Reviewed and Approved by Executive Director: _____

July 7, 2021

FOR ACTION

I. REQUEST

Consider the request for a Conditional Use Permit by Kalaeloa Home Lands Solar, LLC (Applicant) to allow 'Solar Farm' use on Tax Map Key (TMK) No: (1)-9-1-013: 029. Pursuant to Hawaii Administrative Rules (HAR), Chapter 215, Figure 1.7, *Land Use*, 'Solar Farm' is permitted as a Conditional Use and requires a Conditional Use Permit (CUP). Approval of the Conditional Use Permit to allow the proposed Solar Farm use is required prior to approval of a Development Permit application. The CUP process is subject to review and approval by the Authority. The CUP Application is attached as Exhibit A.

II. BACKGROUND

The Project site is located in the Kalaeloa Community Development District (KCDD) Transect 3 (T3), General Urban zone. The Project site is bounded by West Perimeter Road, the Kalaeloa Airport to the east, and two DHHL parcels to the north and south. See Figure 1. The Project site is 29.8 acre in size and is owned by the Department of Hawaiian Home Lands (DHHL). The DHHL has provided landowner authorization for the Project.

In 2018, the DHHL granted the Applicant the rights to lease the property for the development and operation of the Project. It is anticipated that the proposed Project will contribute to the Oahu electrical renewable portfolio through Hawaiian Electric's Community-Based Renewable Energy Program.

On April 7, 2021, a presentation on the Project was made to the Authority as an information item. The Applicant's presentation is provided as Exhibit B.

III. ANALYSIS

Pursuant to §15-215-79, *Conditional use permit, Findings*, HAR, the following findings of fact have been submitted by the Applicant:

(1) The use is allowed within the applicable zone and complies with all other applicable provisions of the rules.

Solar Farm use is allowed within the T3 zone; however, 'Solar Farm' use requires a Conditional Use Permit, pursuant to §15-215-79, *Conditional use permit, Applicability*.

(2) *The use will conform to the Kalaeloa Master Plan (KMP).*

Section 3.2.2 of the KMP states that due to the "continued escalation in fossil fuel energy prices, interest in renewable energy resources is increasing" and industries such as solar energy generation "may have development potential in Kalaeloa."

Section 4.1.4 of the KMP also states that "Potential industries such as solar or hybrid energy generation, bio-filtration, or other such technologies are compatible in these parcels. The identified Eco-industrial lands at Kalaeloa present a unique opportunity to foster research and the hands-on application of alternative or hybrid energy production. Advantages include close proximity to existing power plants at Campbell Industrial Park and to electrical transmission lines serving the region, as well as a large number of sunny days each year and relatively stable diurnal range."

The KMP designates the Project site as an eco-industrial lot appropriate for alternative energy use. The project, consisting of up to 8.8 MW of solar energy generation supports the State's renewable energy goals. The Project also provides plan-compatible uses which are severely limited due to the proximity of the airport restricted airspace and land-use requirements. Accordingly, the Project is in conformance with, and promotes the goals of the KMP in an area that would otherwise be underutilized.

(3) *The design, location, size, and operating characteristics of the proposed use are compatible with the existing and future uses of the parcels surrounding area.*

Parcel 9-1-013:029 lies at the western edge of Kalaeloa and at the end of the crosswind runway, which is designated Runway 11-29. The Kalaeloa Airport western perimeter fence is 8 feet tall, roughly corresponding with the maximum height of the photovoltaic panels to be installed behind the perimeter fence. Properties to the north of the subject property have been developed for PV use. State-retained lands associated with the airport are on the east boundary. Vacant land used by the Navy as an equipment base yard and composting site are to the south, and the industrial properties of Campbell Industrial Park are to the west, immediately beyond the Western Perimeter Road.

At full development, the Project will consist of 29 acres of PV panels. The proposed action does not increase population or traffic. During operation, the Project will not contribute hazardous waste, air emission, or surface water contamination associated with its operation. The Project does not utilize any potable water or sewer. The Project site is surrounded by industrial or eco-industrial uses on all 4 sides. Land use restrictions imposed by its proximity to the Kalaeloa Airport prevent any use that

involves buildings, or frequent personnel presence. Photovoltaic panels have a low profile, little maintenance and no hardened structures or hazardous materials. The design, location, size, and operating characteristics of the proposed use are compatible with the existing use in the vicinity, and airport operations will prevent significant changes in the future use of the parcel.

(4) The site is physically suitable for the type, density and intensity of use being proposed, including access, utilities, and the absence of physical constraints.

The Project site is in close proximity to the Airport runway, therefore limiting allowable uses. The limited airport related land use makes the site ideal for Solar Farm use.

(5) Granting the permit would not be detrimental to the public health, safety, or welfare or be materially injurious to persons, lots or improvements in the vicinity and zone in which the lot is located.

Operation of a PV facility on the subject property would not be detrimental to the public health, safety, or welfare, or be materially injurious to persons, or airport operations. Construction of the proposed PV facility will be suspended during periods when the crosswind runway is in use in order to mitigate potential conflicts or distractions.

The Conditional Use Permit is provided as Exhibit C.

IV. RECOMMENDATION

Staff has determined that the Project has met all required findings pursuant to HAR § 15-215-79(d), Conditional Use Permit, Findings, and recommends that the Authority approve the request for a Conditional Use Permit to allow Solar Farm use on TMK: (1)-9-1-013: 029. Staff also requests that the Authority authorize the Executive Director to issue the Conditional Use Permit and undertake all tasks necessary to effectuate the purpose(s) of this For Action.

Attachments:
Exhibit A - Conditional Use Permit Application
Exhibit B - Presentation of the Project to the Authority on April 7, 2021
Exhibit C - Conditional Use Permit

Prepared By: Tesha Malama, Director of Planning & Development, Kalaeloa Tesha H. Malama

Reviewed By: Deepak Neupane, P.E., AIA, Executive Director

Kalaeloa Home Lands Solar

HCDA Conditional Use Permit Application

Prepared for

Department of Business, Economic Development & Tourism
Hawai'i Community Development Authority

May 26, 2021

Arion Energy, LLC
Kalaeloa Home Lands Solar
HCDA Conditional Use Permit Application

Prepared for:
Hawaii Department of Business Economic Development and Tourism
Hawaii Community Development Authority
HCDA Kalaeloa Office
547 Queen Street
Honolulu, HI 96813

Prepared by:
NORTH SHORE CONSULTANTS, LLC
2091 Round Top Dr.
Honolulu, HI 96822

and

Imanaka Asato
IMANAKA ASATO | A LIMITED LIABILITY LAW COMPANY
Topa Financial Center, Fort Street Tower
745 Fort Street Mall, 17th Floor, Honolulu, HI 96813

Landowner:
Land Management Division
State of Hawaii, Department of Hawaiian Home Lands
91-5420 Kapolei Parkway, Kapolei, Hawaii 96805

May 26, 2021

Table of Contents

A. Cover Letter

John Whalen, Chairperson
Hawaii Community Development Authority
Planning Office
547 Queen Street
Honolulu, HI 96813

May 26, 2021

Kalaeloa Home Lands Solar Project
Conditional Use Permit Application
TMK # 9-1-013:029

Kalaeloa Home Lands Solar (KHLS) is a Photovoltaic (PV) development that is proposed for installation on land owned by the Department of Hawaiian Home Lands (DHHL). The proposed location is the 29.85-acre parcel designated by TMK# (1) 9-1-013:029 (Figure 1). The photovoltaic installation will contribute to the Oahu electrical renewable portfolio through Hawaiian Electric's Community-Based Renewable Energy Program (CBRE).

Full development of the project is dependent on successful competitive procurements that are estimated to be completed gradually over a 3-5 year time frame. The initial PV installation will cover only 7 acres of the parcel with the system size of 2.2 MWdc, but future allocations will be sought to expand the development to about 8.8 MWdc and cover approximately 55% of the land area. Construction on the initial portion of the project could begin within 3 months following completion of this and all related permits. The proposed full development of the subject property is shown in Figure 2. The project has a completed Environmental Assessment and approval from the State Historic Preservation Division of DLNR.

A Conditional Use Permit is necessary because the parcel is designated within the T-3 General Urban transect. Solar photovoltaic is one of the very few appropriate uses of the land due to restrictions imposed by its proximity to the cross-wind runway at John Rogers Field Airport (Kalaeloa Airport).

The Applicant is seeking a Conditional Use Permit, and if approved by the Authority will submit a Development Permit application for consideration.

The applicant stands ready to provide additional information or clarification of any information contained herein. Please direct questions and comments to the undersigned at your convenience.

Sincerely,

David M. Robichaux
NORTH SHORE CONSULTANTS, LLC
2091 Round Top Dr.
Honolulu, HI 96822
(808) 368-5352 cell
robichaud001@hawaii.rr.com

B. Landowners Authorization (See Appendix A)

PROJECT AUTHORIZATION

Kalaeloa Community Development District

Application No. _____

PROPERTY INFORMATION:

Site Address: Midway Road (per tax records)
Kapolei, HI 96707

Tax Map Key: 1st/9-1-013:029

Lot Size: 29.853 acres

Transect Zone: T-3

Present Use of Property and/or Buildings: Vacant land

LANDOWNER:

Name: State of Hawaii, Department of Hawaiian Home Lands

Mailing Address: Attention: Land Management Division/GL 294
P.O. Box 1879, Honolulu, HI 96805

Telephone: (808) 620-9460 Email: allen.g.yanos@hawaii.gov

APPLICANT:

Name: Kalaeloa Home Lands Solar, LLC

Mailing Address: c/o Arion Energy
500 Ala Moana Boulevard, Bldg. 7, #400, Honolulu, HI 96813

Telephone: (808) 286-7533 Email: nick.azari@arionenergy.com

AGENT:

Name: North Shore Consultants, LLC

Mailing Address: 2091 Round Top Drive
Honolulu, HI 96822

Telephone: (808) 368-5352 Email: robichaud001@hawaii.rr.com

SIGNATURE:

Landowner: By JOBIE M. H. MASAGATANI, Chairman, Hawaiian Homes Commission — Date: 3/1/19

Nick Azari, PhD — Date: 3/1/19

Applicant (Print & Sign)

June 2017

C. Project Plans

Please find below a tax map key map and conceptual plan of the solar farm at full development.

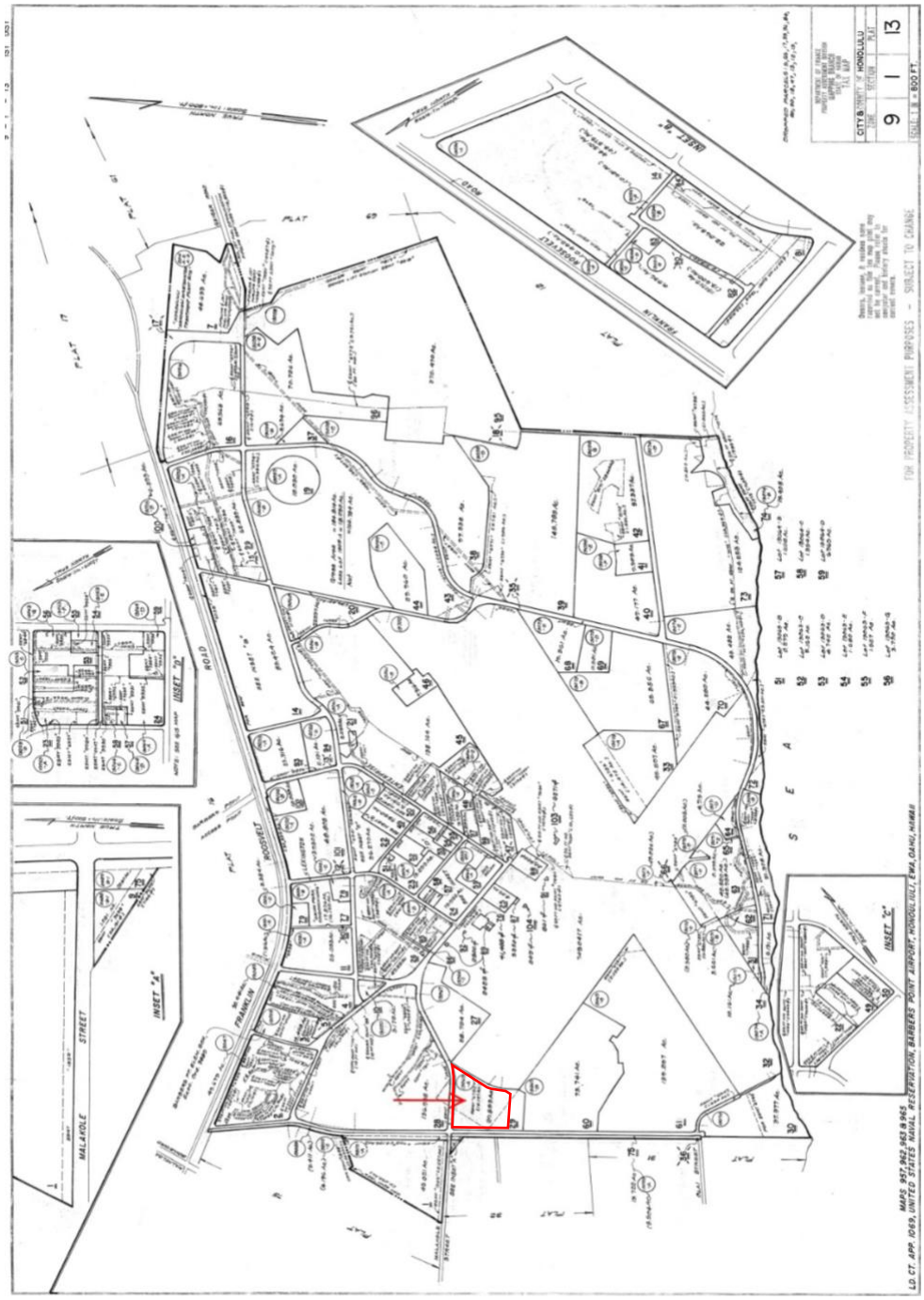


Figure 1: Tax Map Key Map of Kalaeloa showing the project site in red.

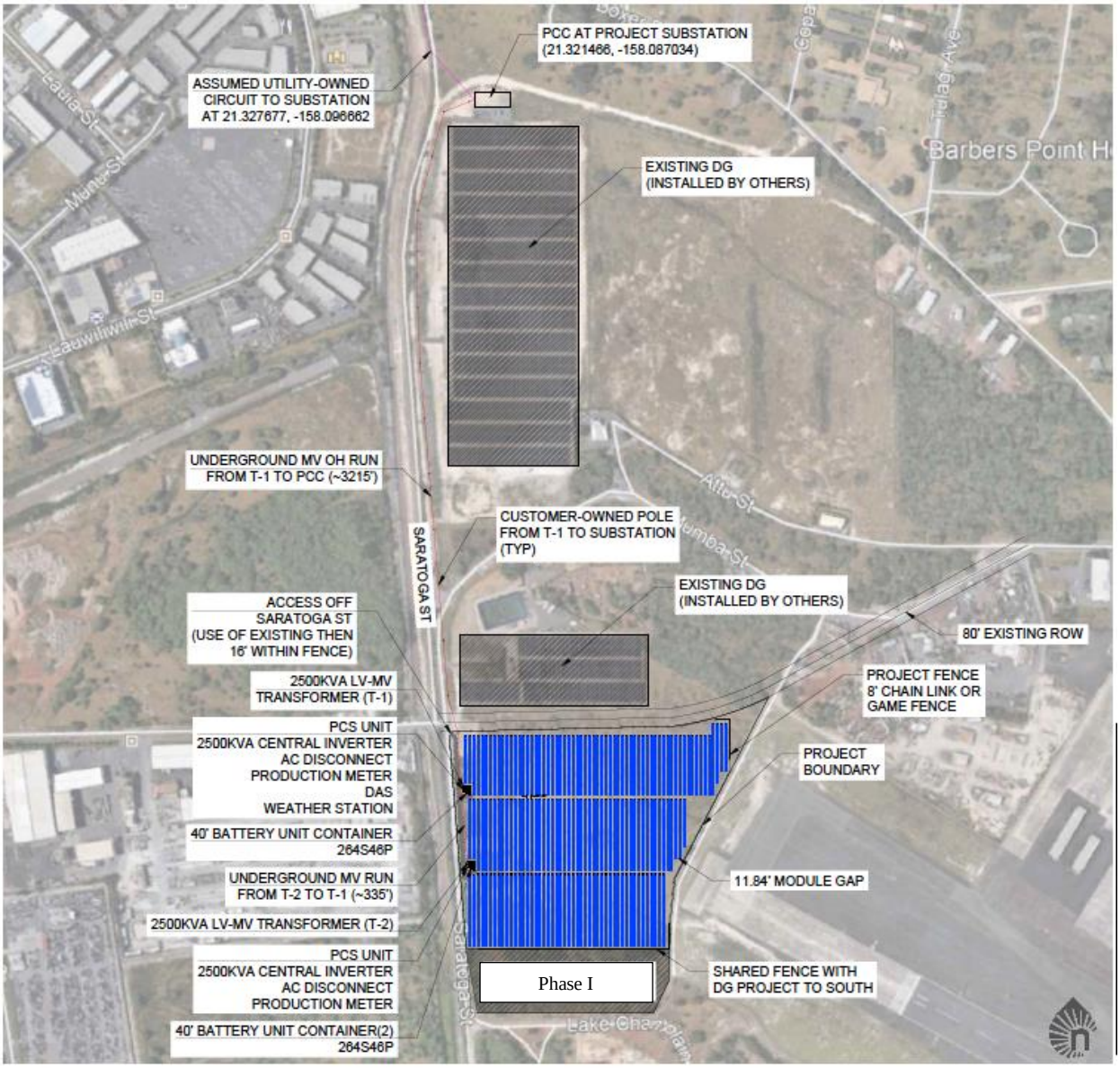


Figure 2: Conceptual layout for Photovoltaic system on the parcel at full capacity. Full capacity may not be obtained for 3-5 years and is dependent on the subscription rate and authorization from Hawaiian Electric.

D. Findings of Fact

Pursuant to Section 15-215-79(d), certain findings of fact, must be made in consideration of a Conditional Use Permit. The Applicant makes the following findings of fact to support this request for a Conditional Use Permit.

1. *The use is allowed within the applicable zone and complies with all other applicable provisions of the rules*;

Construction and operation of a solar farm is permitted in the T-3 transect following approval of a Conditional-Use Permit. This Conditional-Use Permit application seeks that approval.

2. *The use will conform to the KMP;*

KHLS complies with the requirements of the KMP. Specifically, the objectives of the KMP Sections 3.2.2 states that due to the "*continued escalation in fossil fuel energy prices, interest in renewable energy resources is increasing" and industries such as solar energy generation "may have development potential in Kalaeloa*."

Section 4.1.4 of the KMP also states that "*Potential industries such as solar or hybrid energy generation, bio-filtration, or other such technologies are compatible in these parcels… The identified Eco-industrial lands at Kalaeloa present a unique opportunity to foster research and the hands-on application of alternative or hybrid energy production. Advantages include close proximity to existing power plants at Campbell Industrial Park and to electrical transmission lines serving the region, as well as a large number of sunny days each year and relatively stable diurnal range."*

KHLS is designated as lot 2J in the KMP as an eco-industrial lot appropriate for alternative energy use. The project, consisting of up to 8.8 MWdc of solar energy generation supports the State's renewable energy goals. The project also provides plan-compatible uses which are severely limited due to the proximity of the airport restricted airspace and land-use requirements. Accordingly, KHLS is in conformance with, and promotes the goals of, the KMP in an area that would otherwise be underutilized.

3. *The design, location, size and operating characteristics of the proposed use are compatible with the existing and future use in the vicinity;*

Parcel 9-1-013:029 lies at the western edge of Kalaeloa, at the end of the crosswind runway, which is designated Runway 11-29. The Kalaeloa Airport western perimeter fence is 8 feet tall, roughly corresponding with the maximum height of the photovoltaic panels to be installed behind the perimeter fence. Properties to the north of the subject property have been developed for PV use. State-retained lands associated with the airport are on the east boundary. Vacant land used by the Navy as an equipment baseyard and composting site are to the south, and the industrial properties of Campbell Industrial Park are to the west, immediately beyond the Western Perimeter Road. Permits for other solar photovoltaic park have been approved for an

area at the opposite end of the same runway (Parcel 9-1-013:070)[1] and for an area to the North (KS-1).

Safe and effective operation of the Kalaeloa Airport is a primary consideration in the compatibility with surrounding land uses. Airports have a primary mission to serve the flying public and facilitate safe and convenient air travel. All activities in proximity to airports must be compatible with this mission. The Federal Aviation Administration (FAA) is charged with ensuring that aircraft operations are protected, and it has established permit requirements for any construction or operations within the airport restricted area.

The proposed project site is approximately 1200 feet west of the end of the crosswind runway (11-29). A taxiway, blast pad and perimeter buffer lie between Runway 11 and the project site. Historically Runway 11 has been used for departures only and Runaway 29 arrivals only. The use restriction was intended to minimize noise impacts to residential areas and schools located north and east of the airport (FAA, 2010a). Runway 11-29 is used infrequently by both private aircraft and the Coast Guard. Kalaeloa Airport is an alternate to Honolulu International Airport, the Coast Guard's primary aviation Search and Rescue facility for the Central Pacific Region, and home to a significant portion of civil aviation on Oahu.

All solar projects must submit to the FAA a notice of proposed construction Form 7460 to ensure that the proposed project is not located in areas or engage in activities that will impact the safety of airport operations. An Obstruction Evaluation /airport airspace analysis is performed to ensure that the proposed activity does not penetrate imaginary surfaces around an airport, cause interference with communications systems, or create glint and glare. The three primary aspects of the Obstruction analysis are discussed below.

Airspace Penetration: 14 CFR Part 77 establishes standards for determining obstructions in navigable airspace. Imaginary surfaces are defined that extend out from the runway at locations where aircraft are likely to fly. This imaginary surface is called the Runway Protection Zone (RPZ). The height above ground of the RPZ is lowest and narrowest near the runway increasing in width and altitude with distance from the runway. The imaginary surface is different for different types of airports. Kalaeloa Airport does not now have instrument landing capacity, thus the angle of the RPZ is 50:1 (H/V). Figure 3-4 shows the components of restricted surfaces and Figure 3 shows the slope position of the RPZ and Figure 4 shows the approximate location of the RPZ with respect to the project site.

[1] https://dbedt.hawaii.gov/hcda/files/2017/12/KAL-17-017-ASEF-II-Development-Permit-Application.pdf

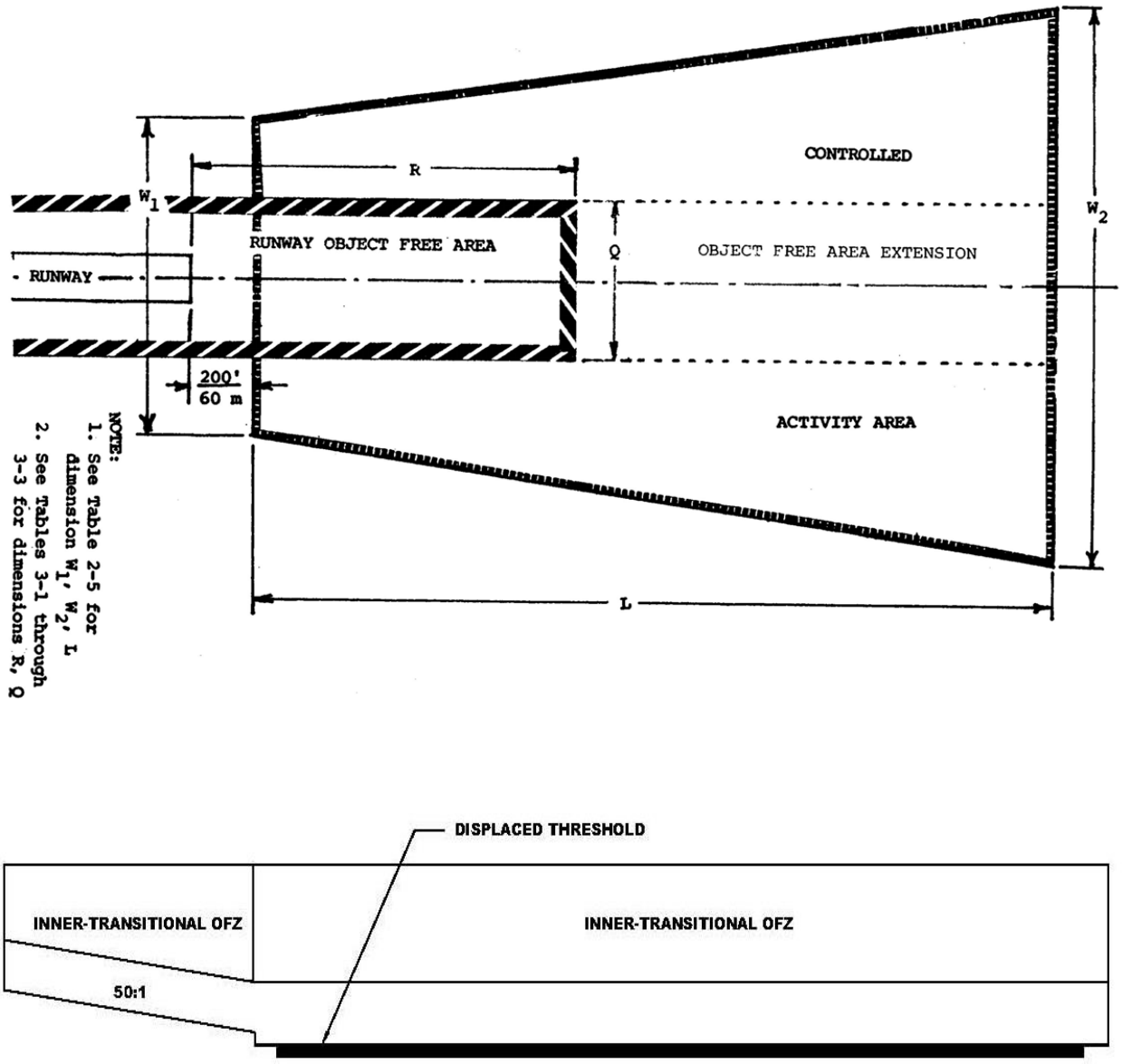


Figure 3: General components of restricted areas surrounding an airport. All structures must be below the RPZ plane to avoid being an obstruction to aircraft navigation. From FAA Advisory Circular 150/5300-13, 1989

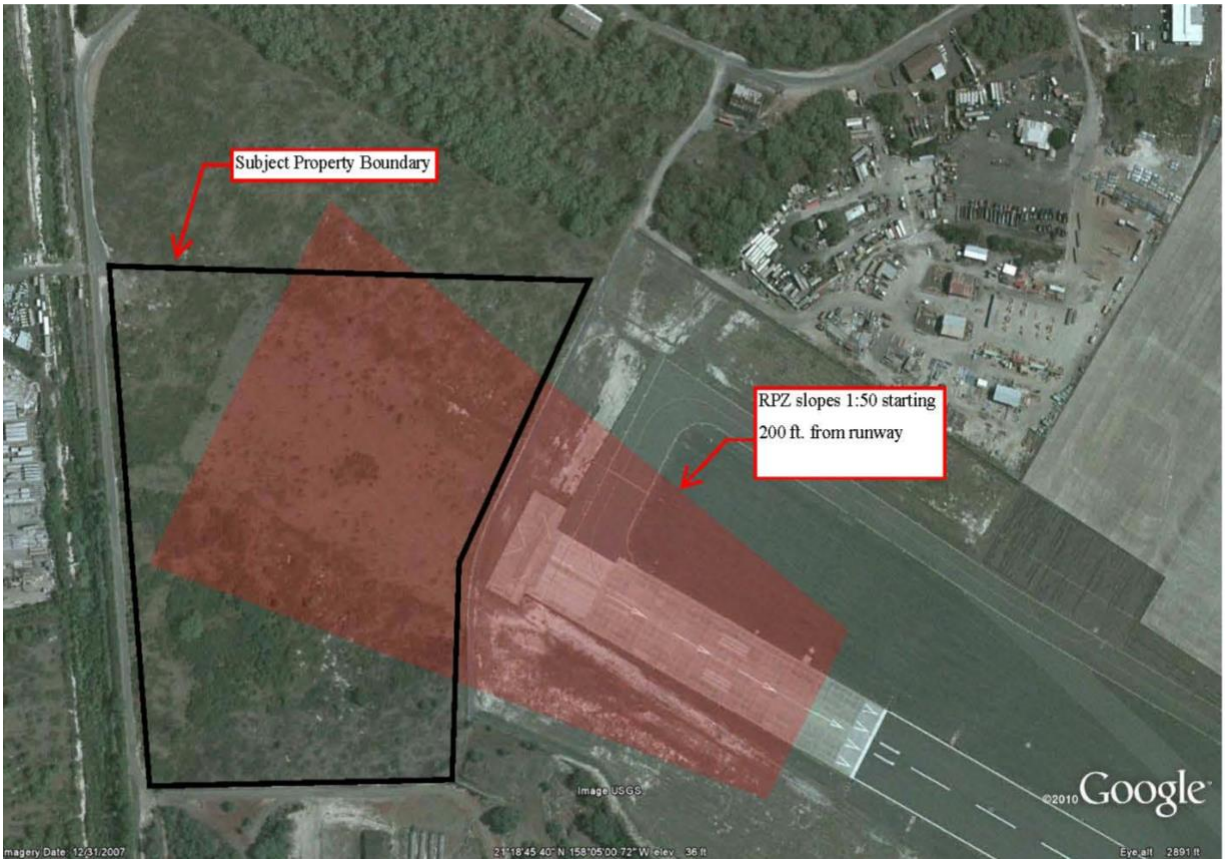


Figure 4: RPZ dimensions and slope in relation to the subject property boundaries. The RPZ starts 200 feet from the end of the runway and slopes upwards and outwards. For Kalaeloa Airport the slope angle is 50:1

As the project site is approximateley1200 feet from the end of Runway 11, and the RPZ slope is 50:1 angle starting 200 feet from the end of the runway, the altitude of the RPZ where it enters the project site is approximately 20 feet above ground level. The maximum elevation of the proposed PV panels is 8 feet above ground level which is approximately the level of the airport perimeter fence, and 10 feet below the RPZ. Authorization for construction was received from the FAA on May 7, 2019 with the approval of the FAA Form 7460-1 permit (Appendix A).

Communications systems Interference: Communications interference includes negative impacts on radar, navigational aids and infrared instruments. Radar interference occurs when objects are placed too close to radar antennae and reflect or block the transmission of signals between the transmitter and receiver such as an aircraft. It is possible for interference to be caused by other communications signals, but more commonly it is caused by a physical structure placed between the transmitter and receiver. Navigational aids (NAVAIDS) are passive systems with no transmitted signal. These can be impacted by objects within the line of sight between aircraft and the NAVAID. Infrared (IR) communications systems can be impacted by objects that retain heat after dark creating false signals in the IR communications systems (FAA 2010b). No transmitting equipment is proposed in the development of a solar farm on the subject property. No communications system interference is anticipated.

Glint and Glare: Glint and glare are components of reflectivity, or light reflected off of surfaces which can cause temporary visual interference even after the source of illumination has ceased. Glint is defined as an instantaneous flash and glare is a steadier reflection.

The amount of reflectivity varies greatly among solar technologies with concentrated solar power (CSP) technologies being highly reflective and Photovoltaic (PV) technologies being primarily absorptive rather than reflective (Figure 5). Existing conditions surrounding most airports include a number of reflective surfaces. In the case of Kalaeloa there are large metal warehouses with reflective roofs, and the Pacific Ocean in close proximity to the runways. The property is near 21 degrees north latitude, which implies that the sun is normally to the south of the site. Panels would be expected to have a slight angle facing south and may track the sun's location from southeast to southwest.

Solar installations are presently operating at a number of airports. To date there have been no serious complaints from air traffic controllers or pilots due to glare impacts from existing airport solar PV installations. Anecdotal evidence suggests that either significant glare is not occurring during times of operation or if glare is occurring it is a minor part of the landscape to which pilots and tower personnel are exposed (FAA, 2010b).

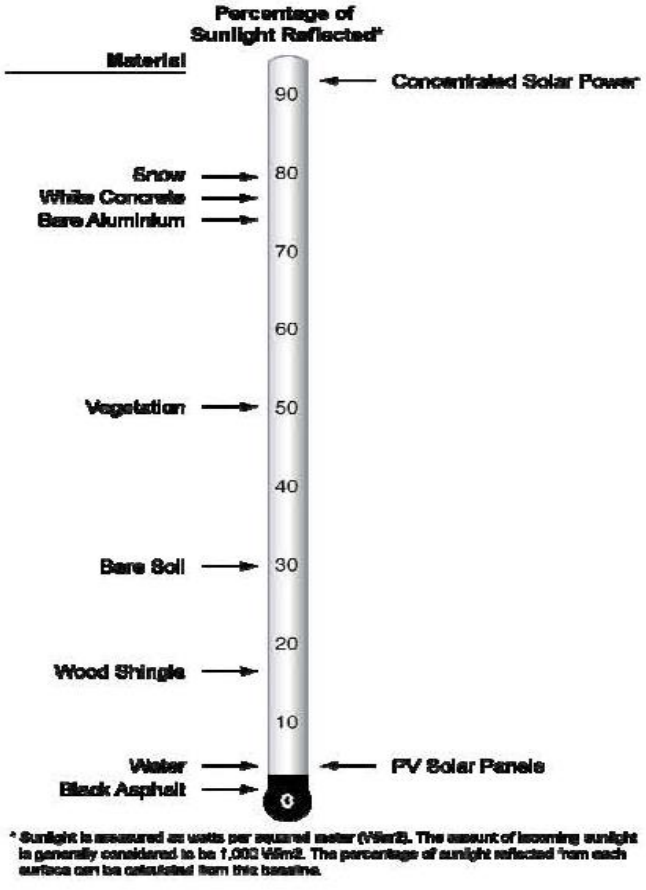


Figure 5: Relative reflectivity of various surfaces. Note that CSP technologies are toward the top of the reflective scale and PV is toward the bottom. (Technical Guidance for Evaluating Selected Solar Technologies on Airports. Federal Aviation Administration 2010b)

A glint and glare study for the proposed development was commissioned in 2012. The Study is appended to this document as Appendix B. In its conclusion the reflectivity study states:

It has been demonstrated that, in the few cases when there is some risk of glint by PV modules, the airplane will also be directly facing the sun and the corresponding reflections from the ocean, so it can be concluded that glint from PV modules will not have any relevant effect on airplanes' visibility, nor deteriorate the actual approaching flight conditions. Risk is also diminished by the monthly distribution of predominant wind direction in Kalaeloa when superimposed to the calendar days glint might occur.

At full development the subject property will consist of 29 acres of PV panels. The proposed action does not increase population or traffic. During operation the project will not contribute hazardous waste, air emission, or surface water contamination associated with its operation. The proposed PV park does not utilize any potable water, or sewer. No growth inducing factors, cumulative impacts, or secondary impacts associated with the proposed action have been identified. Although the parcel is in the T-3 transect it is surrounded by industrial or "eco-industrial uses on all 4 sides. Land use restrictions imposed by its proximity to the Kalaeloa Airport prevent any use that involves buildings, or frequent personnel presence. Photovoltaic panels have a low profile, little maintenance and no hardened structures or hazardous materials. Photovoltaic is one of the very few acceptable land uses for the site. The design, location, size and operating characteristics of the proposed use are compatible with the existing use in the vicinity, and airport operations will prevent significant changes in the future.

4. *The site is physically suitable for the type, density and intensity of use being proposed, including access, utilities, and the absence of physical constraints;*

Parcel 9-1-013:029 is covered by approximately 10 feet of fill materials that forms an extension to the crosswind runway of Kalaeloa Airport. Construction of the field was during the 1940s in response to World War II. Approximately 20 acres are filled and graded flat, forming an excellent substrate for photovoltaic panels. There are no tall structures or vegetation to shade the panels and a transmission corridor runs along the boundary between Kalaeloa and Campbell Industrial Park. Photovoltaic installations do not require much traffic during operation or construction. The site currently has access from an extension of Midway Street on the north east, and it is bounded by the Western Perimeter Road on the west.

A site analysis prior to application to the landowner revealed no physical constraints to the construction or operation of a PV park at the proposed site.

5. *Granting the permit would not be detrimental to the public health, safety, or welfare, or be materially injurious to persons, lots, or improvements in the vicinity and zone in which the lot is located.*

The site is 1,200 feet beyond the end of a crosswind runway at Kalaeloa Airport, but it is in line with the runway axis and will be in the flight path of aircraft that approach and depart from the crosswind runway. Runway 11-29 is used only during southeasterly and westerly winds. A wind rose (Sea Engineering, 2013)[2] based on wind speed and direction at Kalaeloa Airport shows that southwesterly winds blow approximately 3% of the time (Figure 6). This would correspond to the percentage of flights landing on Runway 11 and passing over the PV installation. Flights taking off on Runway 29 would only do so at time when the wind is westerly, which is approximately ½ of 1%. Flights landing over the PV facility on Runway 11 would do so approximately 3% of the time. Airport operations during low or slack wind periods use the primary runway due to noise impacts on nearby residential areas and the school from crosswind runway usage.

[2] http://kalaeloaharbor2040.com/pdf/03a_KBPH_DRAFT_DEIS_Feb2017.pdf

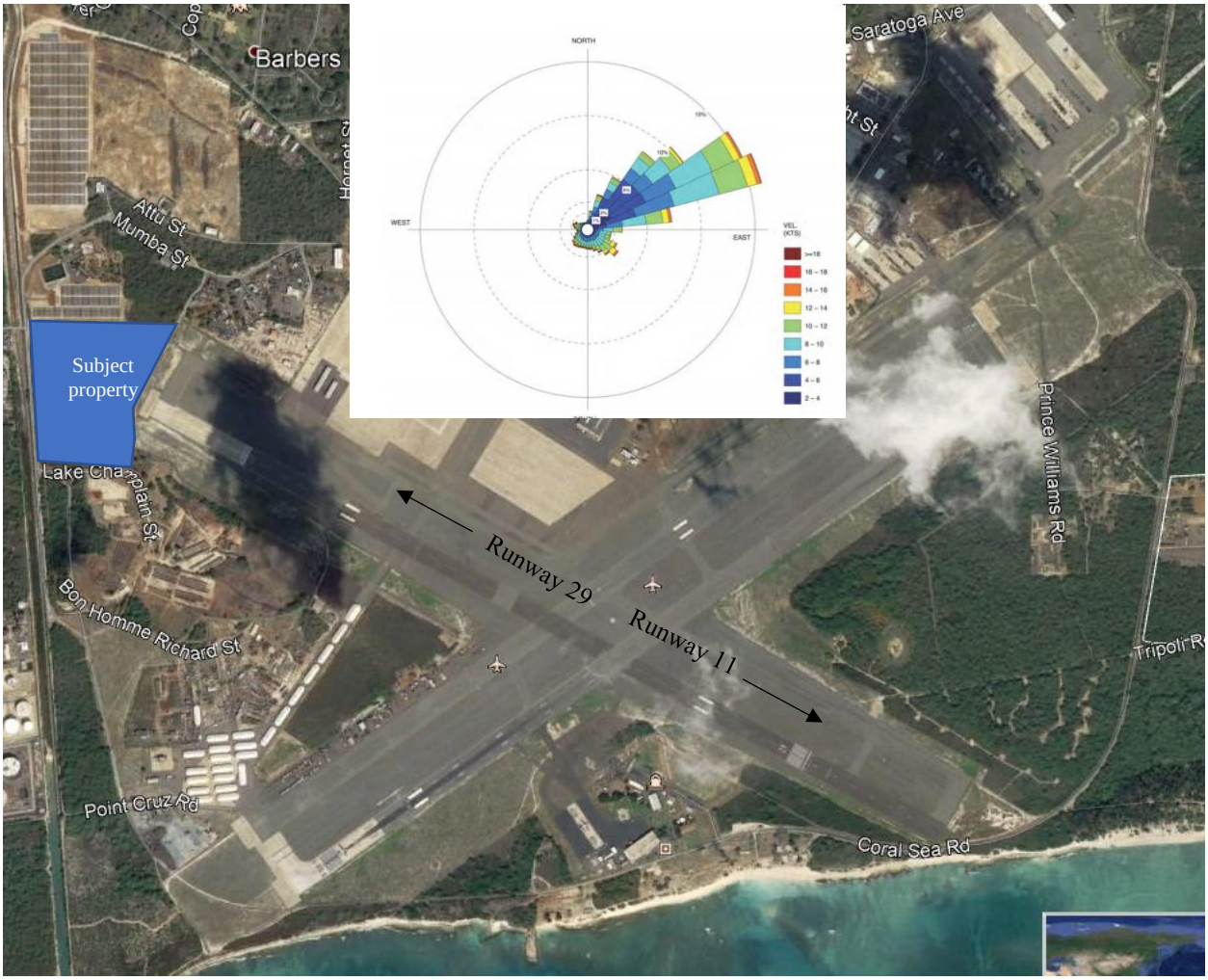


Figure 6: Conditions of use for Runway 11-29. The Kalaeloa Airport showing the runway orientation and a wind rose showing the frequency of winds from each direction. The wind rose rings represent 15% (outer), 10%, 5% and 1% (inner). Aircraft would be expected to take off from Runway 29 when wind is blowing from the west or northwest (less than 1%). Aircraft pass over the project site when landing on Runway 11 during periods when the wind blows from the southeast (3% of the time).

One concern expressed by pilots contacted during the Environmental Assessment was for the potential of glint and glare originating on the PV panel glass. The glint and glare study commissioned for this project showed that reflected light from the solar panels may be directed at aircraft using the crosswind runway during certain times of the year, and only when they are taking off or landing while facing directly into the sun. The study concluded that the additional glare added by solar panels would be insignificant in comparison to that reflected from the ocean and metal roofed-buildings in Campbell Industrial Park.

The pilots also expressed concern over the physical properties of the PV installation because of its location at the end of the runway. In the event of an emergency landing or aircraft running off the end of the runway PV panels would be a structure where now there is only Koa Haole and

low brush. The standard ground roll distance for a Cessna 152 is around 750 feet, while the PV site boundary is 1,200 feet from the end of the runway. The likelihood of an aircraft running that far off the end of the runway is slight, and the frequency of flights taking off on Runway 29 is ½ of 1%. Around 3% of flights are projected to land over the project site. Undershooting a landing by 1200 feet is quite a large error and would normally only be expected as a result of engine or other mechanical failure. The perimeter fence and panels themselves are not hard structures and may lessen the impact of an aircraft in comparison to hitting the ground. Both the fence and panels may act as arresting gear in the event of an emergency. In summary, the instances that bring aircraft over the subject property at the critical time during takeoff are extremely rare due to prevailing wind and airport circulations patterns, and in the event of an emergency, the proposed photovoltaic infrastructure provides a softer crumple zone than hitting bare ground.

Public outreach to pilots and other interested parties was conducted during preparation of the Environmental Assessment for this project.[3] The reaction of most private pilots was initially negative, but after presenting the issues and discussions following a meeting with approximately 10 pilots the General Aviation Council of Hawaii (GACH) concluded that the proposed action will not have an adverse impact on airport operations.

The FAA found that operation of the PV facility the proposed action would not have an adverse impact on aircraft operations[4]. The opinion cautioned that potential negative effect on airport operations may result if a drilling rig is required to install the posts on which panels are mounted, and the rig mast was higher than 20 feet. If a drilling rig or other equipment having a mast taller than 15 feet is used for installation of the PV panels, they will be mitigated by removing work crews and equipment during periods when the crosswind runway is needed.

Operation of a PV facility on the subject property would not be detrimental to the public health, safety, or welfare, or be materially injurious to persons, or airport operations. Construction of the proposed PV facility will be suspended during periods when the crosswind runway is in use in order to mitigate potential conflicts or distractions.

[3] http://oeqc2.doh.hawaii.gov/EA_EIS_Library/2012-09-08-OA-FEA-Kalaeloa-Home-Lands-5-MW-Solar-Photovoltaic-Park.pdf

[4] FAA permit # 404393474 form 75460-1 May 7, 2019

APPENDICES

APPENDIX A: FAA APPROVAL LETTER AND EXTENSION
APPENDIX B: GLINT AND GLARE STUDY
APPENDIX C: SHPD AUTHORIZATION

APPENDIX A: FAA APPROVAL LETTER AND EXTENSION

Mail Processing Center
Federal Aviation Administration
Southwest Regional Office
Obstruction Evaluation Group
10101 Hillwood Parkway
Fort Worth, TX 76177

Aeronautical Study No.
2019-AWP-2413-OE
Prior Study No.
2012-AWP-8129-OE

Issued Date: 10/14/2020

Ms Jody Allione
Kalaeloa Homelands Solar, LLC
Kailua Road
Kailua, HI 96734

**** Extension ****

A Determination was issued by the Federal Aviation Administration (FAA) concerning:

Structure:	Solar Panel Kalaeloa Home Lands Solar
Location:	Kalaeloa, HI
Latitude:	21-18-48.79N NAD 83
Longitude:	158-05-14.29W
Heights:	28 feet site elevation (SE)
	10 feet above ground level (AGL)
	38 feet above mean sea level (AMSL)

In response to your request for an extension of the effective period of the determination, the FAA has reviewed the aeronautical study in light of current aeronautical operations in the area of the structure and finds that no significant aeronautical changes have occurred which would alter the determination issued for this structure.

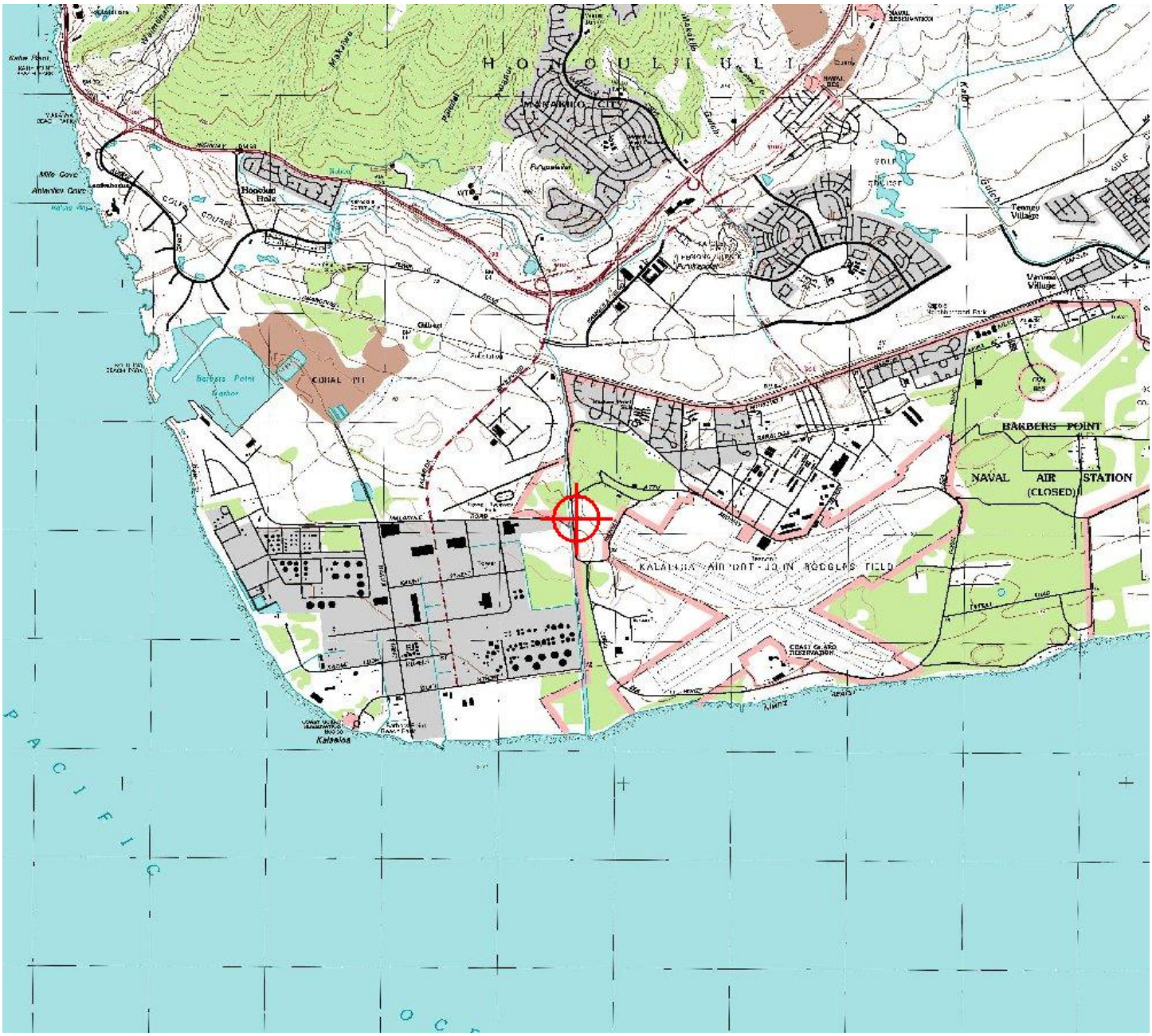
Accordingly, pursuant to the authority delegated to me, the effective period of the determination issued under the above cited aeronautical study number is hereby extended and will expire on 04/14/2022 unless otherwise extended, revised, or terminated by this office. You must adhere to all conditions identified in the original determination.

This extension issued in accordance with 49 U.S.C., Section 44718 and, if applicable, Title 14 of the Code of Federal Regulations, part 77, concerns the effect of the structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

If we can be of further assistance, please contact our office at (206) 231-2877, or Nicholas.Sanders@faa.gov. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2019-AWP-2413-OE.

Signature Control No: 399154643-453833922 (EXT)
Nicholas Sanders
Technician

TOPO Map for ASN 2019-AWP-2413-OE



Mail Processing Center
Federal Aviation Administration
Southwest Regional Office
Obstruction Evaluation Group
10101 Hillwood Parkway
Fort Worth, TX 76177

Aeronautical Study No.
2019-AWP-2413-OE
Prior Study No.
2012-AWP-8129-OE

Issued Date: 05/01/2019

Ms Jody Allione
Kalaeloa Homelands Solar, LLC
Kailua Road
Kailua, HI 96734

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has conducted an aeronautical study under the provisions of 49 U.S.C., Section 44718 and if applicable Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Solar Panel Kalaeloa Home Lands Solar
Location:	Kalaeloa, HI
Latitude:	21-18-48.79N NAD 83
Longitude:	158-05-14.29W
Heights:	28 feet site elevation (SE)
	10 feet above ground level (AGL)
	38 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

It is required that FAA Form 7460-2, Notice of Actual Construction or Alteration, be e-filed any time the project is abandoned or:

_____ At least 10 days prior to start of construction (7460-2, Part 1)
__X__ Within 5 days after the construction reaches its greatest height (7460-2, Part 2)

Based on this evaluation, marking and lighting are not necessary for aviation safety. However, if marking/ lighting are accomplished on a voluntary basis, we recommend it be installed in accordance with FAA Advisory circular 70/7460-1 L Change 2.

This determination expires on 11/01/2020 unless:

(a) the construction is started (not necessarily completed) and FAA Form 7460-2, Notice of Actual Construction or Alteration, is received by this office.
(b) extended, revised, or terminated by the issuing office.
(c) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE E-FILED AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE. AFTER RE-EVALUATION OF CURRENT OPERATIONS IN THE AREA OF THE STRUCTURE TO DETERMINE THAT NO SIGNIFICANT AERONAUTICAL CHANGES HAVE OCCURRED, YOUR DETERMINATION MAY BE ELIGIBLE FOR ONE EXTENSION OF THE EFFECTIVE PERIOD.

This determination is based, in part, on the foregoing description which includes specific coordinates, heights, frequency(ies) and power. Any changes in coordinates, heights, and frequencies or use of greater power, except those frequencies specified in the Colo Void Clause Coalition; Antenna System Co-Location; Voluntary Best Practices, effective 21 Nov 2007, will void this determination. Any future construction or alteration, including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.This determination includes all previously filed frequencies and power for this structure.

If construction or alteration is dismantled or destroyed, you must submit notice to the FAA within 5 days after the construction or alteration is dismantled or destroyed.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

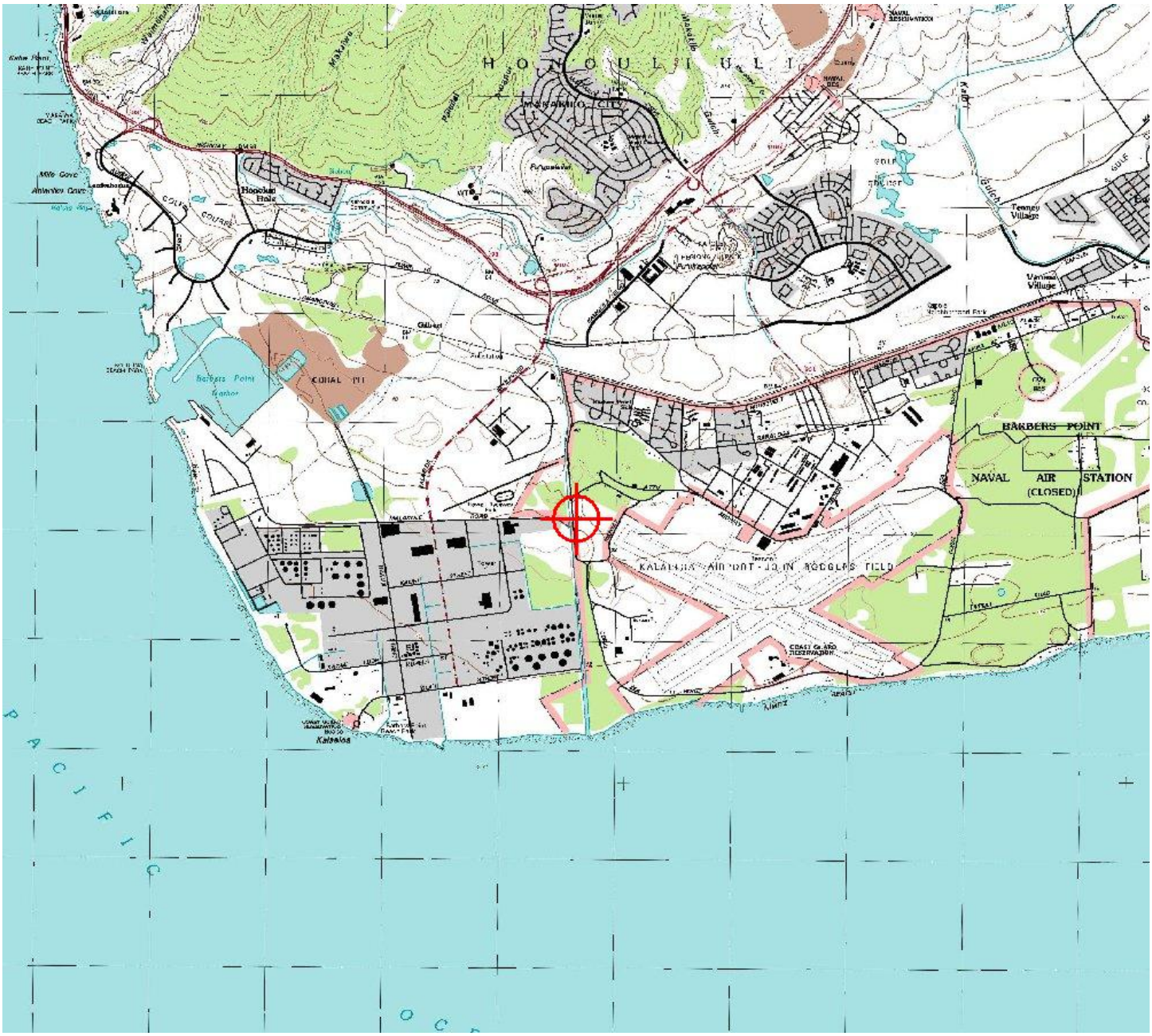
This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

If we can be of further assistance, please contact our office at (424) 405-7643, or karen.mcdonald@faa.gov. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2019-AWP-2413-OE.

Signature Control No: 399154643-404393474 (DNE)
Karen McDonald
Specialist

Attachment(s)
Map(s)

TOPO Map for ASN 2019-AWP-2413-OE



APPENDIX B: GLINT AND GLARE STUDY

KALAELOA – 4.25 MW PHOTOVOLTAIC POWER PLANT

REFLECTIVITY ANALYSIS

REVISION INDEX

Page/Reason	REV	Date	PROD	CHECK	APRV
All	0	10/11/2010	JDL	LOC	LTA
Updated with horizontal single axis trackers	1	05/02/2012	JDL	JDL	JDL

Contents

1 Introduction

This document analyzes the risk of sun reflectivity due to a future photovoltaic (PV) power plant being developed by AES Solar Power, LCC. Project location is nearby the Kalaeloa (John Rodgers Field) airport in Kapolei, Hawaii. Reflectivity events due to the presence of PV modules might affect airplane visibility while approaching the corresponding airport runways, if reflected sun light beam intersects the flight path.

Fig. 1 shows the location of the future PV plant relative to Kalaeloa airport:

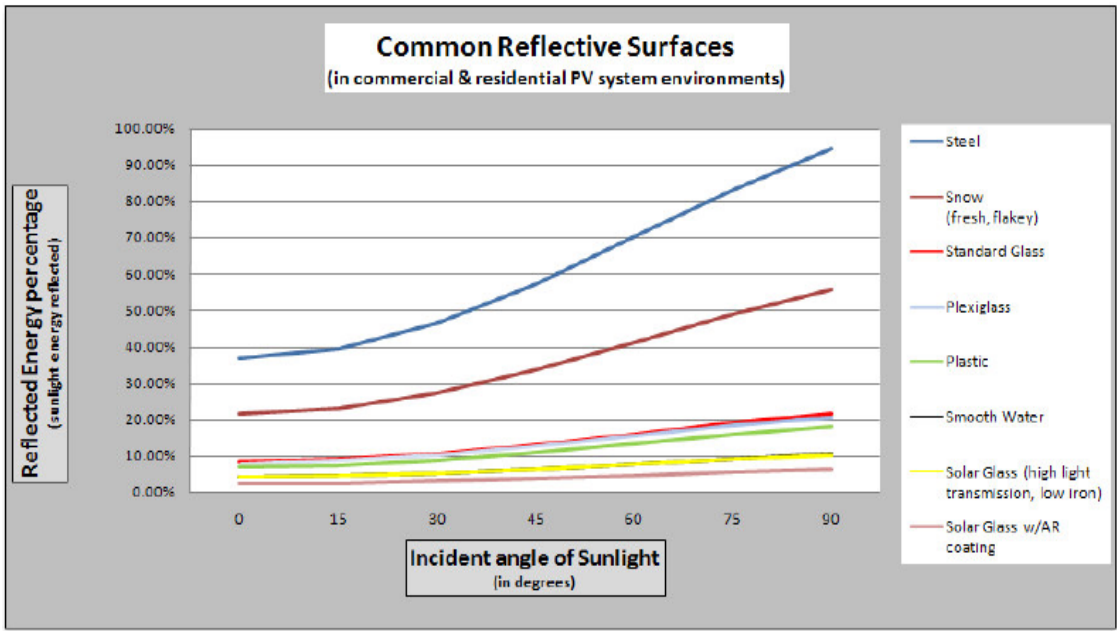
Fig 1.- Location of PV Project

To evaluate the risk of direct sun light reflection events a mathematical (geometric) model has been developed. The model predicts when in the year there is a possibility for approaching airplanes to suffer direct reflection.

2 Definitions

The following definitions and descriptions are key to understanding the methodology and results of the study:

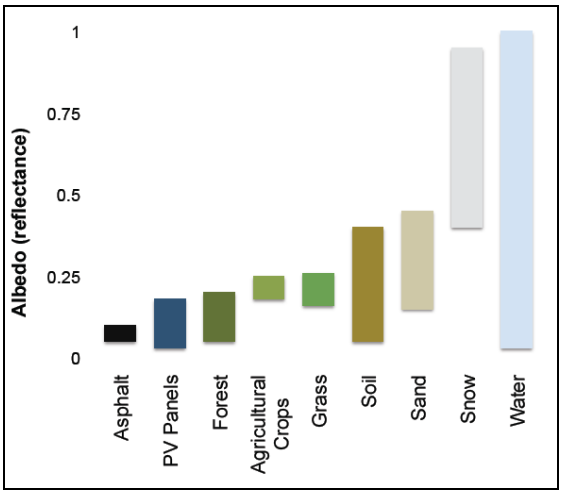
Photovoltaic Module – Photovoltaic panels, also known as PV modules. By nature, PV panels are designed to absorb as much of the solar spectrum as possible in order to convert sunlight to electricity. Reflectivity levels of solar panels are decisively lower than standard glass or galvanized steel, and should not pose a reflectance hazard to viewers. The next graph relates the reflectivity properties of solar modules in function of the incidence angle, and compares with other common reflecting surfaces in an airport environment:



Reflected light from PV modules' surface is just between 10% - 20% of the incident radiation, as low as water surfaces, while galvanized steel (used in industrial roofs) is between 40% and 90%. It should also be noted that high incidence angles are always related to low sun elevation angles (i.e, the sun beams are close to be tangent to the reflecting surface) and, in this case, the intensity of incident light is much lower than -say- noon time.

Glint – Also known as a specular reflection, produced by direct reflection of the sun in the surface of the PV solar panel. This is the potential source of the visual issues regarding viewer distraction.

Glare – A continuous source of brightness, relative to diffused light. This is not a direct reflection of the sun, but rather a reflection of the bright sky around the sun. Technically this is described as the reflection of the circumsolar diffuse component. Glare is significantly less intense than glint and have negligible effects. As Glare is the reflection of diffuse irradiance is not directional. Other glare sources in the nature (often called Albedo reflectance) are much more intense that glare from PV modules, as sown in graph below. It can be seen that even agricultural environment has higher Glare effect than PV modules.



Key View Point (KVP) – KVPs are viewpoints used in the glint and glare study, and serve as the offsite viewpoint locations for photo simulations. In this analysis, KVP can be any point in the most probable airplane approaching path to the airport runways.

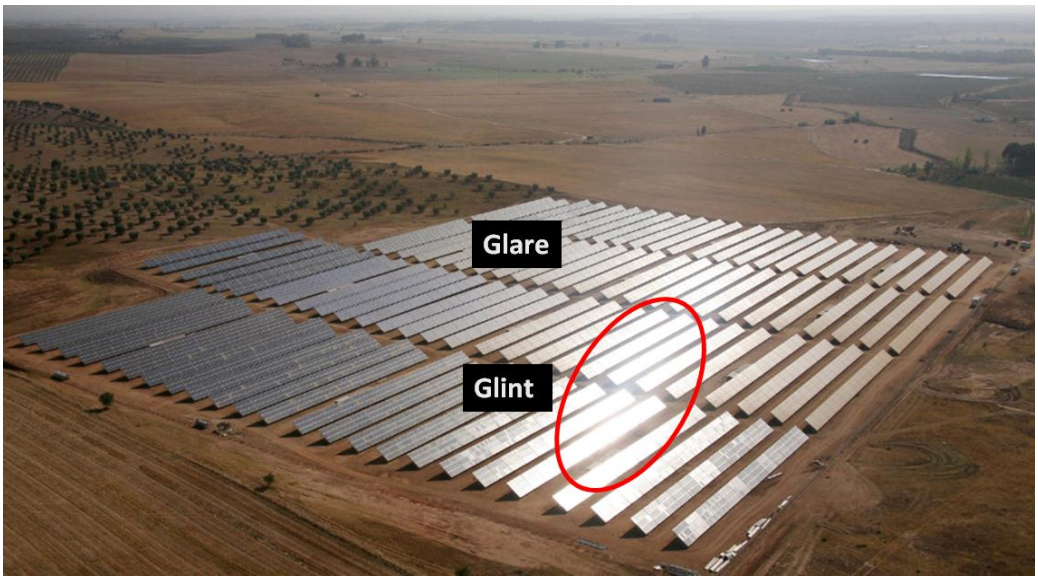


Fig 2 .- Glint and Glare

3 Mathematical analysis

3.1 Reference coordinate system

Solar reflection from flat surfaces is a mathematical problem that can be solved by means of 3D geometry concepts. In order to properly relate sun position, PV modules position and orientation, and KVP location; is necessary to define a global coordinate system to which the previous position and orientation will be referred to.

In this analysis, the 3D Cartesian coordinate system is defined as follows:

Positive X-Axis	Pointing South
Positive Y-Axis	Pointing East
Positive Z-Axis	Pointing upwards

Origin of the coordinate system is chosen at the future PV plant location, as shown in Fig. 3 below:

Fig 3 .- Reference coordinate system

3.2 Sun position

Instantaneous sun position is defined by two angular (spherical) coordinates. These angles are Azimuth (φ) and Elevation (θ). Azimuth is the deviation of sun's horizontal projection from South, while elevation is the angle between the horizontal plane and sun's position. The following graphs illustrates above definitions, and criteria for positive values:

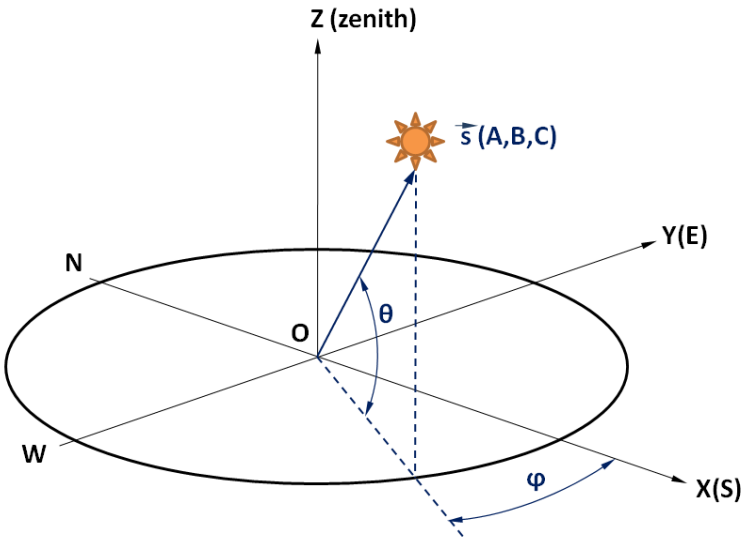


Fig 4.- Sun position coordinates

Sun position can be also defined by a unit-length pointing vector s = (A, B, C). Cartesian coordinates of the sun position vector are written in terms of the azimuth and elevation angles as follows:

$$A = \cos\theta \ \cos\varphi$$
$$B = -\cos\theta \ \sin\varphi$$
$$C = \sin\theta$$

Azimuth and elevation angular coordinates (φ, θ) are both function of:

- Earth latitude (L) at the origin
- Day of the year (i) and hour of the day (H)

and can be calculated as per the following equations:

Earth declination:

$$D = 23.45 \ \sin(0.986[284 + i])$$

Azimuth and elevation angles:

$$\sin\theta = \sin D \sin L + \cos D \cos L \cos H$$
$$\cos\varphi = \frac{\sin D \cos L - \cos D \sin L \cos H}{\cos\theta}$$

In the above expressions the day of the year (i) is following a Julian day convention (January, 1st is i=1; February, 1st is i = 32,… until i =365). The hour of the day (H) is referred to noon time (12:00 is H = 0; 10:00 is H = -2; 14:00 is H = +2; … etc).

As an example, the calculated values for azimuth and elevation angles for the equinox (March, 21st, i = 80) are plotted in function of the hour of the day in the next graph:

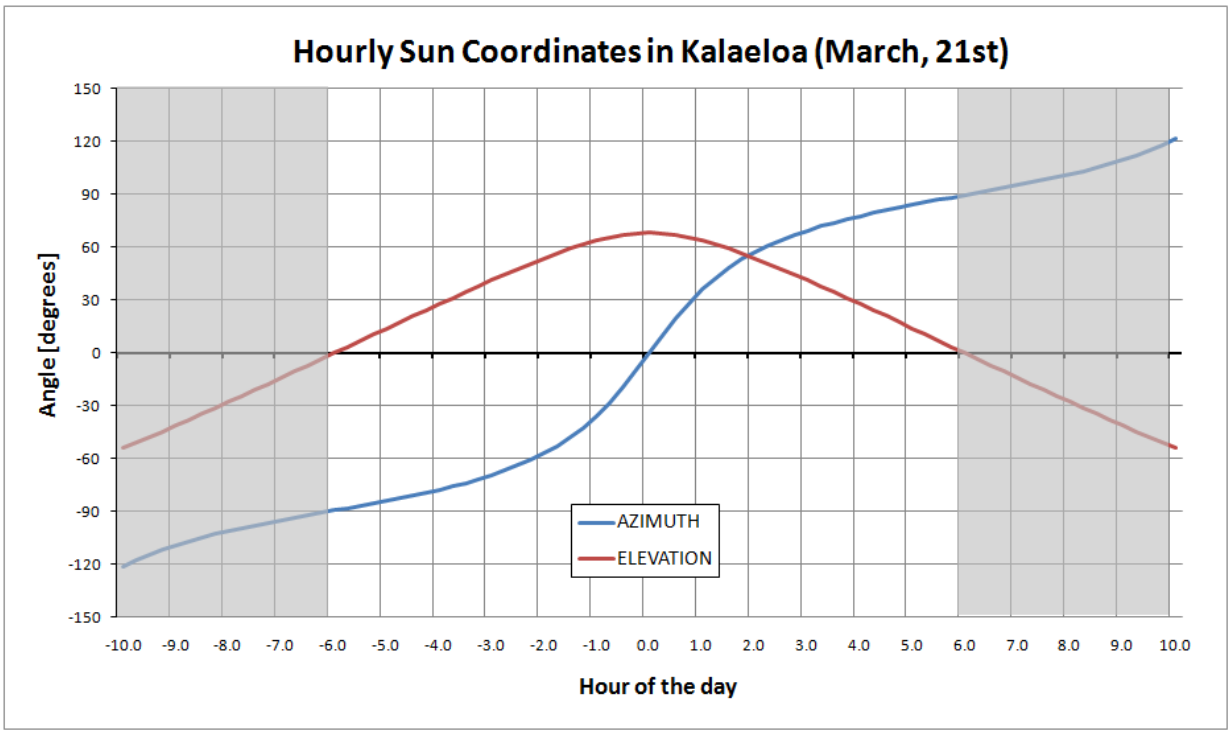


Fig 5.- Sun position coordinates

Negative values of the elevation angle means night time (the sun is below the horizon). In the above example the daylight period is 12 hours and the azimuth at sunrise is -90° (pure East), as expected for the equinox. Maximum elevation angle (at noon) is 68.24° for this latitude and particular day.

For the purpose of geometric calculations later in this report, the relevant results are the Cartesian coordinates of the sun position vector (A, B, C). For the sample day above, these are plotted in Fig. 6:

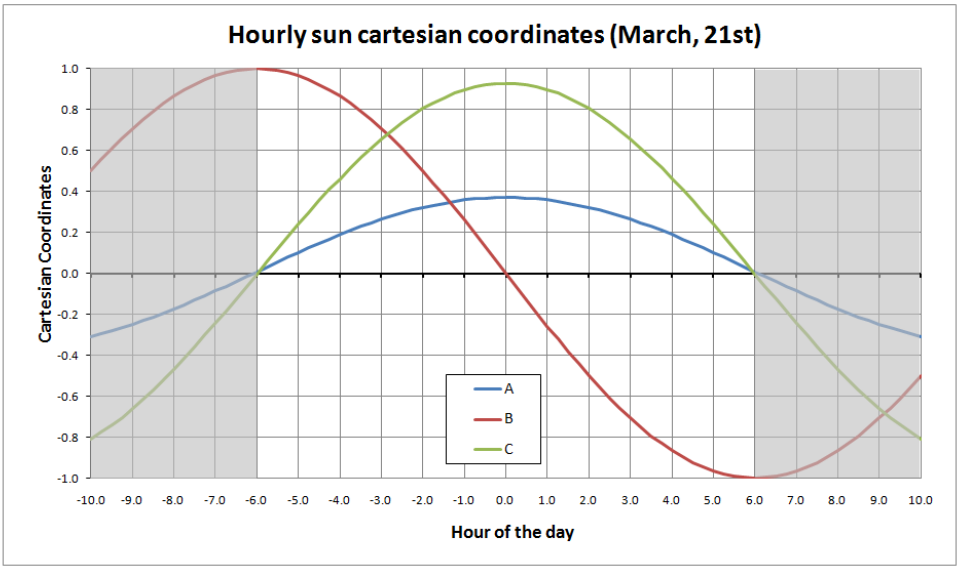
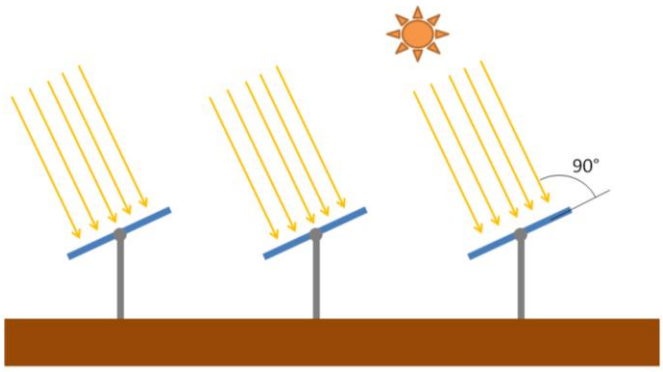


Fig 6.- Sun position Cartesian coordinates

3.3 PV modules and reflection equations with trackers

PV modules are considered reflecting planes located at the origin of the coordinate system (O). A plane is geometrically defined by its perpendicular (normal) unit vector [n]. Notation for Cartesian coordinates of this fixed vector is n = (Ap, Bp, Cp).

From the PV plant design, the PV modules are mounted on horizontal single axis trackers. Tracker systems are mechanical devices that continuously change the PV modules orientation with sun position, so to obtain the maximum irradiance at any time during the day. In particular, the horizontal axis trackers are oriented in North-South direction, so the modules attached to the horizontal rotating axis are inclined towards East during sunrise and are rotated towards West as the earth rotates.



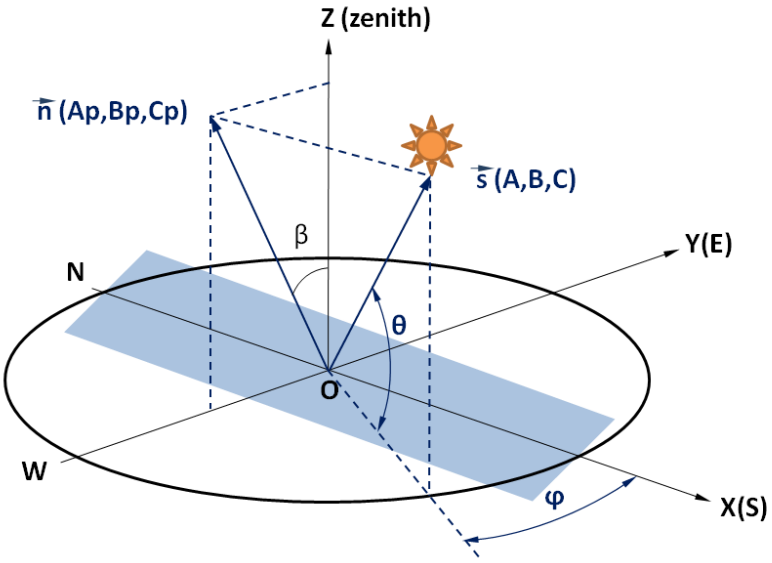


Fig 17.- Normal vector to PV modules in an horizontal axis tracker

Given the instantaneous rotation of the tracker as an angle (β), the normal vector n=(Ap, Bp, Cp) perpendicular to the plane of the modules is

$$A_p = 0$$
$$B_p = -\sin\beta$$
$$C_p = \cos\beta$$

The objective is to track for the minimum incidence angle (γ). This will occur also if the cosine of the incidence angle (γ) is a maximum:

$$\cos\gamma = \vec{s}\ \vec{n} = A\,A_p + B\,B_p + C\,C_p$$

this can be written as

$$\cos\gamma = -B\sin\beta + C\cos\beta$$

The minimum incidence angle occurs when

$$\frac{d\,(\cos\gamma)}{d\beta} = -B\cos\beta - C\sin\beta = 0 \qquad \tan\beta = -\frac{B}{C}$$

Which describes the rotation angle of the tracker in function of sun position, and hence the coordinates for the vector perpendicular to the plane of the PV modules.

Backtracking

At low sun elevation angles (i.e., sunrise and sunset), the trackers would be fully deployed and mutual shading between successive rows of modules will occur. To avoid this situation, the tracking control system has the so called backtracking algorithm, which defines the tracker rotation angle so to avoid this mutual shading. When the backtracking is active, the tracker will not rotate to follow the sun path, but to avoid mutual shading between rows. This occurs every day early in the morning and late in the evening, and depends on the PV plant geometry, day of the year, and latitude.

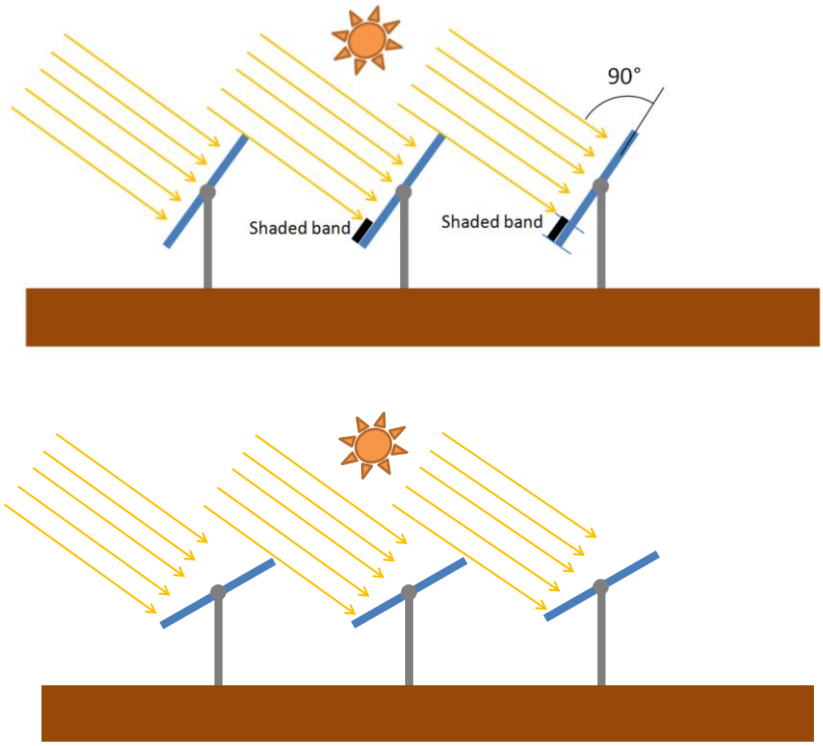


Fig 18.- Above: Mutual shading without backtracking.
Below: Backtrackin corrected incidence angle to avoid mutual shading

The tracker angle when the backtracking is active is given by the following equation:

$$\tan\theta = \frac{L\,sin\beta}{p - Lcos\beta}$$

Where [L] is the length of the modules (9.89 ft) and [p] is the pitch between tracker rows (20 ft). Maximum tracker angle is ±45° for mechanical and constructive reasons.

Fig. 19 shows the tracker angle, together with sun elevation angle for a sample day (March, 21st).

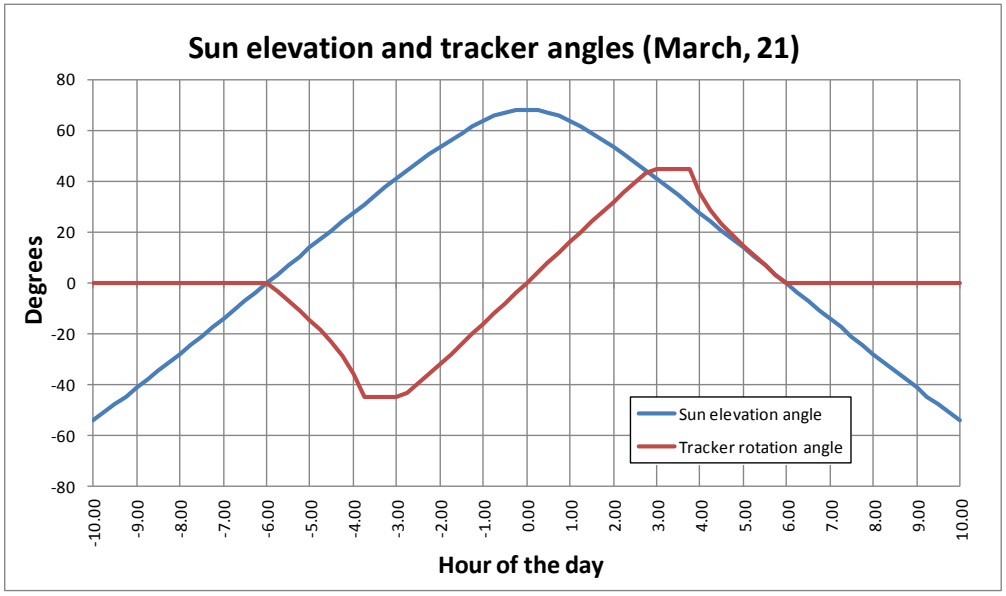


Fig 19.- Tracker angle on a sample day

Equations for the reflected beam

Reflection of sun beams by a given surface can be calculated once the direction of the incident beam and plane orientation is known.

Instantaneous solar beam direction vector s = (A, B, C) and reflecting plane normal vector n = (Ap, Bp, Cp) intersects at the origin, and both defines a new plane in the space. From reflectivity laws, the reflected beam vector r = (Ar, Br, Cr) will be contained in this plane and symmetric to the incident beam with respect to the reflecting surface vector, as shown in the next figure:

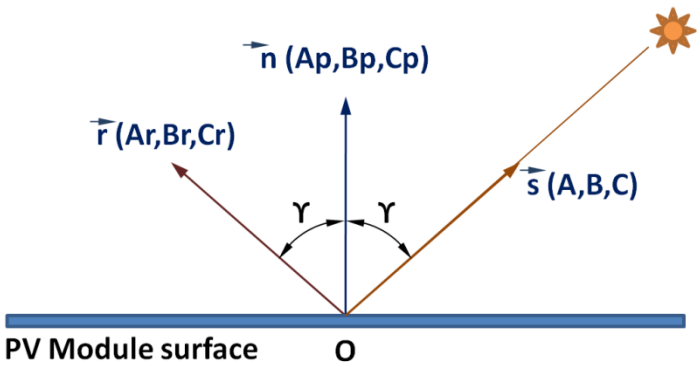


Fig 8.- Reflecting surfaces – Notation for reflected beam vector

A relevant variable in this figure is the incidence angle [Y], which measures the angle between the incident sun beam vector and the surface normal. No reflection can occur when the incidence angle is equal or larger than 90°. This situation will occur whenever the sun is behind the PV modules surface. The incidence angle can be calculated as per the dot product of unit vectors [s] and [n]:

$$\cos\gamma = \vec{s}\ \vec{n} = A\ A_p + B\ B_p + C\ C_p$$

The symmetric-reflected vector [r] is calculated as

$$\vec{r} = 2\ \cos\gamma\ \vec{n} - \vec{s}$$

and its Cartesian coordinates given by:

$$A_r = 2\ \cos\gamma\ A_p - A$$
$$B_r = 2\ \cos\gamma\ B_p - B$$
$$C_r = 2\ \cos\gamma\ C_p - C$$

For example, for the equinox day chosen the results for (Ar, Br, Cr) are plotted below in function of the hour of the day. Incidence angle cosine also included.

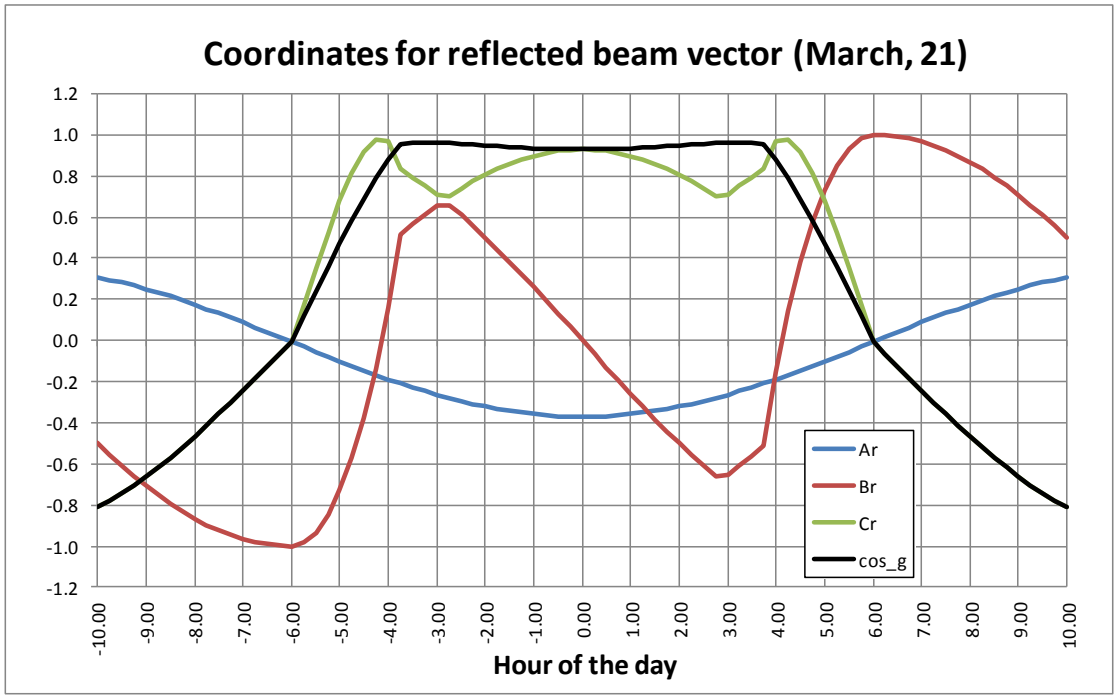


Fig 20.- Cartesian coordinates for reflected beam in a sample day. Incidence angle is very low, thus optimizing irradiance on PV modules with trackers.

3.4 Approaching flight plane and reflectivity at Runways 04R & 22L

To define the location of relevant KVP it is hereby assumed that the approaching airplane follows a straight line contained in a vertical plane (the "flight plane") that also contains the runway axis (Fig. 10).

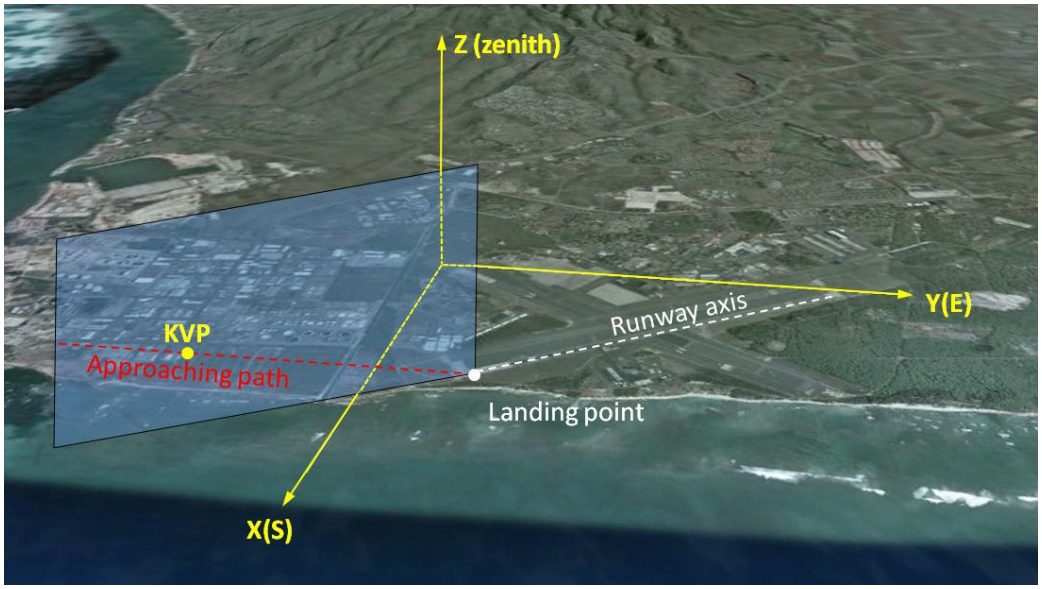
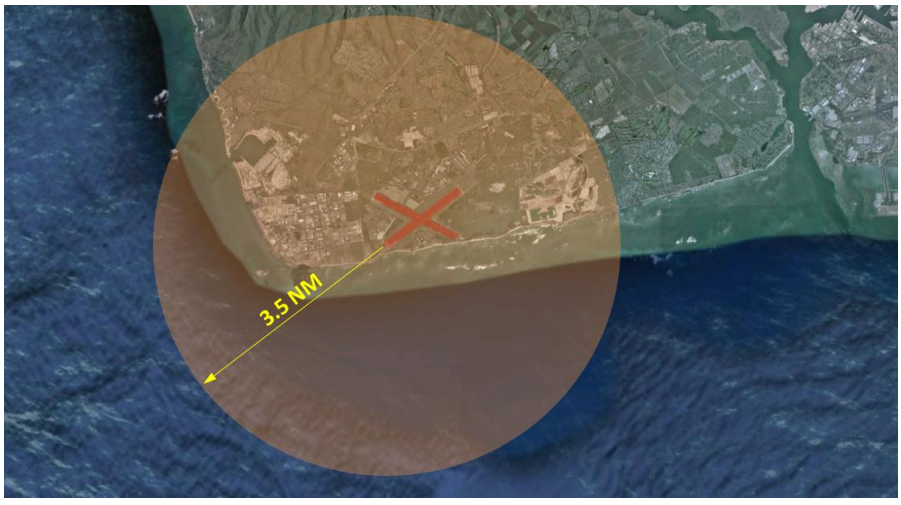


Fig 10.- Geometry of approaching path

The above assumption is valid whenever the airplane aligns the runway and faces the landing point, at the limit of the corresponding runway, which is the normal procedure for distances lower than 3.5 NM from the airport. It is considered that, at larger distances, reflection from the PV plant will not have any impact on visibility.



The vertical flight plane, containing the approaching path, is defined by the following equation in the reference Cartesian axis system:

$$\Pi \equiv 0.81915\ x + 0.5736\ y - 4874 = 0$$

Where 4,874 ft is the distance from the origin (O) to the landing point (Q).

A reflected solar beam will intersect the above flight plane in a given point P_i, with coordinates relative to the reference systems being $P_i = (x_i, y_i, z_i)$. As the sun moves along its daily path and trackers rotate, the intersection point P_i will define a given trajectory curve in the flight plane.

Whenever the curve drawn by successive P_i intersects the landing path of the airplane, at point T_i, there is a risk of glint (Fig. 11).

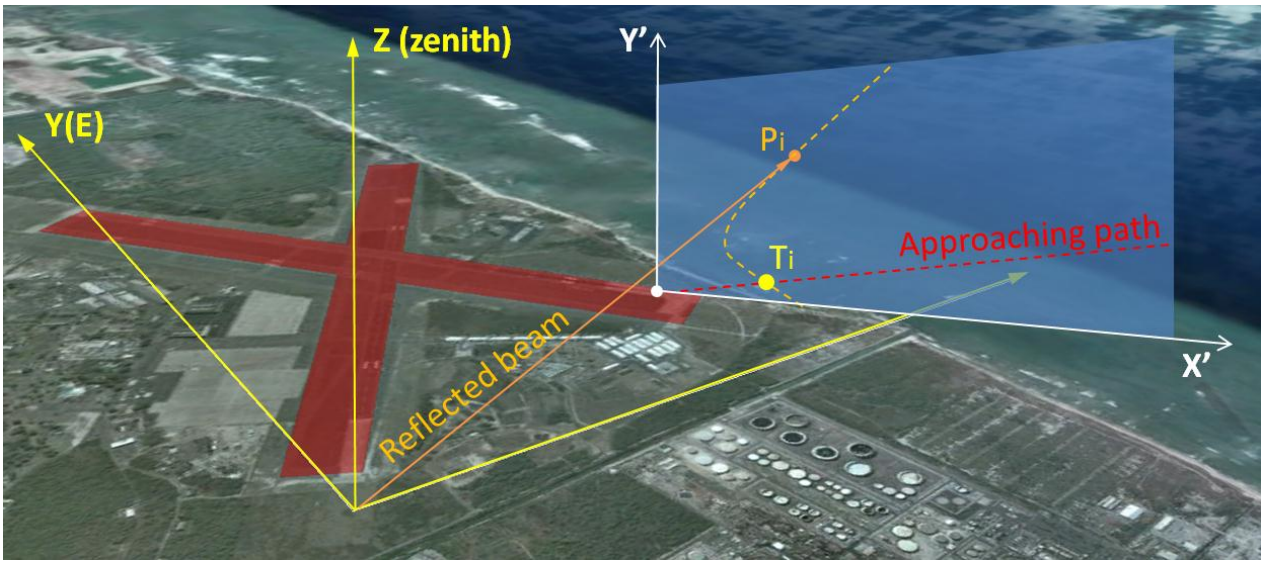


Fig 11.- Intersection of reflected beam with the flight plane(Runway 04R)

To calculate the position of the Ti points along the year, the following procedure applies:

Vector OP_i is an extension of the reflected beam unit vector r = (Ar, Br, Cr), so vector OP_i can be written as

$$\overrightarrow{OP_t} = t\ \vec{r}$$

where the proportionality factor [t] is given by the flight plane equation parameters as

$$t = \frac{-4{,}874}{0.81915\ A_r + 0.5736\ B_r}$$

When calculating the intersection point coordinates (P_i), it is convenient to express them relative to a new coordinate system. The new coordinate system (X' , Y') contains the flight plane and the origin is located at the landing point, as shown in Fig. 11 above.

Position of point P_i referred to the new origin can be obtained with vector [L]:

$$\vec{L} = \overrightarrow{OP_i} - \overrightarrow{R_0}$$

Being vector [Ro] the position of the landing point in the original Cartesian coordinates:

$$R_{o,x} = 3{,}876\ ft \qquad R_{o,y} = 3{,}022\ ft \qquad R_{0,z} = 0$$

then

$$L_x = t\ A_r - 3{,}876\ ft \qquad L_y = t\ B_r - 3{,}022\ ft \qquad L_z = t\ C_r$$

Finally, the coordinates of the intersection point in the flight plane reference axis P_i = ($L_{x'}$, $L_{y'}$) are given by:

$$L_{x'} = \sqrt{L_x^2 + L_y^2} \qquad\qquad L_{y'} = L_z$$

Fig. 12 below shows the curve drawn by successive intersection points P_i in the flight plane for several distributed days along the year, together with the approaching landing cones by South (Runway 04R) and North (Runway 22L).

It can be seen that there is not interference with flight plane before day 75 (and symmetrically after day 290). For the rest of the days, there are two curves per day representing morning and everning interferences respectively. Interferences during morning hours occur always at altitudes over 6,000 ft, therefore there is not glint risk for airplanes approaching the airfield. The path curve of interferences during evenings might intersect the landing or takingoff cones at very late hours. This is cosistent with the fact that the trackers will go back to the horizontal position at dusk, so reflection beams will be nearly horizontal and aligned with the sun disk.

In all cases for evening interferences, the reflected beam will intersect the flight plane at some point over the runways, so risk of glint might happen when the airplane is taking-off or already landed from East to West. However, it shall be noted that the pilots will in all cases be facing the sun's disk directly. Clearly, bedazzle effect of direct exposure to sun's disk is much higher than any eventual glint from the PV modules. Also reflection form the ocean shall be considered, being this is much more noticeable than glint from the future PV plant.

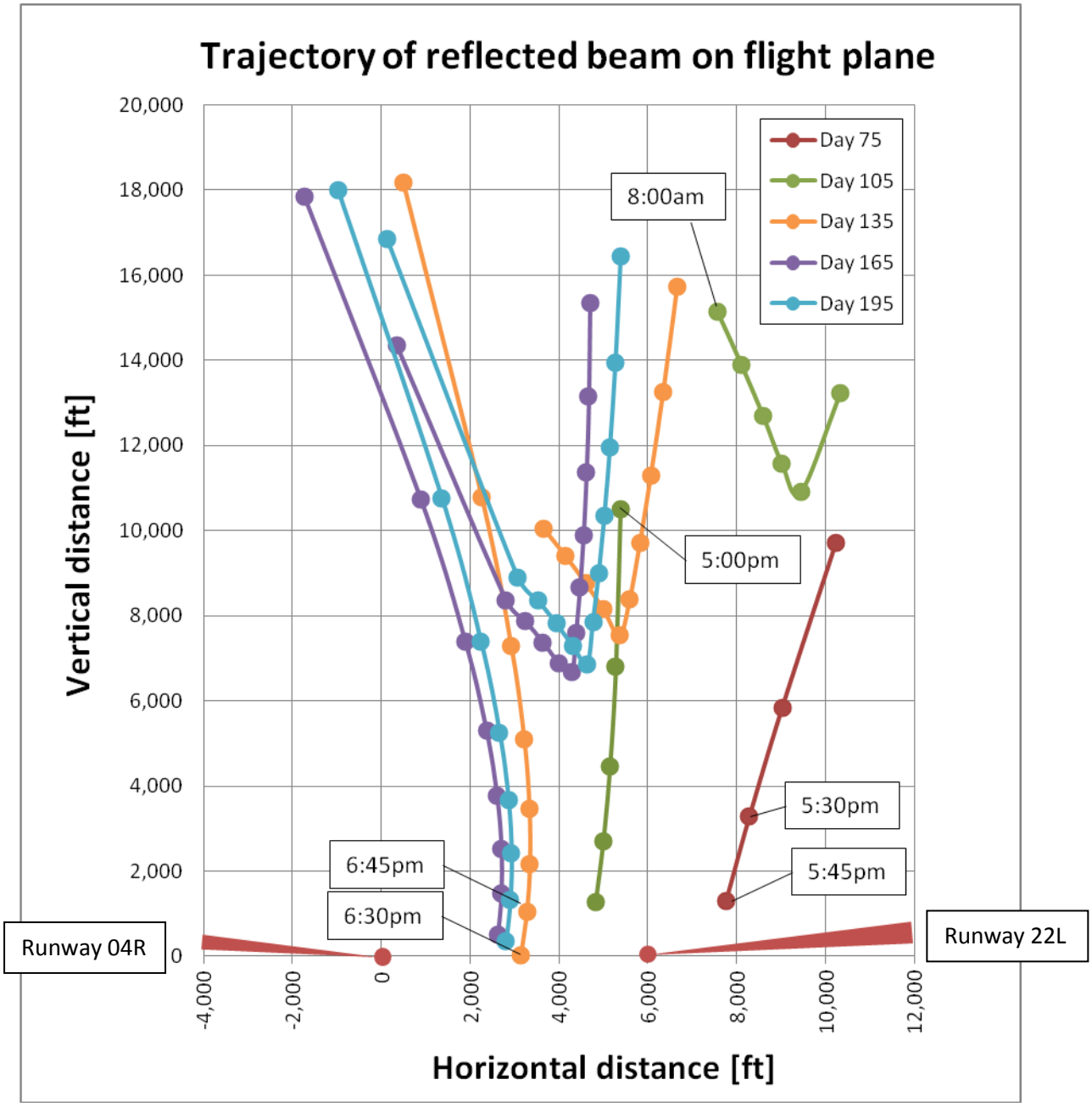


Fig 13.- Intersection of reflected beam with the flight plane at runways 22L & 22R

For example, in April 21st the following will be the projected angles at sunset (ground level):

It can be concluded that the effect of glint from the proposed PV plant at runway 22 –whenever it might occur- is negligible when compared to the effect of direct light from the sun and the sun's reflection on the sea. Also reflected beam is not aligned with the Runway, so the pilots shall turn their view to right nearly 45° to see the PV modules and hence facing directly the sun's disk.

3.5 Reflectivity at Runways 11 and 29

The flight plane for runways 11 & 20 contains the PV plant, so the analysis is more straightforward than the previous case. Every day a reflected beam vector would be contained in the flight plane, but relevant glint might only occur if the elevation angle of the reflected beam is coincident with the flight approaching angle.

Runway 11 azimut is -62.0°. Cartesian coordinates for any reflected beam r = (Ar, Br, Cr), if contained in the flight plane, shall satisfy the following condition (beam azimuth):

$$\frac{B_r}{A_r} = \tan 62° = 1.8807$$

The angle between the horizontal plane and the reflected vector (reflection elevation angle) is given by

$$\tan \theta_r = \frac{C_r}{\sqrt{A_r^2 + B_r^2}}$$

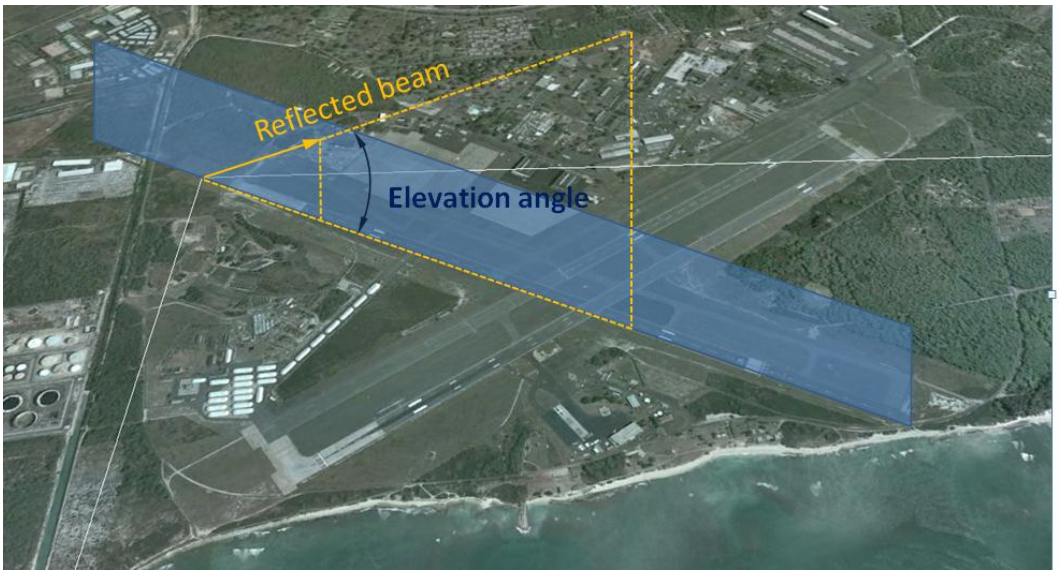


Fig 15.- Reflected beam elevation angle for Runway 29

The next table shows computed results for a complete year, when the azimuth of the reflected beam is ±5° aligned with the runway, and the elevation angle is between 0° and 10°:

day	hour	Azimuth Reflected Beam	Elevation Reflected Beam	Sun azimuth	Sun elevation
1	6.75	64.49	4.13	-64.55	1.44
2	6.75	64.56	4.17	-64.63	1.47
3	6.75	64.64	4.31	-64.71	1.51
4	6.75	64.72	4.45	-64.79	1.55
5	6.75	64.81	4.60	-64.88	1.59
6	6.75	64.91	4.64	-64.98	1.63
7	6.75	65.00	4.79	-65.09	1.68
8	6.75	65.11	4.95	-65.20	1.73
9	6.75	65.22	5.11	-65.31	1.78
10	6.75	65.34	5.27	-65.44	1.83
11	6.75	65.46	5.44	-65.56	1.89
12	6.75	65.59	5.60	-65.70	1.95
13	6.75	65.72	5.77	-65.84	2.01
14	6.75	65.86	5.95	-65.99	2.08
15	6.75	66.01	6.12	-66.14	2.14
16	6.75	66.16	6.41	-66.30	2.21
17	6.75	66.31	6.59	-66.46	2.29

18	6.75	66.48	6.77	-66.63	2.36
19	6.75	66.64	7.07	-66.80	2.44
20	6.75	66.81	7.26	-66.98	2.52
21	6.75	66.99	7.45	-67.17	2.60
151	18.50	66.92	3.72	113.03	1.29
152	18.50	66.78	3.88	113.17	1.35
153	18.50	66.66	4.03	113.29	1.40
154	18.50	66.53	4.18	113.41	1.45
155	18.50	66.41	4.33	113.52	1.50
156	18.50	66.30	4.48	113.63	1.54
157	18.50	66.20	4.52	113.73	1.58
158	18.50	66.10	4.66	113.83	1.62
159	18.50	66.01	4.80	113.91	1.66
160	18.50	65.92	4.83	114.00	1.69
161	18.50	65.84	4.97	114.07	1.72
162	18.50	65.77	4.99	114.14	1.75
163	18.50	65.70	5.12	114.20	1.78
164	18.50	65.65	5.14	114.26	1.80
165	18.50	65.59	5.27	114.31	1.82
166	18.50	65.55	5.28	114.36	1.84
167	18.50	65.51	5.30	114.39	1.86
168	18.50	65.48	5.31	114.42	1.87
169	18.50	65.45	5.42	114.45	1.88
170	18.50	65.43	5.43	114.47	1.89
171	18.50	65.42	5.44	114.48	1.89
172	18.50	65.41	5.44	114.49	1.90
173	18.50	65.41	5.44	114.49	1.90
174	18.50	65.42	5.44	114.48	1.89
175	18.50	65.43	5.43	114.46	1.89
176	18.50	65.45	5.42	114.44	1.88
177	18.50	65.48	5.31	114.42	1.87
178	18.50	65.52	5.30	114.39	1.85
179	18.50	65.56	5.28	114.35	1.84
180	18.50	65.60	5.26	114.30	1.82
181	18.50	65.66	5.14	114.25	1.80
182	18.50	65.72	5.12	114.19	1.77
183	18.50	65.79	4.99	114.13	1.75
184	18.50	65.86	4.96	114.06	1.72
185	18.50	65.94	4.82	113.98	1.69

186	18.50	66.03	4.79	113.89	1.65
187	18.50	66.12	4.65	113.81	1.61
188	18.50	66.22	4.51	113.71	1.57
189	18.50	66.33	4.47	113.61	1.53
190	18.50	66.44	4.32	113.50	1.49
191	18.50	66.56	4.17	113.38	1.44
192	18.50	66.68	4.02	113.26	1.39
193	18.50	66.81	3.87	113.14	1.34
194	18.50	66.95	3.71	113.00	1.28
324	6.75	66.95	7.43	-67.13	2.58
325	6.75	66.77	7.24	-66.94	2.50
326	6.75	66.60	6.94	-66.76	2.42
327	6.75	66.44	6.76	-66.59	2.34
328	6.75	66.28	6.57	-66.42	2.27
329	6.75	66.13	6.29	-66.26	2.20
330	6.75	65.98	6.11	-66.10	2.13
331	6.75	65.83	5.93	-65.95	2.06
332	6.75	65.69	5.76	-65.81	2.00
333	6.75	65.56	5.59	-65.67	1.94
334	6.75	65.43	5.42	-65.54	1.88
335	6.75	65.31	5.26	-65.41	1.82
336	6.75	65.20	5.10	-65.29	1.77
337	6.75	65.09	4.94	-65.17	1.72
338	6.75	64.98	4.78	-65.06	1.67
339	6.75	64.88	4.63	-64.96	1.62
340	6.75	64.79	4.48	-64.86	1.58
341	6.75	64.70	4.44	-64.77	1.54
342	6.75	64.62	4.30	-64.69	1.50
343	6.75	64.55	4.16	-64.61	1.47
344	6.75	64.47	4.12	-64.54	1.43
345	6.75	64.41	3.99	-64.47	1.41
346	6.75	64.35	3.96	-64.41	1.38
347	6.75	64.30	3.83	-64.36	1.36
348	6.75	64.26	3.81	-64.31	1.33
349	6.75	64.22	3.79	-64.27	1.32
350	6.75	64.19	3.67	-64.24	1.30
351	6.75	64.16	3.66	-64.21	1.29
352	6.75	64.14	3.65	-64.19	1.28
353	6.75	64.12	3.64	-64.17	1.27

354	6.75	64.11	3.64	-64.16	1.27
355	6.75	64.11	3.64	-64.16	1.27
356	6.75	64.11	3.64	-64.16	1.27
357	6.75	64.12	3.64	-64.17	1.27
358	6.75	64.14	3.65	-64.19	1.28
359	6.75	64.16	3.66	-64.21	1.29
360	6.75	64.19	3.68	-64.24	1.30
361	6.75	64.22	3.79	-64.27	1.32
362	6.75	64.26	3.81	-64.32	1.34
363	6.75	64.31	3.84	-64.36	1.36
364	6.75	64.36	3.96	-64.42	1.38
365	6.75	64.42	3.99	-64.48	1.41

It can be seen that every day from days 151 to 194 (May and June) the reflected beam will be sometime contained in the flight plane at sunset, and from days 324 to 21 (October to January) at sunrise. In all cases the sun azimuth angle is nearly aligned with the runway, and the sun elevation angle is very low (below 2.6 degrees over the horizon). Therefore, planes approaching or taking-off from this runway will always be facing directly the sun disk during such events.

4 Conclusion

This report analyzes the risk of glint and glare for approaching airplanes eventually caused by a photovoltaic power plant located close to the Kalaeloa airport.

To analyze the possibility of glint events, a mathematical model has been developed. The model implements the reflection laws from corresponding moving surfaces and solar trajectories for a full year in 15-minutes periods. Interference between the reflected beams and the airplane trajectories are then calculated for both runways in Kalaeloa.

It has been demonstrated that, in the few cases when there is some risk of glint by PV modules, the airplane will also be directly facing the sun and the corresponding reflections from the ocean. It can be concluded that glint from PV modules will not have any relevant effect on airplanes' visibility, nor deteriorate the actual approaching or taking-off flight conditions.

APPENDIX C:
AUTHORIZATION FROM THE STATE HISTORIC PRESERVATION DIVISION

DAVID Y. IGE
GOVERNOR OF
HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
FIRST DEPUTY

M. KALEO MANUEL
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD., STE 555
KAPOLEI, HI 96707

May 14, 2020

IN REPLY REFER TO:
Log No. 2020.00654
Doc. No. 2005SL02
Archaeology

Aedward Los Banos, Executive Director
Hawaii Community Development Authority
547 Queen Street
Honolulu, Hawaii 96817

Dear Mr. Los Banos:

SUBJECT: **Chapter 6E-42 Historic Preservation Review –**
Kalaeloa Home Lands Solar Project
Request for Concurrence with Effect Determination of "No Historic Properties Affected"
Honouliuli Ahupua'a, 'Ewa District, Island of O'ahu
TMK: (1) 9-1-013:029

This letter provides the State Historic Preservation Division's (SHPD's) review of the subject project proposed by Arion Energy, LLC dba Kalaeloa Home Lands Solar, LLC (KHLS), an assignee under the Department of Hawaiian Home Lands' (DHHL's) General Lease No. 294, originally issued in October 2011, covering 29.853 acres. KHLS plans to construct and operate a solar photovoltaic farm on the subject property identified as TMK: (1) 9-1-013:029.

This proposed project is subject to HRS 6E-42 historic preservation review and its implementing regulations. Per HAR §13-284-1, the agency approving or issuing a permit, license, certificate, land use change, subdivision, or other entitlements to use, must afford the SHPD an opportunity to comment on any such approval or permit. Two agencies are identified in the project submittal, the DHHL and the Hawaii Community Development Authority (HCDA).

SHPD received KHLS' original project submittal on May 20, 2019 (SHPD Log No. 2019.01154). This submittal included a SHPD HRS 6E Submittal Form, a SHPD HRS 6E Submittal Fee Form, an archaeological field inspection report prepared by ASM Affiliates, a permit set, and an unsigned and undated HDCA form titled, *Project Authorization, Kalaeloa Community Development District*. The form identified the KHLS as the applicant and indicated the project area is a vacant lot.

The ASM Affiliates report (Gotay and Rechtman, February 28, 2019) is titled, *Archaeological Field Inspection of TMK: (1) 9-1-013:029, Honouliuli Ahupua'a, 'Ewa, Island of O'ahu.* It was prepared in support of HAR §13-284-3, requiring an agency (1) to determine if historic properties are present in the project area and, if so, to identify and document (inventory) them, (2) to evaluate their significance, (3) to provide a project effect determination, and, if necessary, (4) to provide mitigation commitments, (5) develop necessary mitigation plans, and (6) implement mitigation plans.

The Gotay and Rechtman (2019) report states that no historic properties were identified within the proposed project area during a field inspection conducted in 2010, nor during the field inspection conducted on January 18, 2019. The project area is undeveloped and has been extensively modified by prior grading and clearing activities. Low potential exists for the project to encounter subsurface historic properties. However, pit caves may be present below the fill deposits, some of which have been documented elsewhere as containing fossil evidence or traditional Hawaiian cultural materials, including burials. The report also summarizes archival research and prior archaeological studies pertinent to the project area and vicinity.

On January 13, 2020, SHPD received via email (David Robichaux [consultant for Arion Energy] to Susan Lebo [SHPD]) a letter dated January 9, 2020 from the HCDA in which the HCDA indicates it is submitting the ASM (2019) field inspection report and, based on the report findings, the HCDA requests the SHPD to indicate whether an archaeological inventory survey is needed to determine if historic properties are present (addition to SHPD Log No. 2019.01154).

In a letter dated March 10, 2020 (Ref No. PO-20-038), the DHHL notified the SHPD that DHHL authorizes KHLS to use the subject 29.853-acre property for the proposed solar photovoltaic farm. SHPD received this letter on March 18, 2020 (SHPD Log No. 2020.00654).

Subsequently, on March 13, 2020, the HCDA notified the SHPD via email (Tesha Malama [HCDA] to Susan Lebo [SHPD]) that the requirements of HAR 13-284-3 have been met. Specifically, ASM Affiliates completed archival research and an archaeological field inspection of the project area and, their report indicates that no significant historic properties were identified in the project area. Prior grading and other activities have extensively impacted the area and, thus, it is unlikely that buried intact cultural deposits remains, and no further archaeological work is recommended (addition to SHPD Log No. 2019.01154).

Based on these findings, HCDA requests the SHPD's concurrence with HCDA's HRS 6E project effect determination of "No historic properties affected" for the proposed solar photovoltaic project. No further archaeological work is required.

SHPD concurs with HCDA's project effect determination of "No historic properties affected" for the proposed project. Pursuant to HAR §13-284-7(e), when the SHPD agrees that the action will not affect any significant historic properties, this is the SHPD's written concurrence and historic preservation review ends.

Although the LRFI report does not fulfill the requirements of an archaeological inventory survey as specified in HAR §13-276, it serves to facilitate project planning and supports the historic preservation review process. **Please send** one hard copy of the document, clearly marked FINAL, along with a copy of this review letter and a text-searchable PDF version of the report to the Kapolei SHPD office, attention SHPD Library. Additionally, please send a digital copy of the final LRFI report to lehua.k.soares@hawaii.gov.

SHPD hereby notifies DHHL and HCDA that the historic preservation review process is ended for the proposed Kalaeloa Home Lands Solar Project. The approval and permit issuance processes may proceed.

Please attach to construction plans: In the unlikely event that subsurface historic resources, including human skeletal remains, structural remains, cultural deposits, artifacts, sand deposits, or sink holes are identified during the demolition and/or construction work, cease work in the immediate vicinity of the find, protect the find from additional disturbance, and contact the State Historic Preservation Division, at (808) 692-8015.

Please contact Susan A. Lebo, Archaeology Branch Chief, at Susan.A.Lebo@hawaii.gov or at (808) 692-8019 for matters regarding archaeological resources or this letter.

Aloha,
Alan Downer

Alan S. Downer, PhD
Administrator, State Historic Preservation Division
Deputy State Historic Preservation Officer

cc: Allen G. Yano, allen.g.yanos@hawaii.gov
Garett H. Kamemoto, garett.h.kamemoto@hawaii.gov
Tesha Malama, tesha.malama@hawaii.gov
Nick Azari, nick.azari@arionenergy.com
Michael Iosua, miosua@imanaka-asato.com
David Robichaux, robichaud001@hawaii.rr.com
dbrian@onyxrenewables.com

KALAELOA HOME LANDS SOLAR

A community-based Renewable Energy Project

built on Hawaiian Home Lands

WHO WE ARE

Dr. Nick Azari (CEO) and Tim Olsen (CTO) have been active solar energy developers in Hawaii since 2009 and have completed projects Mililani, Pearl City, Kalihi, Kahului and Kapaa. 25 projects in various stages of development. His background in financial management gives Arion a solid economic base and the ability to take projects through all the stages of development

- 4 Times Supermarket Stores on Oahu, Kauai and Maui
- Shima's Supermarket in Waimanalo
- Waimea Canyon Shopping Plaza in Kekaha, Kauai
- Kamehameha Shopping Center
- Pacific Allied Products bottling plant-Campbell Industrial Park

What we do

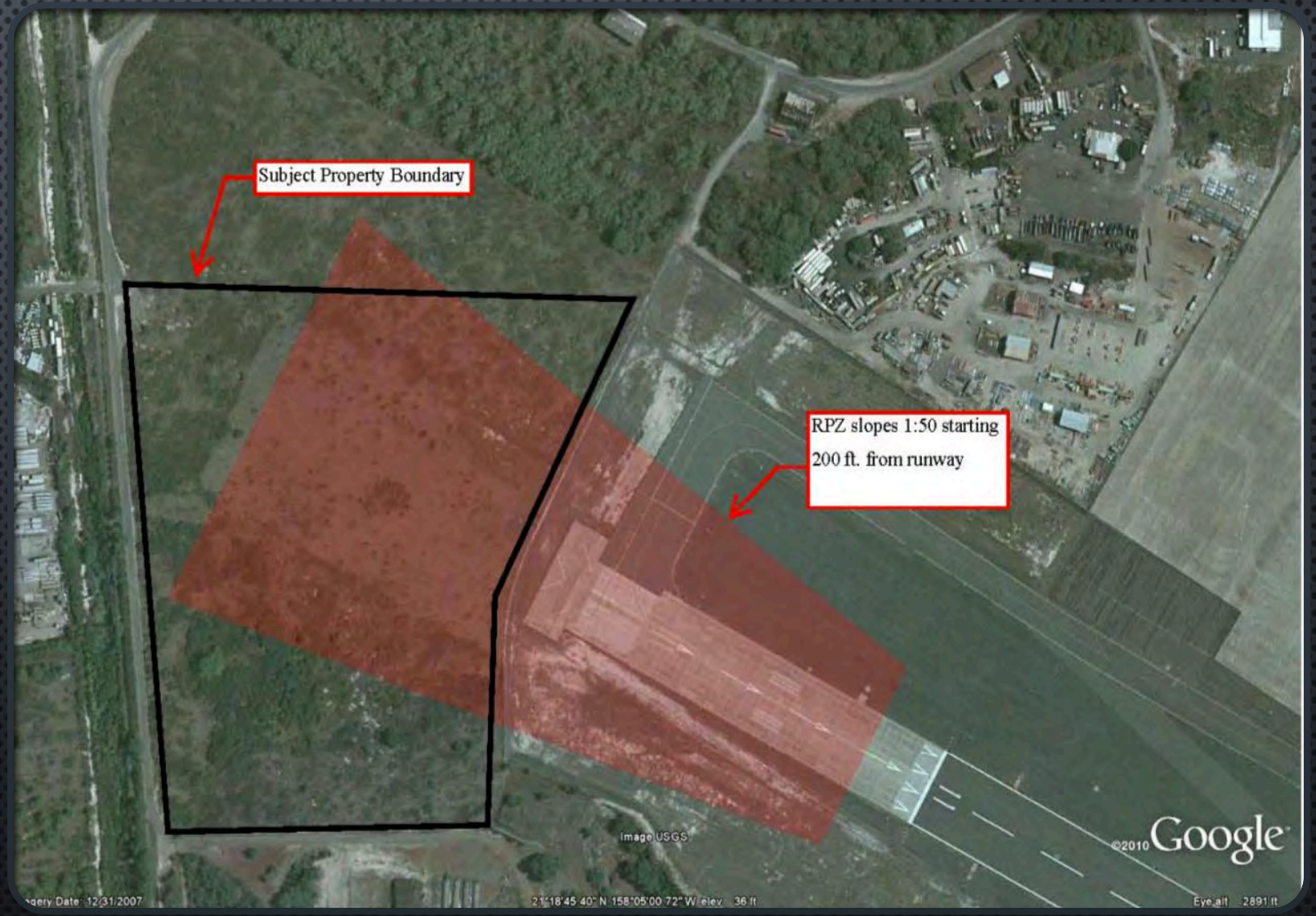
Community-based Renewable energy is a program to allow anyone to subscribe to solar power generation without installing solar on your own roof. Subscribers get a discount on their electric bills, and the HECO gets cheaper power without investing in the infrastructure

Kalaeloa Home Lands Solar

- DHHL Parcel # 9-1-013:029 (29 acres). The western Perimeter is Saratoga Street (aka Western Perimeter Rd.)
- Southern boundary is Lake Champlain St.
- Northern Boundary is Kalaeloa Solar I

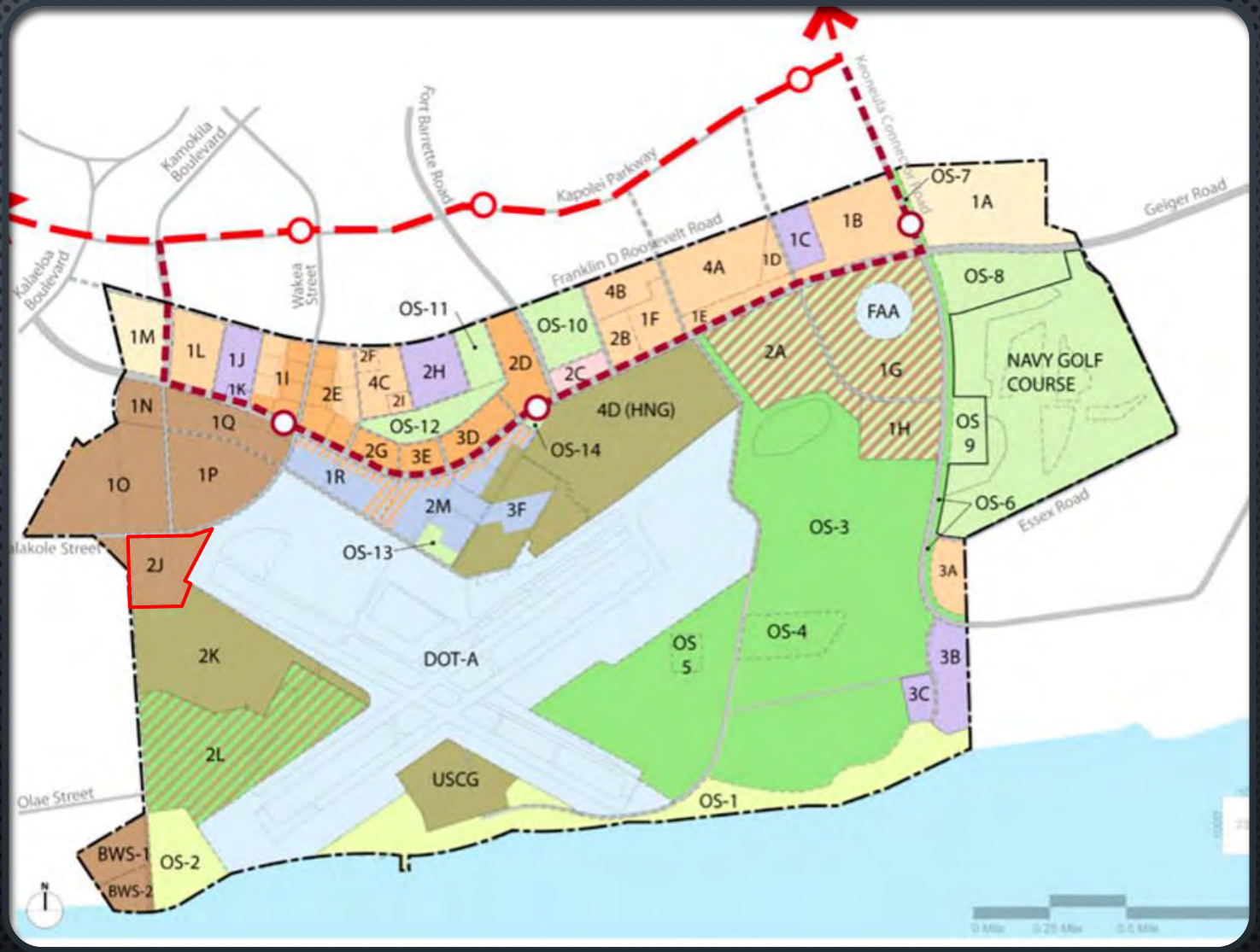
LAND-USE 1
FAA RESTRICTIONS

- THE PARCEL IS WITHIN THE RUNWAY PROTECTION ZONE OF THE KALAELOA AIRPORT CROSSWIND RUNWAY. POTENTIAL LAND USE IS RESTRICTED BY THE FAA TO USES THAT HAVE A LOW PROFILE AND DO NOT REQUIRE FREQUENT OCCUPATION OR USES THAT MAY IMPACT AIRCRAFT OPERATIONS.



Land Use 2. Kalaeloa Master Plan

- The 2006 KALAELOA Master plan designated the parcel as Eco-industrial. For the purposes of the Master Plan, Eco-industrial uses are defined as environmentally compatible industries that benefit the entire population of Oahu. Potential industries such as solar or hybrid energy generation, bio-filtration, or other such technologies are compatible in these parcels. These industries require large land areas and are located within the airport's accident potential zones where height restrictions limit development.".



LAND USE 3
KCDD RULES
HAR 15-215

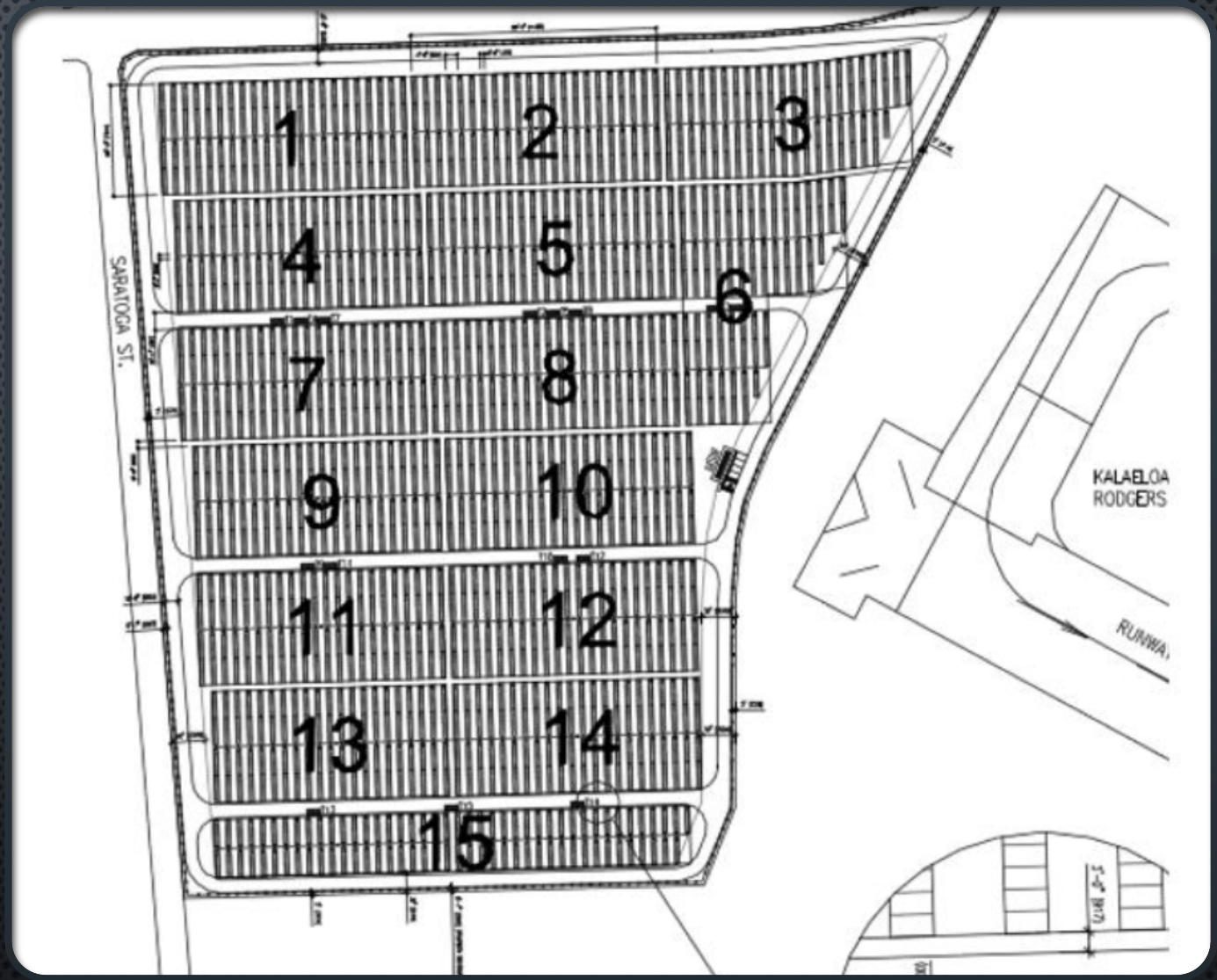
- KCDD RULES PLACE THE PARCEL IN THE GENERAL URBAN ZONE (T-3).
- FAA RESTRICTIONS SPECIFICALLY PROHIBIT ALL PERMITTED USES IN THE T-3 ZONE AS DEFINED IN KCDD TABLE 1.7.
- T-3 IS AN INAPPROPRIATE TRANSECT DESIGNATION FOR THE PROPERTY.

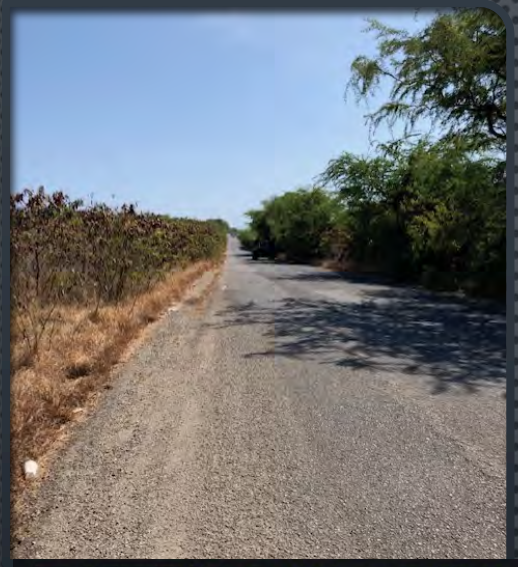
PROPOSED USE

- One of only two Oahu projects awarded in HECO's competitive RFP
- Phase I is currently approved and will cover less than 5-acres and produce 1.7 Mw (340 houses). Connection is to the power corridor in Campbell Industrial Park
- Future allocations are anticipated. At full development, solar panels will cover more than 85 % of the parcel area and power more than 3,000 houses

Full development within 15 years

- Allocations from HECO are on a competitive basis. Full buildout will depend on HECO's rollout schedule and the economic benefits of Community-Based Renewable Energy
- Power for more than 3,000 homes at full development





VIEW PLANE

- Facility can only be seen from Saratoga St. (western perimeter Road. Other sides are not accessible.
- Currently dry scrub land with illegal dumping issues
- Replaced by privacy fence with landscaping Plants from Table 1.10 such as Naupaka

BENEFICIARIES

- Substantial revenues to DHHL and beneficiaries
- Preferential offering to Hawaiian Home Lands tenants,
- Other subscribers who wish to reduce electric bills and participate in carbon-free electric generating (3,000 homes +)
- Residents and visitors who like to breath clean air
- One step toward 100% renewable mandate

PERMIT REQUIREMENTS

- 1. development permit: triggered by lot size > 40,000 sf
- 2. conditional use permit: solar farms are permitted in T-3 transect following approval of cup
- 3. variance: required for
  - Architectural standards 6-foot chain-link fence
  - landscape: landscape plantings with approved plants only around perimeter fence at saratoga Street. temporary irrigation system provided
  - Open Space: at fulldevelopment lot will have more than 85% coverage

Conformance to KCDD ("Kalaeloa Rules") HRS §15-215

CATEGORY	KALAELOA RULES Title 15, Chapter 215 HAR	REQUIREMENTS (Allowable)	PROPOSED	COMMENTS
TRANSECT ZONE	§15-215-23(b)(3) Transect Zones, Figure 1.2 (Regulating Plan) and Figure 1.3 (Development Standards Summary)	Transect Zone: T-3 General Urban Zone	Solar farm	A solar farm is permitted in Transect T-3 following approval of a Conditional Use Permit. An application for a CUP is submitted concurrently with the DP application.
SITE AREA				
PROJECT TYPE	HAR 15-215-78	Development	Development permit	Land areas over 40,000 sf require a Development permit
FRONTAGE TYPE	15-215-39	Detailed in Figure 1.6	No buildings are proposed	Frontage type is not applicable to this project
LAND USE	§15-215-40, Land Use, and Figure 1.7 (Land Use)	Mixed use with commercial emphasis	Solar Farm	A solar farm is permitted in Transect T-3 following approval of a Conditional Use Permit
BUILDING PLACEMENT	HAR 15-215-41 Figure 1.8	Not applicable	No buildings will be constructed	Not Applicable
BUILDING FORM	HAR 15-215-42	Not applicable	No buildings will be constructed	Not Applicable
ARCHITECTURAL STANDARDS	HAR 15-215-43 Figure 1.3	Frontage Type, Building Type, Building Form	No buildings will be constructed	A variance will be requested to permit a 6-foot occluded chain-link fence.
SETBACKS	Figure 1.3 C. (Setback)	5'-15' Front Yard Setback	compliant	Solar farm will have perimeter roads
LANDSCAPE	§15-215-44, Landscape	Landscape plan, Table 1.10 plantings, trees, sprinklers	Sprinklers and approved plantings only along the perimeter of Saratoga St.	Variance will be requested from permanent sprinkler requirement
RECREATION SPACE	§15-215-45	25 SF of recreation per 1000 of industrial.	No industrial development	Not Applicable

CONFORMANCE TO KCDD RULES

OPEN SPACE	§15-215-46, Open Space	20% of each lot	85+% lot coverage at full development	Variance will be requested from open space requirements at such time as full development is subscribed
PARKING	§15-215-47 Parking and Loading	One (1) off-street stall per 450 SF of floor area	No buildings will be constructed	Not Applicable
	§15-215-47(1), Loading	Loading spaces are required from 5,000 SF of floor area.	No buildings will be constructed	Not Applicable
BICYCLE PARKING	§15-215-47(m), Bicycle Parking	Within 400 feet of building entrance.	No buildings will be constructed	Not Applicable
GREEN BUILDING	§15-215-48, Green Building (applicable to new buildings and additions and renovations of existing buildings that increase existing floor area by 25% or more)	Project qualification based on green building rating system.	No buildings will be constructed	Not Applicable
LARGE LOT DEVELOPMENT	§15-215-62 Walkability and pedestrian Orientation	Design standards for large lots	No buildings will be constructed.	Not Applicable
HISTORIC AND CULTURAL SITES	§15-215-63, Historic and Cultural Sites	Developer shall obtain a letter from SHPD which confirms that the developer has complied with all requirements.	No Effect Recommendations have been accepted by SHPD	Project is in compliance with §15-215-63
DEDICATION OF PUBLIC FACILITIES	§15-215-64(a), Public Facilities Dedication (applicable to projects where existing floor area is increased by more than 25%)	The developer shall dedicate land for public purposes	There will be no publicly accessible space	Not Applicable
Joint Zone Development	§15-215-64 multiple transects	Land use requirements	Project will be within T-3 transect	Not Applicable

Summary

- Proximity to the crosswind runway and aircraft operations severely restricts practical use of the parcel.
- Solar Generation is one of the very few land uses consistent with FAA guidance, the KMP, and KCDD Rules (contingent on obtaining a CUP).
- Surrounding land use is Military, Industrial, and existing solar. Very low visual impacts.
- Parcel cannot be used for other general urban (T-3) uses which include housing and commercial.
- Project will help DHHL beneficiaries and others through funding and carbon-free generation.
- No archeological resources identified

THANK YOU

CONDITIONAL USE PERMIT

KAL 21-004

I. REQUEST

Kalaeloa Home Land Solar, LLC, (Applicant), is requesting a Conditional Use Permit to develop a photovoltaic generation installation called the Kalaeloa Home Land Solar Project (Project). Pursuant to Hawaii Administrative Rules (HAR), § 15-215-79, *Conditional Use Permit* and Figure 1.7, *Land Use*, 'Solar Farm' is permitted as a Conditional Use and requires a Conditional Use Permit (CUP). Approval of the CUP to allow the proposed Solar Farm use is required prior to approval of a Development Permit application.

II. BACKGROUND

The Project site is located in the Kalaeloa Community Development District (KCDD) Transect 3 (T3), General Urban zone and is identified as Tax Map Key No. (1) 9-1-013:029. The Project site is bounded by West Perimeter Road, the Kalaeloa Airport to the east, and two DHHL parcels to the north and south. See Figure 1, Exhibit A. The Project site is 29.8 acre in size is owned by the Department of Hawaiian Home Lands (DHHL). The DHHL has provided landowner authorization for the Project.

In 2018, the DHHL granted the applicant the rights to lease the property for the development and operation of the Project. The Project will contribute to Oahu's electrical renewable portfolio through Hawaiian Electric's Community-Based Renewable Energy Program (CBRE), as approved by the Public Utilities Commission in 2018.

On April 7, 2021, a presentation on the Project was made to the Authority as an information item.

II. ANALYSIS

Pursuant to §15-215-79, *Conditional use permit, Findings*, HAR, the following findings of fact have been submitted by the Applicant:

(1) The use is allowed within the applicable zone and complies with all other applicable provisions of the rules.

Solar Farm use is allowed within the T3 zone; however, 'Solar Farm' use requires a CUP, pursuant to §15-215-79, *Conditional use permit, Applicability*.

(2) The use will conform to the Kalaeloa Master Plan (KMP).

Section 3.2.2 of the KMP states that due to the "continued escalation in fossil fuel energy prices, interest in renewable energy resources is increasing" and industries such as solar energy generation "may have development potential in Kalaeloa."

Section 4.1.4 of the KMP also states that "Potential industries such as solar or hybrid energy generation, bio-filtration, or other such technologies are compatible in these parcels. The identified Eco-industrial lands at Kalaeloa present a unique opportunity to foster research and the hands-on application of alternative or hybrid energy production. Advantages include close proximity to existing power plants at Campbell Industrial Park and to electrical transmission lines serving the region, as well as a large number of sunny days each year and relatively stable diurnal range."

The KMP designates the Project site as an eco-industrial lot appropriate for alternative energy use. The project, consisting of up to 8.8 MWdc of solar energy generation supports the State's renewable energy goals. The Project also provides plan-compatible uses which are severely limited due to the proximity of the airport restricted airspace and land-use requirements. Accordingly, Project is in conformance with, and promotes the goals of the KMP in an area that would otherwise be underutilized.

(3) The design, location, size, and operating characteristics of the proposed use are compatible with the existing and future uses of parcels surrounding area.

Parcel 9-1-013:029 lies at the western edge of Kalaeloa and at the end of the crosswind runway, which is designated Runway 11-29. The Kalaeloa Airport western perimeter fence is 8 feet tall, roughly corresponding with the maximum height of the photovoltaic panels to be installed behind the perimeter fence. Properties to the north of the subject property have been developed for PV use. State-retained lands associated with the airport are on the east boundary. Vacant land used by the Navy as an equipment base yard and composting site are to the south, and the industrial properties of Campbell Industrial Park are to the west, immediately beyond the Western Perimeter Road.

At full development, the Project will consist of 29 acres of PV panels. The proposed action does not increase population or traffic. During operation, the Project will not contribute hazardous waste, air emission, or surface water contamination associated with its operation. The Project does not utilize any potable water or sewer. The Project site is surrounded by industrial or "eco-industrial uses on all 4 sides. Land use restrictions imposed by its proximity to the Kalaeloa Airport prevent any use that involves buildings, or frequent personnel presence. Photovoltaic panels have a low profile, little maintenance and no hardened structures or hazardous materials. The design, location, size, and operating characteristics of the proposed use are compatible with the existing use in

the vicinity, and airport operations will prevent significant changes in the future

(4) The site is physically suitable for the type, density and intensity of use being proposed, including access, utilities, and the absence of physical constraints.

The Project site is in close proximity to the Airport runway, therefore limiting allowable uses. The limited airport related land use makes the site ideal for Solar Farm use.

(5) Granting the permit would not be detrimental to the public health, safety, or welfare or be materially injurious to persons, lots or improvements in the vicinity and zone in which the lot is located.

Operation of a PV facility on the subject property would not be detrimental to the public health, safety, or welfare, or be materially injurious to persons, or airport operations. Construction of the proposed PV facility will be suspended during periods when the crosswind runway is in use in order to mitigate potential conflicts or distractions.

III. CONCLUSION AND ACTION

The proposed Project has met all required findings of fact pursuant to §15-215-79, *Conditional use permit, Findings*, HAR. As such, the request for a Conditional Use Permit is approved.

Dated at Honolulu, Hawaii, this 7th day of July 2021.

HAWAII COMMUNITY DEVELOPMENT
AUTHORITY, State of Hawaii

By_____
Deepak Neupane, P.E., AIA
Executive Director