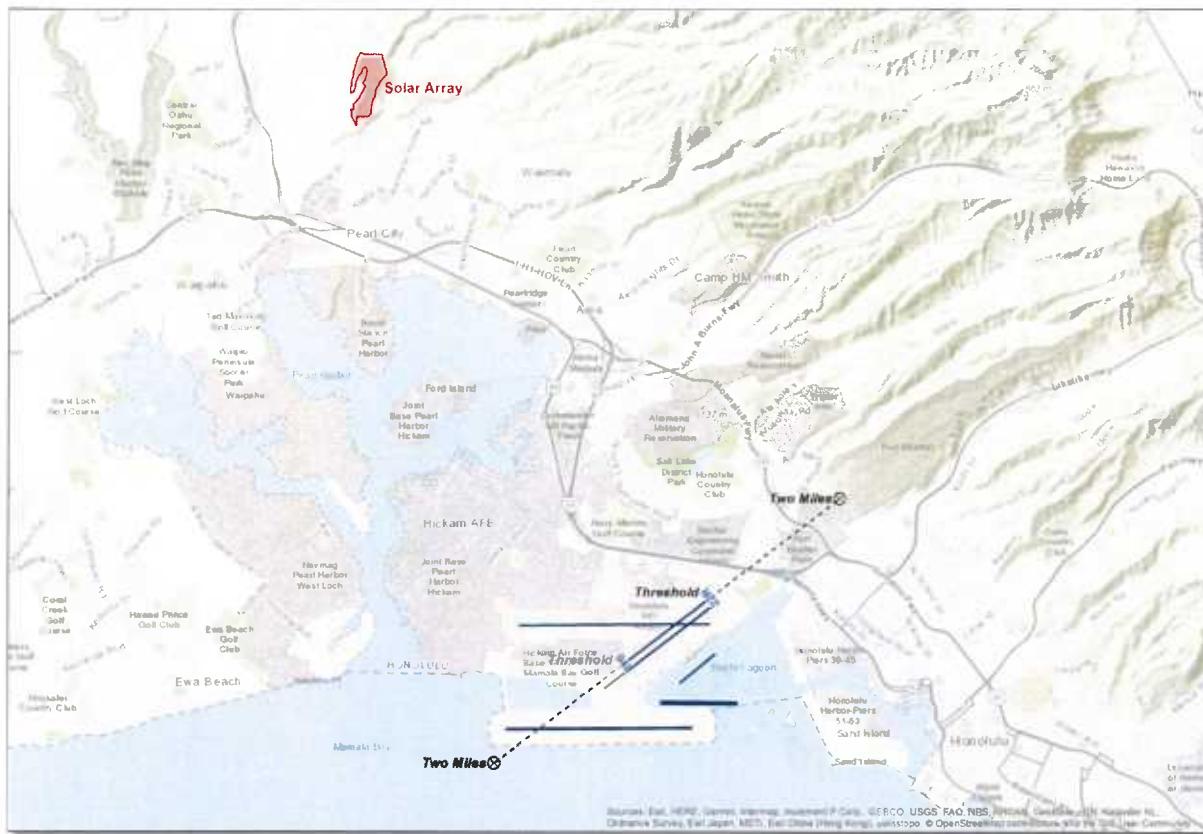


Figure 4: Runway 04L/22R SGHAT flight path and Waiawa Solar project

Parameter	Runway 04L	Runway 22R
Threshold height (ft)	50.0	50.0
Direction (deg)	53	233
Glide slope (deg)	3.0	3.0
Consider pilot visibility from cockpit	Yes	Yes

Table 5: Runway 04L/22R flight path and viewing parameters

Runway	Observation Point	Latitude	Longitude	Ground Elevation (feet)	Height above ground (feet)	Total Elevation (feet)
04L	Threshold	21.318335	-157.923340	9.80	50.00	59.80
	Two-mile	21.300935	-157.948156	-31.01	644.27	613.26
22R	Threshold	21.329602	-157.907366	7.40	50.00	57.40
	Two-mile	21.347002	-157.882548	116.61	494.25	610.86

Table 6: Runway 04L/22R flight path observation points



Runway 08L/26R – Daniel K. Inouye International Airport

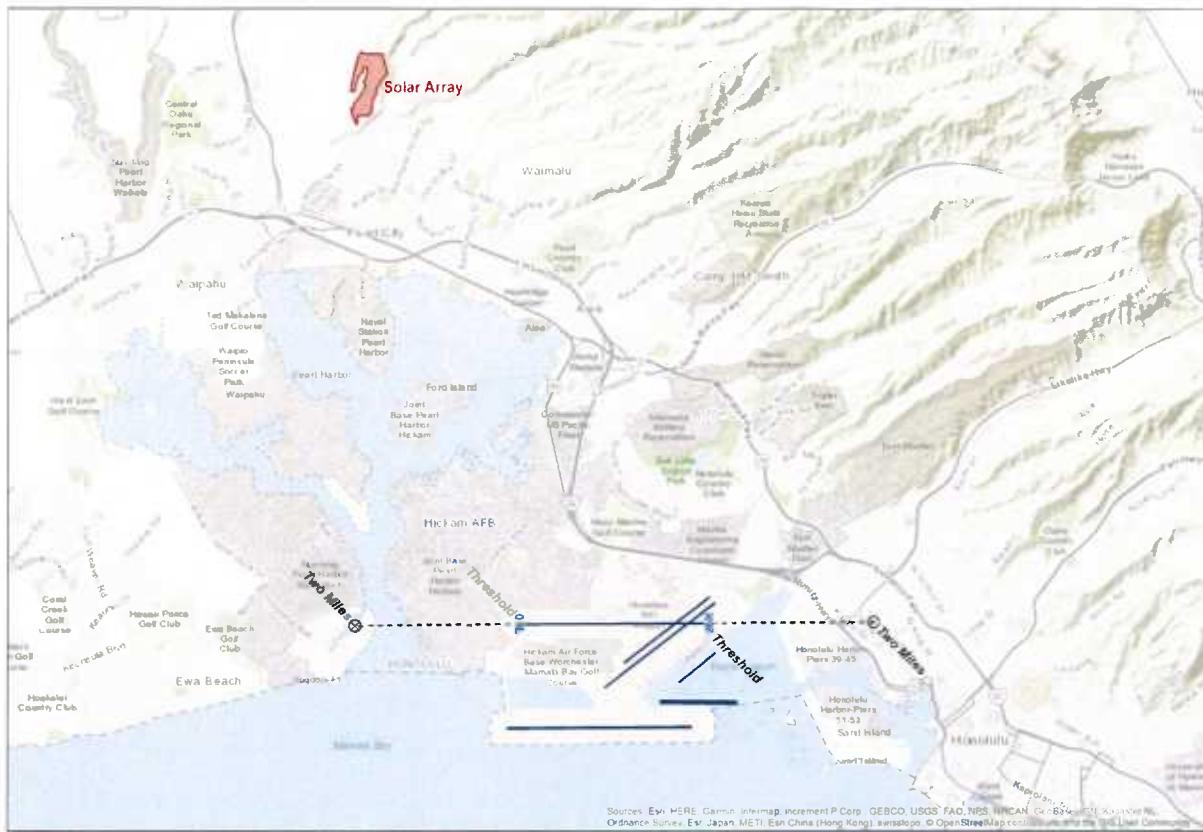


Figure 5: Runway 08L/26R SGHAT flight path and Waiau Solar project

Parameter	Runway 08L	Runway 26R
Threshold height (ft)	50.0	50.0
Direction (deg)	90	270
Glide slope (deg)	3.0	3.0
Consider pilot visibility from cockpit	Yes	Yes

Table 7: Runway 08L/26R flight path and viewing parameters

Runway	Observation Point	Latitude	Longitude	Ground Elevation (feet)	Height above ground (feet)	Total Elevation (feet)
08L	Threshold	21.325256	-157.943326	11.60	50.00	61.60
	Two-mile	21.325256	-157.974400	0.00	615.06	615.06
26R	Threshold	21.325245	-157.907078	8.40	50.00	58.40
	Two-mile	21.325245	-157.876004	18.66	593.19	611.86

Table 8: Runway 08L/26R flight path observation points



Runway 08R/26L – Daniel K. Inouye International Airport

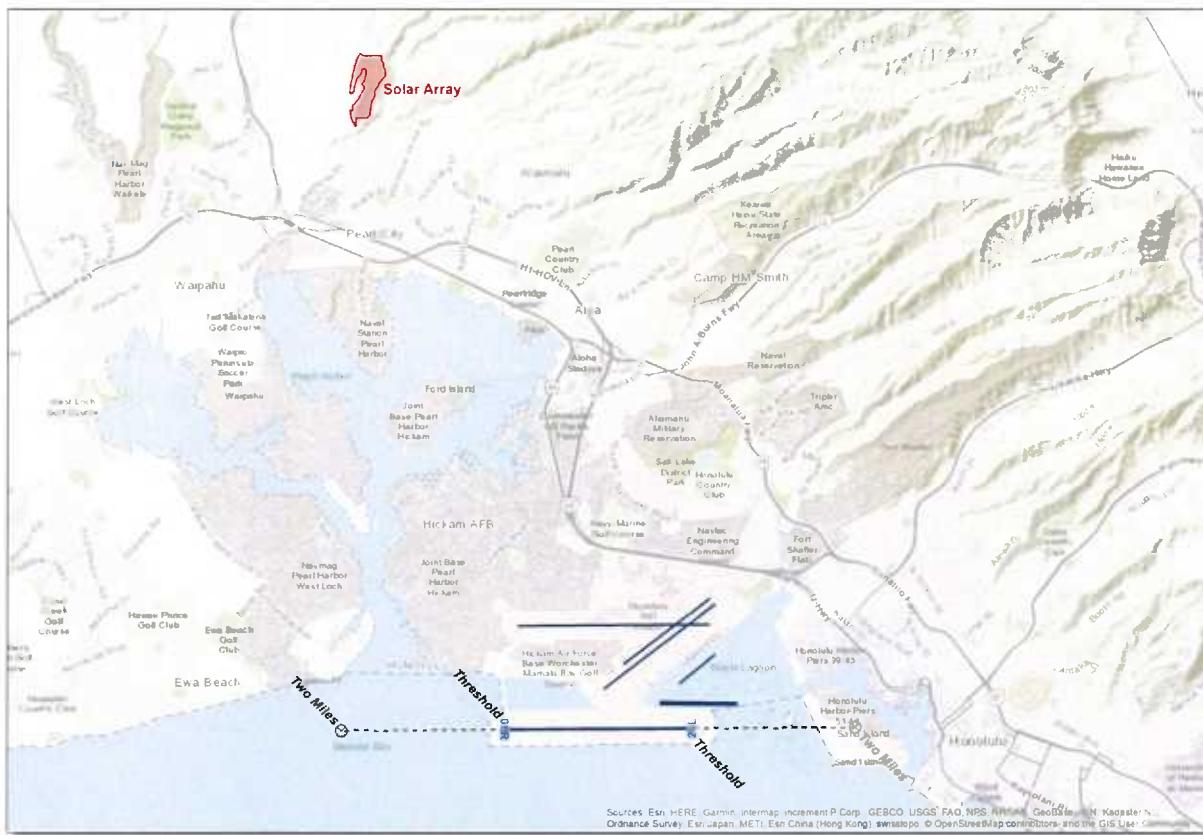


Figure 6: Runway 08R/26L SGHAT flight path and Waiawa Solar project

Parameter	Runway 08R	Runway 26L
Threshold height (ft)	50.0	50.0
Direction (deg)	90	270
Glide slope (deg)	3.0	3.0
Consider pilot visibility from cockpit	Yes	Yes

Table 9: Runway 08R/26L flight path and viewing parameters

Runway	Observation Point	Latitude	Longitude	Ground Elevation (feet)	Height above ground (feet)	Total Elevation (feet)
08R	Threshold	21.306809	-157.945881	10.00	50.00	60.00
	Two-mile	21.306304	-157.976946	-11.76	625.22	613.46
26L	Threshold	21.306804	-157.910604	10.00	50.00	60.00
	Two-mile	21.306804	-157.879534	7.66	605.80	613.46

Table 10: Runway 08R/26L flight path observation points



Runway 04W/22W – Daniel K. Inouye International Airport

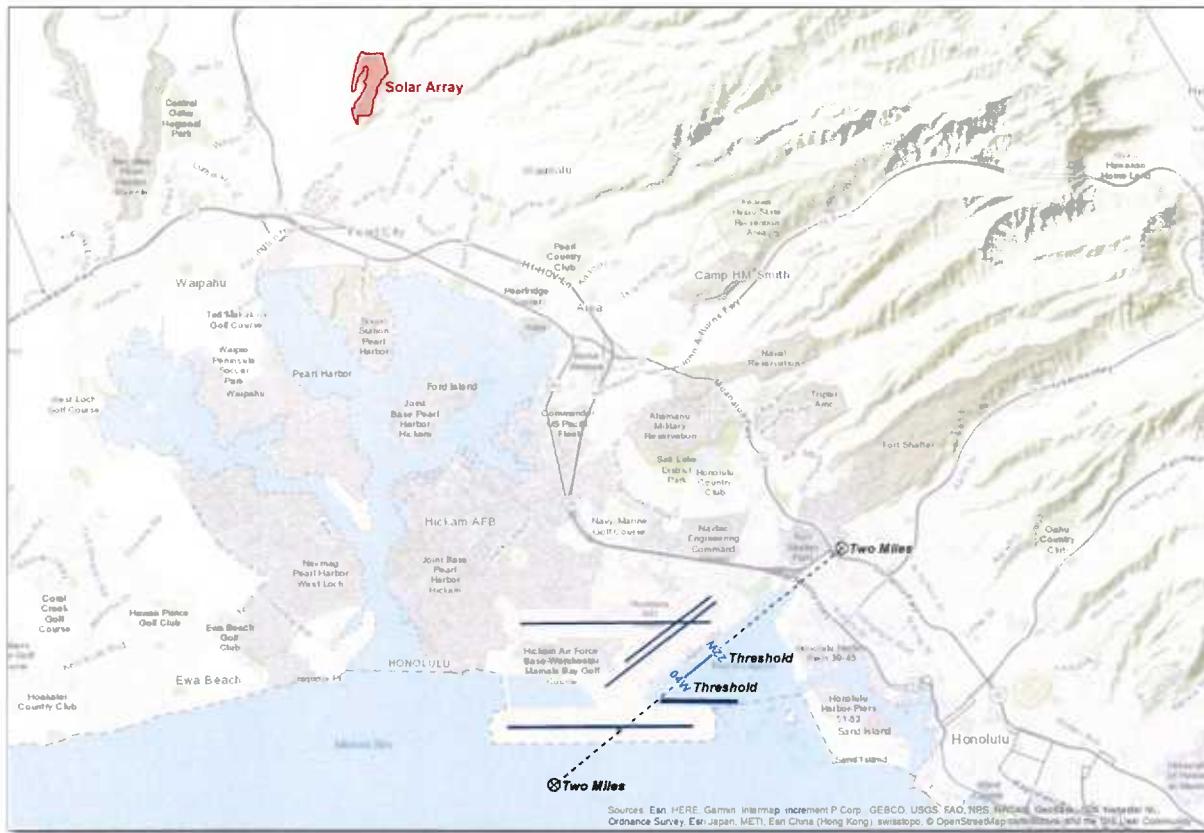


Figure 7: Runway 04W/22W SGHAT flight path and Waiau Solar project

Parameter	Runway 04W	Runway 22W
Threshold height (ft)	50.0	50.0
Direction (deg)	53	233
Glide slope (deg)	3.0	3.0
Consider pilot visibility from cockpit	Yes	Yes

Table 11: Runway 04W/22W flight path and viewing parameters

Runway	Observation Point	Latitude	Longitude	Ground Elevation (feet)	Height above ground (feet)	Total Elevation (feet)
04RW	Threshold	21.314746	-157.912901	-3.73	50.00	46.27
	Two-mile	21.297346	-157.937717	-56.34	656.07	599.73
22W	Threshold	21.319944	-157.906051	-4.38	50.00	45.62
	Two-mile	21.337344	-157.881235	63.86	535.22	599.08

Table 12: Runway 04W/22W flight path observation points



Runway 08W/26W – Daniel K. Inouye International Airport

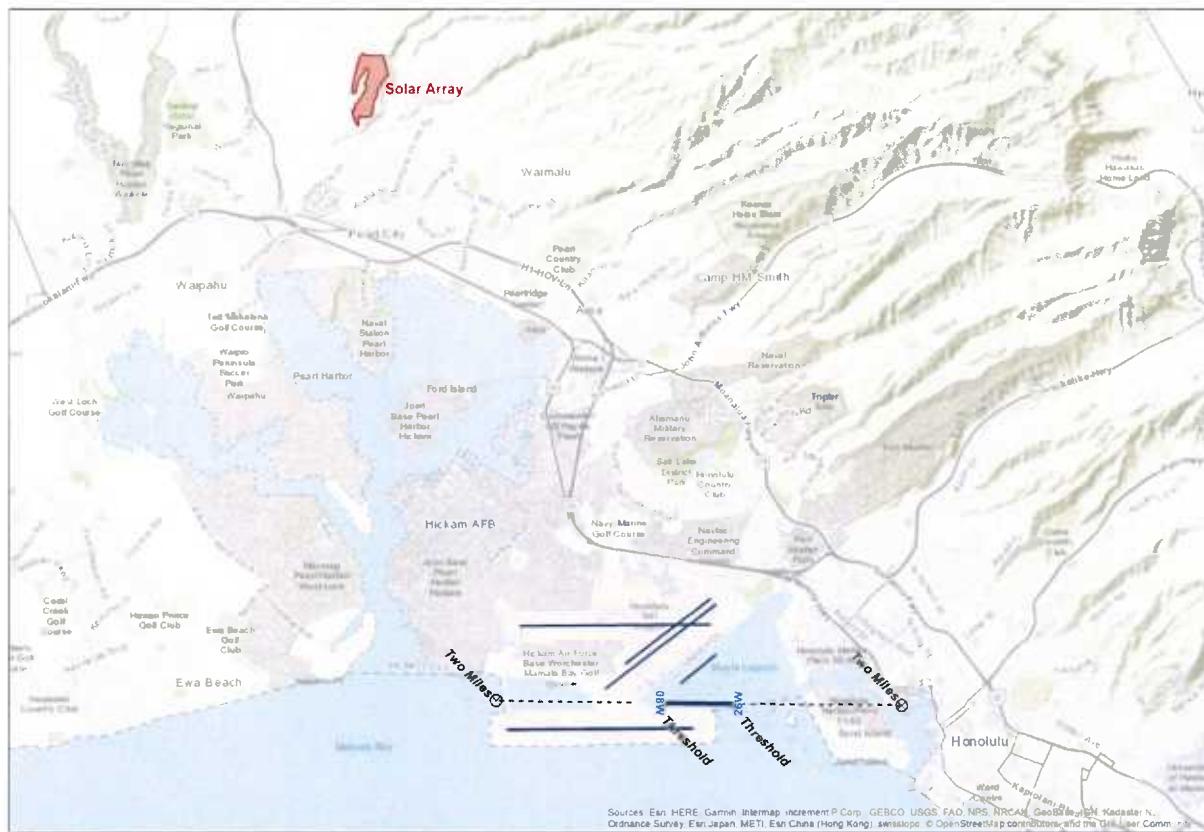


Figure 8: Runway 08W/26W SGHAT flight path and Waiawa Solar project

Parameter	Runway 08W	Runway 26W
Threshold height (ft)	50.0	50.0
Direction (deg)	91	271
Glide slope (deg)	3.0	3.0
Consider pilot visibility from cockpit	Yes	Yes

Table 13: Runway 08W/26W flight path and viewing parameters

Runway	Observation Point	Latitude	Longitude	Ground Elevation (feet)	Height above ground (feet)	Total Elevation (feet)
08W	Threshold	21.311347	-157.916667	-1.64	50.00	48.37
	Two-mile	21.311851	-157.947734	-2.17	603.99	601.82
26W	Threshold	21.311105	-157.901981	-9.19	50.00	40.82
	Two-mile	21.310601	-157.870915	2.32	591.96	594.27

Table 14: Runway 08W/26W flight path observation points



Air Traffic Control Tower – Daniel K. Inouye International Airport

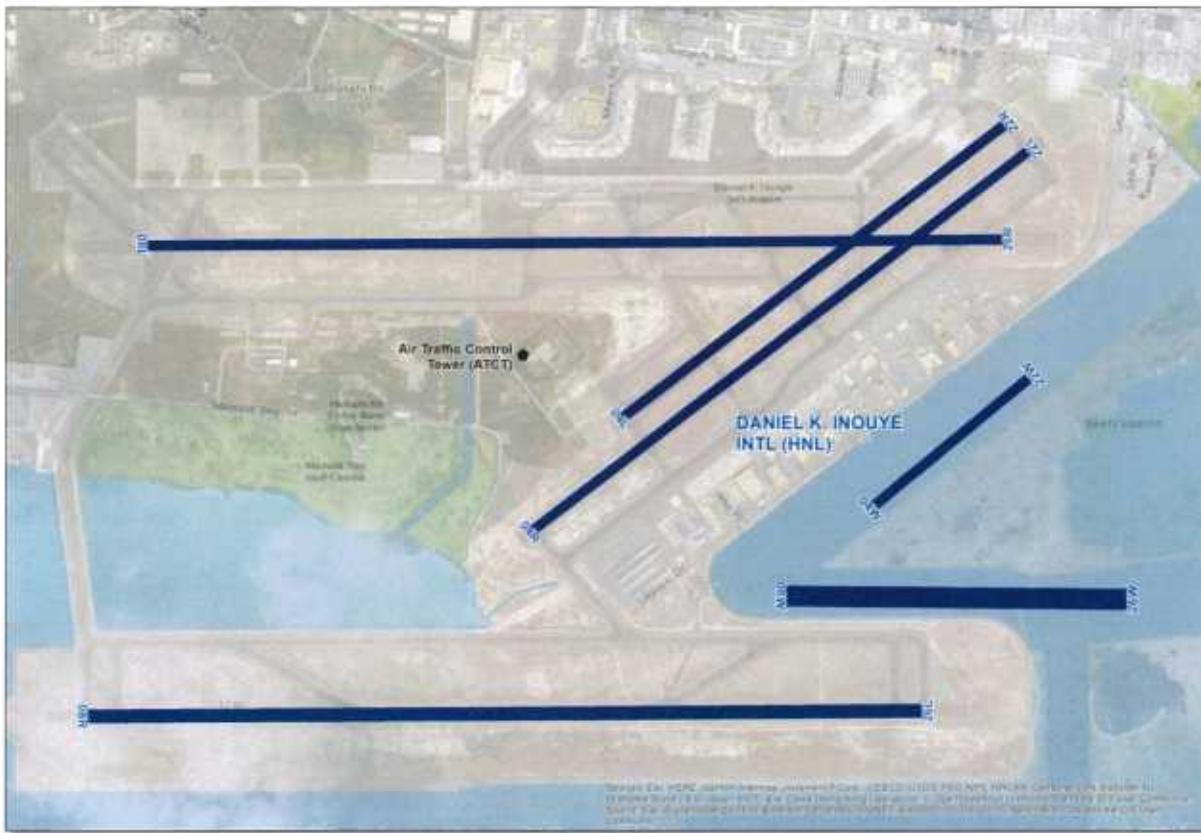
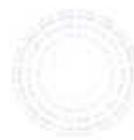


Figure 9: Air Traffic Control Tower at Daniel K. Inouye International Airport

Observation Point	Latitude	Longitude	Ground Elevation (feet)	Height above ground (feet)	Total Elevation (feet)
ATCT	21.320872	-157.927382	6.00	174.01	180.01

Table 15: Air Traffic Control Tower observation points



Runway 06/24 – Wheeler Army Airfield

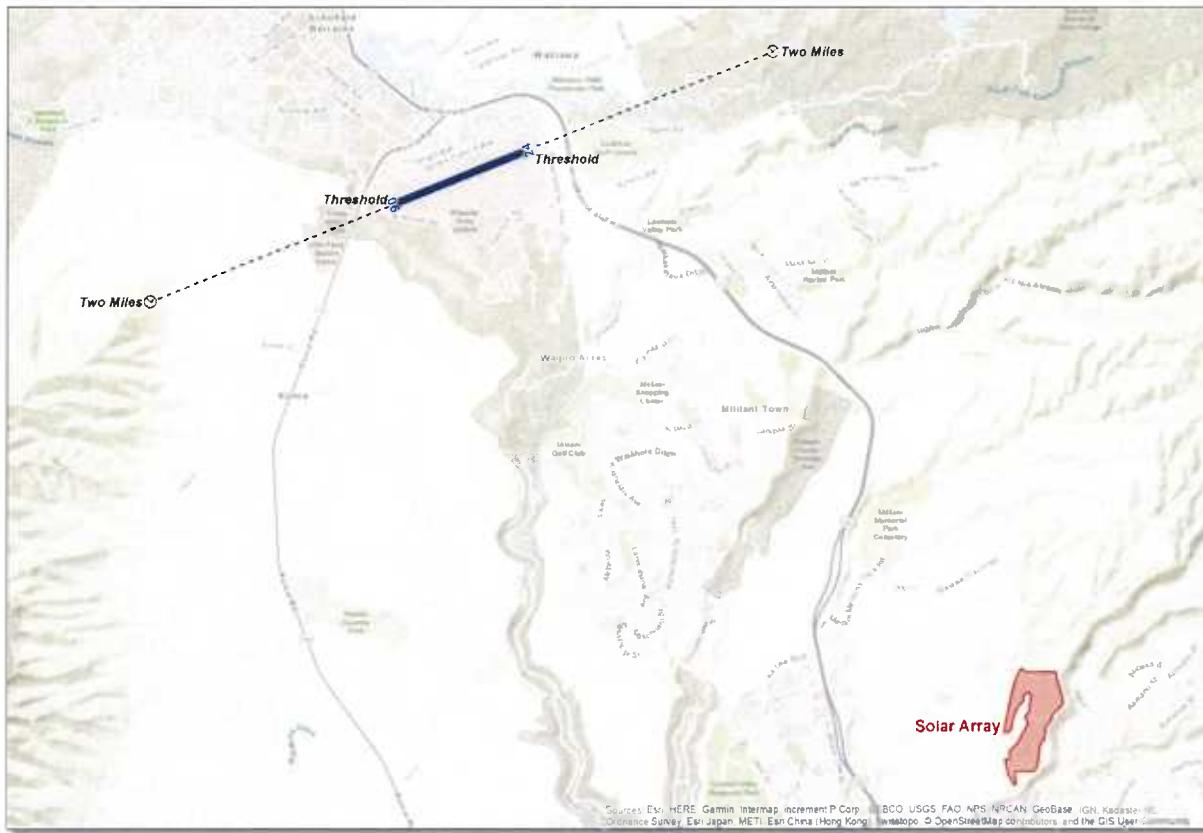


Figure 10: Runway 06/24 SGHAT flight path and Waiawa Solar project

Parameter	Runway 06	Runway 24
Threshold height (ft)	50.0	50.0
Direction (deg)	69	249
Glide slope (deg)	3.0	3.0
Consider pilot visibility from cockpit	Yes	Yes

Table 16: Runway 06/24 flight path and viewing parameters

Runway	Observation Point	Latitude	Longitude	Ground Elevation (feet)	Height above ground (feet)	Total Elevation (feet)
06	Threshold	21.479191	-158.043945	816.17	50.00	866.17
	2-mile point	21.468830	-158.072986	1188.83	230.80	1419.63
24	Threshold	21.484311	-158.030153	836.66	50.00	886.66
	2-mile point	21.494673	-158.001112	994.65	445.46	1440.11

Table 17: Runway 06/24 flight path observation points



Air Traffic Control Tower – Wheeler Army Airfield



Figure 11: Air Traffic Control Tower at Wheeler Army Airfield

Observation Point	Latitude	Longitude	Ground Elevation (feet)	Height above ground (feet)	Total Elevation (feet)
ATCT	21.483108	-158.038381	840.04	47.00	887.04

Table 18: Air Traffic Control Tower observation points



Waiawa Solar Discrete Observation Points - Residents



Figure 12: Location of Waiawa Solar Array Discrete Observation Points - Residents

ID	Latitude	Longitude	Ground Elevation (feet)	Height Above Ground - Single Story (feet)	Total Elevation - Single Story	Height Above Ground – Second Story (feet)	Total Elevation - Second Story
OP 1	21.410445	-157.977413	71.3	8	79.3	16	87.3
OP 2	21.411019	-157.976339	73.46	8	81.46	16	89.46
OP 3	21.41165	-157.974957	67.5	8	75.5	16	83.5
OP 4	21.412264	-157.973391	110.04	8	118.04	16	126.04
OP 5	21.412869	-157.972155	80.26	8	88.26	16	96.26
OP 6	21.41496	-157.970352	160.04	8	168.04	16	176.04
OP 7	21.414842	-157.965588	128.39	8	136.39	16	144.39
OP 8	21.414542	-157.965667	129.1	8	137.1	16	145.1
OP 9	21.415081	-157.965407	121.11	8	129.11	16	137.11
OP 10	21.415209	-157.965166	131.04	8	139.04	16	147.04
OP 11	21.416414	-157.96553	323.95	8	331.96	16	339.96
OP 12	21.416777	-157.965545	320.6	8	328.6	16	336.6
OP 13	21.41771	-157.965402	317.8	8	325.8	16	333.8
OP 14	21.41797	-157.965378	338.81	8	346.81	16	354.81
OP 15	21.418212	-157.965359	350.75	8	358.75	16	366.75
OP 16	21.418517	-157.965383	351.9	8	359.91	16	367.91
OP 17	21.418904	-157.965394	352.66	8	360.66	16	368.66
OP 18	21.419278	-157.96534	370	8	378	16	386
OP 19	21.419628	-157.96512	365.81	8	373.81	16	381.81
OP 20	21.419718	-157.96482	372.38	8	380.38	16	388.38
OP 21	21.422336	-157.962479	432.21	8	440.21	16	448.22
OP 22	21.42267	-157.962401	433.37	8	441.37	16	449.37
OP 23	21.422953	-157.962289	430.53	8	438.53	16	446.53
OP 24	21.420723	-157.963284	419.05	8	427.05	16	435.05
OP 25	21.424335	-157.962173	466.41	8	474.41	16	482.41
OP 26	21.424167	-157.962152	472.81	8	480.81	16	488.81
OP 27	21.424061	-157.962047	477.82	8	485.82	16	493.82

Table 19: Waiawa Solar Array Discrete Observation Receptors

Waiawa Solar Discrete Observation Points - Routes

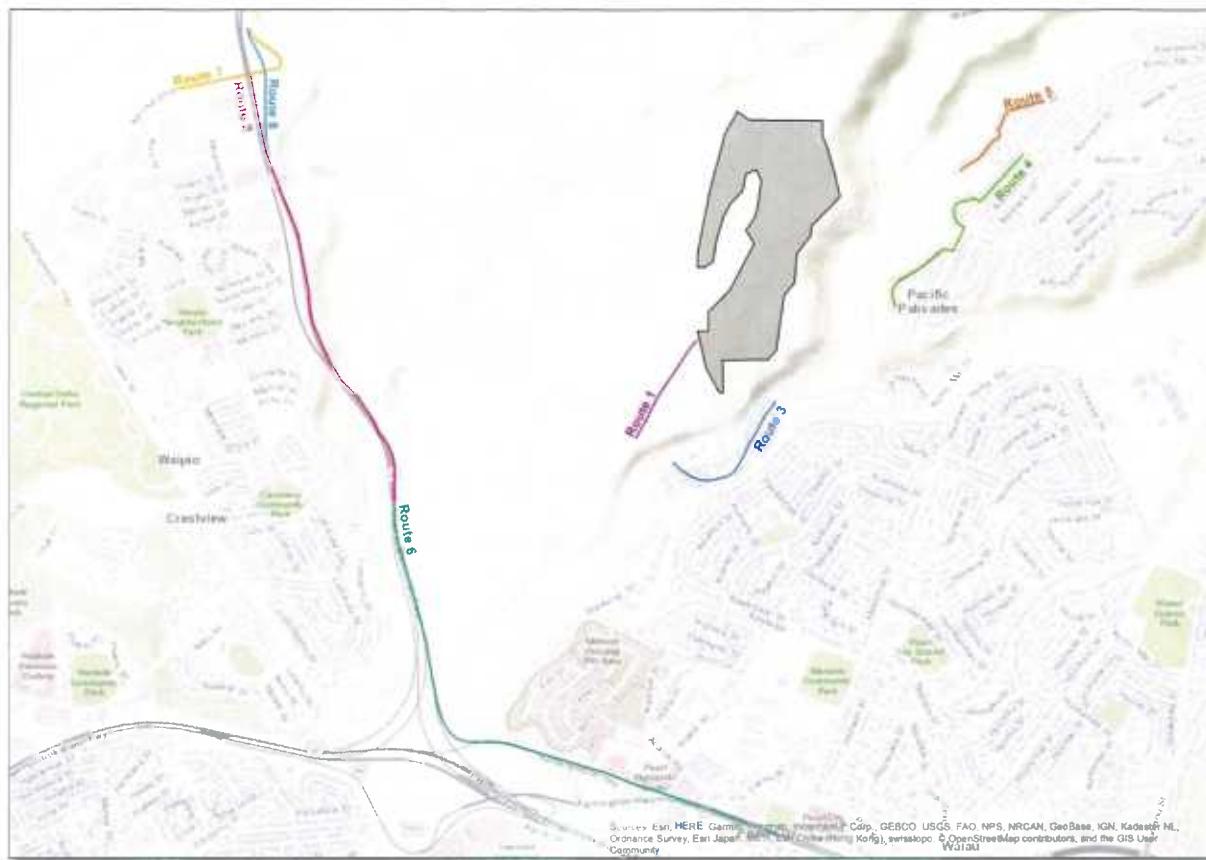


Figure 13: Location of Waiawa Solar Array Discrete Observation Points - Routes

ID	Latitude	Longitude	Ground Elevation (feet)	Height Above Ground – Cars (feet)	Total Elevation - Cars	Height Above Ground – Trucks (feet)	Total Elevation - Trucks
1	21.412234	-157.977661	247.92	4	251.93	8	255.93
2	21.412809	-157.977303	270.9	4	274.9	8	278.9
3	21.413091	-157.977118	283.01	4	287.01	8	291.01
4	21.413382	-157.976961	293.44	4	297.44	8	301.44
5	21.413977	-157.976651	313.3	4	317.3	8	321.3
6	21.41427	-157.97647	321.76	4	325.76	8	329.76
7	21.414528	-157.976255	329.06	4	333.06	8	337.06
8	21.415611	-157.975475	348.48	4	352.48	8	356.48
9	21.416153	-157.975083	357.14	4	361.14	8	365.14
10	21.416414	-157.974869	362.42	4	366.42	8	370.42
11	21.416662	-157.974645	366.84	4	370.84	8	374.84

Table 20: Waiawa Solar Array Observation Receptors Route 1



ID	Latitude	Longitude	Ground Elevation (feet)	Height Above Ground – Cars (feet)	Total Elevation - Cars	Height Above Ground – Trucks (feet)	Total Elevation - Trucks
1	21.409392	-157.989463	188.84	4	192.84	8	196.84
2	21.410836	-157.989425	249.85	4	253.85	8	257.85
3	21.411348	-157.989505	260.7	4	264.7	8	268.7
4	21.411865	-157.989666	254.09	4	258.09	8	262.09
5	21.412359	-157.99002	183.69	4	187.69	8	191.69
6	21.412549	-157.99023	151.92	4	155.92	8	159.92
7	21.413093	-157.990428	183.69	4	187.69	8	191.69
8	21.414187	-157.991185	277.12	4	281.12	8	285.12
9	21.414921	-157.992	168.38	4	172.38	8	176.38
10	21.415375	-157.992274	200.21	4	204.21	8	208.21
11	21.41569	-157.992467	242.8	4	246.8	8	250.8
12	21.416479	-157.992864	322.02	4	326.02	8	330.02
13	21.417428	-157.993293	324.94	4	328.94	8	332.94
14	21.418097	-157.993459	330.37	4	334.37	8	338.37
15	21.418916	-157.993523	370.21	4	374.21	8	378.21
16	21.420379	-157.993813	371.85	4	375.85	8	379.85
17	21.421608	-157.994055	398.92	4	402.92	8	406.92
18	21.422427	-157.994366	402.5	4	406.5	8	410.5
19	21.42392	-157.995025	403.89	4	407.89	8	411.89
20	21.425338	-157.995594	402.9	4	406.9	8	410.9
21	21.426652	-157.99595	442.59	4	446.59	8	450.59
22	21.428829	-157.996324	484.42	4	488.42	8	492.42

Table 21: Waiawa Solar Array Observation Receptors Route 2



ID	Latitude	Longitude	Ground Elevation (feet)	Height Above Ground – Cars (feet)	Total Elevation - Cars	Height Above Ground – Trucks (feet)	Total Elevation - Trucks
1	21.411143	-157.975835	74.65	4	78.65	8	82.65
2	21.410716	-157.975423	78.77	4	82.77	8	86.77
3	21.410698	-157.975296	77.47	4	81.47	8	85.47
4	21.410564	-157.975116	75.42	4	79.42	8	83.42
5	21.410455	-157.97493	71.22	4	75.22	8	79.22
6	21.410357	-157.974687	69.69	4	73.69	8	77.69
7	21.410281	-157.974367	70.26	4	74.26	8	78.26
8	21.410284	-157.974098	71.22	4	75.22	8	79.22
9	21.41032	-157.973769	72.37	4	76.38	8	80.38
10	21.410417	-157.973357	80.86	4	84.86	8	88.86
11	21.410576	-157.973008	87.66	4	91.66	8	95.66
12	21.410876	-157.972716	80.69	4	84.69	8	88.69
13	21.411461	-157.972374	78.35	4	82.35	8	86.35
14	21.412058	-157.972053	64.41	4	68.41	8	72.41
15	21.412258	-157.971916	65.42	4	69.42	8	73.42
16	21.412467	-157.971797	66.67	4	70.67	8	74.67
17	21.412879	-157.971549	67.66	4	71.66	8	75.66
18	21.413275	-157.971317	71.13	4	75.13	8	79.13
19	21.413596	-157.971037	72.98	4	76.98	8	80.98
20	21.413868	-157.970842	74.48	4	78.48	8	82.48

Table 22: Waiawa Solar Array Observation Receptors Route 3

ID	Latitude	Longitude	Ground Elevation (feet)	Height Above Ground – Cars (feet)	Total Elevation - Cars	Height Above Ground – Trucks (feet)	Total Elevation - Trucks
1	21.41814	-157.964984	366.91	4	370.91	8	374.91
2	21.418394	-157.965027	369.87	4	373.87	8	377.88
3	21.419145	-157.964967	383.7	4	387.7	8	391.7
4	21.419241	-157.96491	386.62	4	390.62	8	394.62
5	21.419354	-157.964814	390.77	4	394.77	8	398.77
6	21.419417	-157.964712	395.15	4	399.15	8	403.16
7	21.419585	-157.964297	407.56	4	411.56	8	415.56
8	21.419742	-157.964002	414.38	4	418.38	8	422.38
9	21.420042	-157.963543	422.12	4	426.12	8	430.12
10	21.42032	-157.963196	438.48	4	442.48	8	446.48
11	21.420561	-157.962887	448.43	4	452.43	8	456.43
12	21.420678	-157.962748	447.74	4	451.74	8	455.74
13	21.420717	-157.962678	447.88	4	451.88	8	455.89
14	21.420745	-157.962563	448.53	4	452.53	8	456.53
15	21.420735	-157.962444	448.95	4	452.95	8	456.95
16	21.4207	-157.962305	450.05	4	454.05	8	458.06
17	21.420645	-157.962145	451.97	4	455.97	8	459.97
18	21.421767	-157.961568	464.46	4	468.46	8	472.46
19	21.421915	-157.961874	457.25	4	461.25	8	465.25
20	21.422062	-157.961989	454.97	4	458.97	8	462.97
21	21.422289	-157.962052	454.23	4	458.23	8	462.23
22	21.422519	-157.96208	453.23	4	457.23	8	461.23
23	21.422694	-157.962043	453.29	4	457.29	8	461.29
24	21.422799	-157.96195	454.37	4	458.37	8	462.37
25	21.422864	-157.961851	455.52	4	459.52	8	463.52
26	21.422915	-157.961689	458.3	4	462.3	8	466.3
27	21.423041	-157.961179	475.63	4	479.63	8	483.63
28	21.42305	-157.961089	478.96	4	482.96	8	486.96
29	21.423033	-157.961017	481.44	4	485.44	8	489.44
30	21.4229	-157.960808	486.51	4	490.51	8	494.51
31	21.425031	-157.958682	532.24	4	536.24	8	540.24

Table 23: Waiawa Solar Array Observation Receptors Route 4



ID	Latitude	Longitude	Ground Elevation (feet)	Height Above Ground – Cars (feet)	Total Elevation - Cars	Height Above Ground – Trucks (feet)	Total Elevation - Trucks
1	21.424327	-157.961781	490.4	4	494.4	8	498.4
2	21.424867	-157.960852	502.08	4	506.08	8	510.08
3	21.424976	-157.960732	506.41	4	510.41	8	514.41
4	21.425292	-157.96047	517.6	4	521.6	8	525.6
5	21.425631	-157.960183	520.67	4	524.67	8	528.67
6	21.425712	-157.960057	522.42	4	526.42	8	530.42
7	21.42583	-157.959849	526.15	4	530.15	8	534.15
8	21.425855	-157.95979	526.61	4	530.61	8	534.61
9	21.426054	-157.959844	530.38	4	534.38	8	538.38
10	21.426147	-157.959852	532.51	4	536.51	8	540.51
11	21.4263	-157.959802	536.56	4	540.56	8	544.56
12	21.426789	-157.959591	542.93	4	546.93	8	550.93
13	21.426912	-157.959495	545.98	4	549.98	8	553.98
14	21.426998	-157.959406	548.57	4	552.57	8	556.57
15	21.427091	-157.959255	554.74	4	558.74	8	562.74
16	21.427148	-157.959025	564.05	4	568.05	8	572.05
17	21.427479	-157.957662	586.37	4	590.37	8	594.37

Table 24: Waiawa Solar Array Observation Receptors Route 5



ID	Latitude	Longitude	Ground Elevation (feet)	Height Above Ground – Cars (feet)	Total Elevation - Cars	Height Above Ground – Trucks (feet)	Total Elevation - Trucks
1	21.409157	-157.989435	181.96	4	185.96	8	189.96
2	21.407833	-157.989338	140.47	4	144.47	8	148.47
3	21.407069	-157.989107	127.3	4	131.3	8	135.3
4	21.403735	-157.988161	134.7	4	138.7	8	142.7
5	21.402911	-157.987931	127.85	4	131.85	8	135.85
6	21.40207	-157.987796	110.69	4	114.69	8	118.69
7	21.401233	-157.987623	39.65	4	43.65	8	47.65
8	21.400805	-157.987547	23.04	4	27.04	8	31.04
9	21.400392	-157.987479	24.19	4	28.2	8	32.2
10	21.399972	-157.987359	26.34	4	30.34	8	34.34
11	21.399565	-157.987224	28.18	4	32.18	8	36.19
12	21.399178	-157.987047	30.9	4	34.9	8	38.9
13	21.398838	-157.986785	31.8	4	35.8	8	39.8
14	21.398569	-157.986439	29.57	4	33.57	8	37.57
15	21.398479	-157.98618	26.92	4	30.92	8	34.92
16	21.398436	-157.985921	26.99	4	30.99	8	34.99
17	21.398429	-157.98473	21.73	4	25.73	8	29.73
18	21.398364	-157.984177	19.69	4	23.69	8	27.69
19	21.396953	-157.979118	38.87	4	42.87	8	46.87
20	21.396519	-157.978024	37.87	4	41.87	8	45.87
21	21.395275	-157.974121	58.3	4	62.3	8	66.3
22	21.393902	-157.970267	45.79	4	49.79	8	53.79

Table 25: Waiawa Solar Array Observation Receptors Route 6

ID	Latitude	Longitude	Ground Elevation (feet)	Height Above Ground – Cars (feet)	Total Elevation - Cars	Height Above Ground – Trucks (feet)	Total Elevation - Trucks
1	21.428272	-157.999922	475.56	4	479.56	8	483.56
2	21.428445	-157.998944	478.54	4	482.54	8	486.54
3	21.428968	-157.996138	486.26	4	490.26	8	494.26
4	21.42907	-157.995636	475.74	4	479.74	8	483.74
5	21.42922	-157.994869	456.48	4	460.48	8	464.48
6	21.429327	-157.994816	457.79	4	461.79	8	465.79
7	21.429494	-157.994843	459.24	4	463.24	8	467.24
8	21.429639	-157.994894	459.01	4	463.01	8	467.01
9	21.429769	-157.994982	460.68	4	464.68	8	468.68
10	21.429896	-157.995146	464.81	4	468.81	8	472.81
11	21.430236	-157.995621	456.96	4	460.96	8	464.96
12	21.430513	-157.996028	469.83	4	473.83	8	477.83
13	21.430762	-157.996246	471.17	4	475.17	8	479.17
14	21.430997	-157.996353	469.93	4	473.93	8	477.93

Table 26: Waiawa Solar Array Observation Receptors Route 7

ID	Latitude	Longitude	Ground Elevation (feet)	Height Above Ground – Cars (feet)	Total Elevation - Cars	Height Above Ground – Trucks (feet)	Total Elevation - Trucks
1	21.425287	-157.995422	397.66	4	401.66	8	405.66
2	21.425502	-157.995489	402.53	4	406.53	8	410.53
3	21.425684	-157.995519	409.56	4	413.56	8	417.56
4	21.425946	-157.995548	418.6	4	422.6	8	426.6
5	21.426485	-157.995599	430.86	4	434.86	8	438.86
6	21.428185	-157.995587	444.61	4	448.61	8	452.61
7	21.428661	-157.995576	459.48	4	463.48	8	467.48
8	21.428826	-157.995601	466.68	4	470.68	8	474.68
9	21.429095	-157.995625	475.02	4	479.02	8	483.02
10	21.429552	-157.995762	475.2	4	479.2	8	483.2
11	21.42981	-157.995885	471.16	4	475.16	8	479.16
12	21.430207	-157.996102	468.84	4	472.84	8	476.84
13	21.430569	-157.996309	473.82	4	477.82	8	481.82
14	21.430994	-157.996471	475.78	4	479.78	8	483.78

Table 27: Waiawa Solar Array Observation Receptors Route 8



Results

Capitol Airspace utilized the above specified inputs to analyze potential glint and glare at various points along the flight paths. Runway end coordinates were obtained from the FAA National Flight Data Center (NFDC) National Airspace System Resources (NASR) dataset. SGHAT uses this information to analyze each flight path between a two-mile final and the runway threshold.

If glare is detected, “Glare Occurrence Plots” are generated by SGHAT. The plots show when glare can occur (as viewed from the prescribed observation point) throughout the year. The color indicates the potential ocular hazard. The colors are defined as:

- **Green:** Low potential for temporary after-image glare
- **Yellow:** Potential for temporary after-image glare
- **Red:** Potential for permanent eye damage glare

The results of this analysis predicted no glare for any receptor ([Table 28](#))

Receptor	Green Glare (minutes / year)	Yellow Glare (minutes / year)	Red Glare (minutes / year)
Runway 04R (PHNL)	0	0	0
Runway 22L (PHNL)	0	0	0
Runway 04L (PHNL)	0	0	0
Runway 22R (PHNL)	0	0	0
Runway 08L (PHNL)	0	0	0
Runway 26R (PHNL)	0	0	0
Runway 08R (PHNL)	0	0	0
Runway 26L (PHNL)	0	0	0
Runway 04W (PHNL)	0	0	0
Runway 22W (PHNL)	0	0	0
Runway 08W (PHNL)	0	0	0
Runway 26W (PHNL)	0	0	0
ATCT (PHNL)	0	0	0
Runway 06 (PHHI)	0	0	0
Runway 24 (PHHI)	0	0	0
ATCT (PHHI)	0	0	0
Residents Single Story	0	0	0
Residents Two Story	0	0	0
Route 1 Car	0	0	0
Route 2 Car	0	0	0
Route 3 Car	0	0	0
Route 4 Car	0	0	0
Route 5 Car	0	0	0
Route 6 Car	0	0	0
Route 7 Car	0	0	0
Route 8 Car	0	0	0
Route 1 Truck	0	0	0
Route 2 Truck	0	0	0
Route 3 Truck	0	0	0
Route 4 Truck	0	0	0
Route 5 Truck	0	0	0
Route 6 Truck	0	0	0
Route 7 Truck	0	0	0
Route 8 Truck	0	0	0

Table 28: Waiawa Solar project Glint and Glare summary

Conclusion

The SGHAT analyzed the expected total footprints of the Waiawa Solar project. The SGHAT finding indicated that no glare is predicted from the project array for the approaches to Runway 08L/26R, 08R/26L, 04R/22L, 04L/22R, 08W/26W, and 04W/22W for Daniel K. Inouye International Airport nor is glare predicted for the ATCT personnel in the ATCT. No glare was predicted from the project solar array for the approaches to Runway 06/24 for Wheeler Army Airbase nor is glare predicted for the ATCT personnel in the ATCT. Additionally, no glare was predicted for residents and no glare was predicted for cars or trucks on Route 1, Route 2, Route 3, Route 4, Route 5, Route 6, Route 7, and Route 8. The findings show that the project is compliant with the FAA interim policy for Solar Energy System Projects on Federally Obligated Airports. Additionally as noted in assumptions, the glint and glare analysis does not take into account vegetation, fencing, or other natural obstructions. This glint and glare report takes the most conservative approach in calculating the possibility for glint and glare.

If you have any questions regarding the findings in this analysis, please contact [Rick Coles](#) at (703) 256-2485.