# CIVIL AVIATION SITE SENSITIVITY VERIFICATION REPORT IN SUPPORT OF AN ENVIRONMENTAL IMPACT ASSESSMENT FOR A PROPOSED HYDROGEN POWER PLANT WITH LINKED SOLAR PV ARRAY ON A SITE KNOWN AS SIVUTSE, NEAR ESKOM MAJUBA POWER STATION, MPUMALANGA PROVINCE

**PREPARED FOR:**

**NSOVO ENVIRONMENTAL CONSULTING, ON BEHALF OF RENEWSTABLE MPUMALANGA (PTY) LIMITED, A SUBSIDIARY OF HYDROGENE DE FRANCE (HDF-ENERGY SOUTH AFRICA)**

**PREPARED BY**

GWI Aviation Advisory

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### GWI Aviation Advisory: Company Details

| | | | |
|---|---|---|---|
| **Approved by** | B Karstadt | | |
| **Address** | Portion 730 Witpoort 406JR | | |
| | Midrand | | |
| | 1685 | South Africa | |
| **Telephone** | +27 (0) 82 577-1100 | **Website** | **www.gwi.co.za** |
| **Email** | **jon@gwi.co.za; sibusison@av-innovate.com** | | |
| **Signature** |  | | |

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# Contents

# List of Tables

# List of Figures

# 1 General Introduction

## 1.1 Regulatory Environment

In March 2020, the National Department of Forestry, Fisheries, and the Environment (DFFE) gazetted a Protocol that requires Environmental Assessment Practitioners (EAPs) to assess the environmental impact of proposed developments on nearby civil aviation facilities. While the South African Civil Aviation Authority (SACAA) regulates civil aviation safety and security, the DFFE mandate is to ensure that the environmental impact of developments on civil aviation infrastructure is acceptable. To this end, Protocol 320 specifies distance limits that trigger site sensitivity verification studies (CASSV's) by civil aviation specialists. To assist EAPs, it developed a screening tool (Screening Tool) to allow them to undertake a preliminary assessment of the site sensitivity of proposed developments. If the results of this assessment indicate medium or higher sensitivity, then a specialist Civil Aviation Site Sensitivity Verification (CASSV) study is necessary to verify or revise the assigned sensitivity level. Should the CASSV conclude that the sensitivity of the proposed site is indeed medium or higher, a Civil Aviation Compliance Statement prepared by the specialist, with comment as necessary from the SACAA, is required.

SACAA Regulations and Technical Standards (CARS and CATS) often require Aeronautical Studies for developments deemed to present high safety and/or operational risk to nearby aerodromes. CATS 139.01.30, which was amended in March 2023 (SA-CATS2 of 2023 and Amendment 26 of the Civil Aviation Regulations) imposes on aerodrome licence holders[1] the obligation to mitigate risks that obstacles or other issues may present to aerodrome or aircraft operations. Thus, once Environmental Authorisation for proposed developments close to aerodromes has been procured and the detailed design phase proceeds, further engagement with the SACAA is often necessary to procure approval of obstacles to be constructed and other issues that may have been identified during the CASSV.

*Notes: 1. The wording of the SACAA regulation is 'Licence holder' – in the case of unlicensed or registered aerodromes the standard interpretation is that the obligation becomes that of the aerodrome owner.*

## 1.2 Project Background

Nsovo Environmental Consulting (Nsovo), on behalf of Renewstable® Mpumalanga (Pty) Limited, a special purpose company (SPV) of Hydrogene de France (HDF-Energy South Africa), is undertaking an Environmental Impact Assessment and Environmental Management Programme Report ('EIA/EMPr') for several proposed Hydrogen power plants on 1 782Ha of property near Eskom's Majuba power station, allocated by Eskom SOC in terms of Tender MPW1247GX.

Compliance with the requirements of the DFFE requires separate CASSV's to be undertaken for each of five separate sub-projects that comprise the overall programme of projects, being:

- the Renewstable® Bokamoso sub-project
- the Renewstable® Sivutse 'a' and 'b' sub-projects
- the Renewstable® Qhakaza sub-project
- the Renewstable® Ntkozo sub-project, and
- the Renewstable® 132kV high voltage grid line, which connects the sub-projects to each other and to the distribution grid at Majuba power station.

The scope of the sub-projects is illustrated in Table 1 and Fig 1.

A Screening Tool analysis by Nsovo has indicated a high sensitivity of all the sub-projects on account of their proximity to Eskom's Majuba aerodrome (FAMJ). This is notwithstanding the fact that the Renewstable® Qhakaza and Ntokozo sub-project sites are beyond the 15km trigger distance specified in DFFE Protocol 320 of March 2020.

GWI Aviation Advisory (GWI) were thus appointed by Nsovo to undertake separate CASSV reports for each sub-project, as illustrated in Tables 1 and 2.

GWI were also appointed to undertake a high-level Glint and Glare (G&G) assessment of the Renewstable® Bokamoso and Sivutse sites, since these are located within the 3km 'trigger distance' usually applied by the SACAA for such assessments.

Should the CASSV's confirm that the sensitivity for a particular sub-project is medium or higher, it will be necessary to issue a Civil Aviation Compliance Statement for such sub-project, after further consultation with the SACAA. For this reason, each CASSV study includes elements of an Aeronautical Study in accordance with standard guidelines issued by the SACAA and to conform with accepted professional practice. Similarly, the G&G studies as required will assess the safety risk posed to operations to and from Majuba Aerodrome (FAMJ) by the two sub-projects that trigger such studies, in accordance with standard international practice. These studies draw on guidelines of the US Federal Aviation Authority (FAA), the UK Civil Aviation Authority (UKCAA) and various other authorities. It should be noted, however, that Eskom SOC, as both aerodrome owner and landowner of the project sites, also has sole discretion to implement operational controls and other measures deemed necessary to mitigate any identified risks.

***Table 1: Scope of CASSV for* the 5 Sub-Projects (Renewstable® Sivutse considered as a single sub-project)**

| Sub-Project | Distance & Location from Aerodrome | Site Area excl. buffers (Ha) | PV Modules | Gross PV Array Area (Ha) (2,68m$^2$/module) | Coverage (%) | CASSV SoW |
|---|---|---|---|---|---|---|
| Renewstable gridline | 4,67-15km east – northeast | N/A | N/A | N/A | N/A | CASSV and Obstacle Assessment only |
| Renewstable® Bokamoso | 1,39km northeast | 258 | 350 000 | 94 | 36 | CASSV, Obstacle assessment & Glint/Glare Analysis |
| Renewstable® Ntokozo | 15,8 km east-northeast | 94 | 134 000 | 36 | 38 | CASSV only |
| Renewstable® Qhakaza | 15km east - northeast | 99 | 134 000 | 36 | 36 | CASSV only |
| Renewstable® Sivutse a | 1,49km east | 201 | 350 000 | 94 | 34 | CASSV, Obstacle assessment & Glint/Glare Analysis |
| Renewstable® Sivutse b | 6,19km east-southeast | 79 | Incl | 36 | Incl | CASSV, Obstacle assessment & Glint/Glare Analysis |

***Table 2: Components of the Study***

| Sub-Project | VCASS | Glint/Glare Study |
|---|---|---|
| Renewstable® Bokamoso | Y | Y |
| Renewstable® Ntokozo | Y | N |
| Renewstable® Qhakaza | Y | N |
| Renewstable® Sivutse a & b | Y | Y |
| Renewstable® Gridline | Y | N |

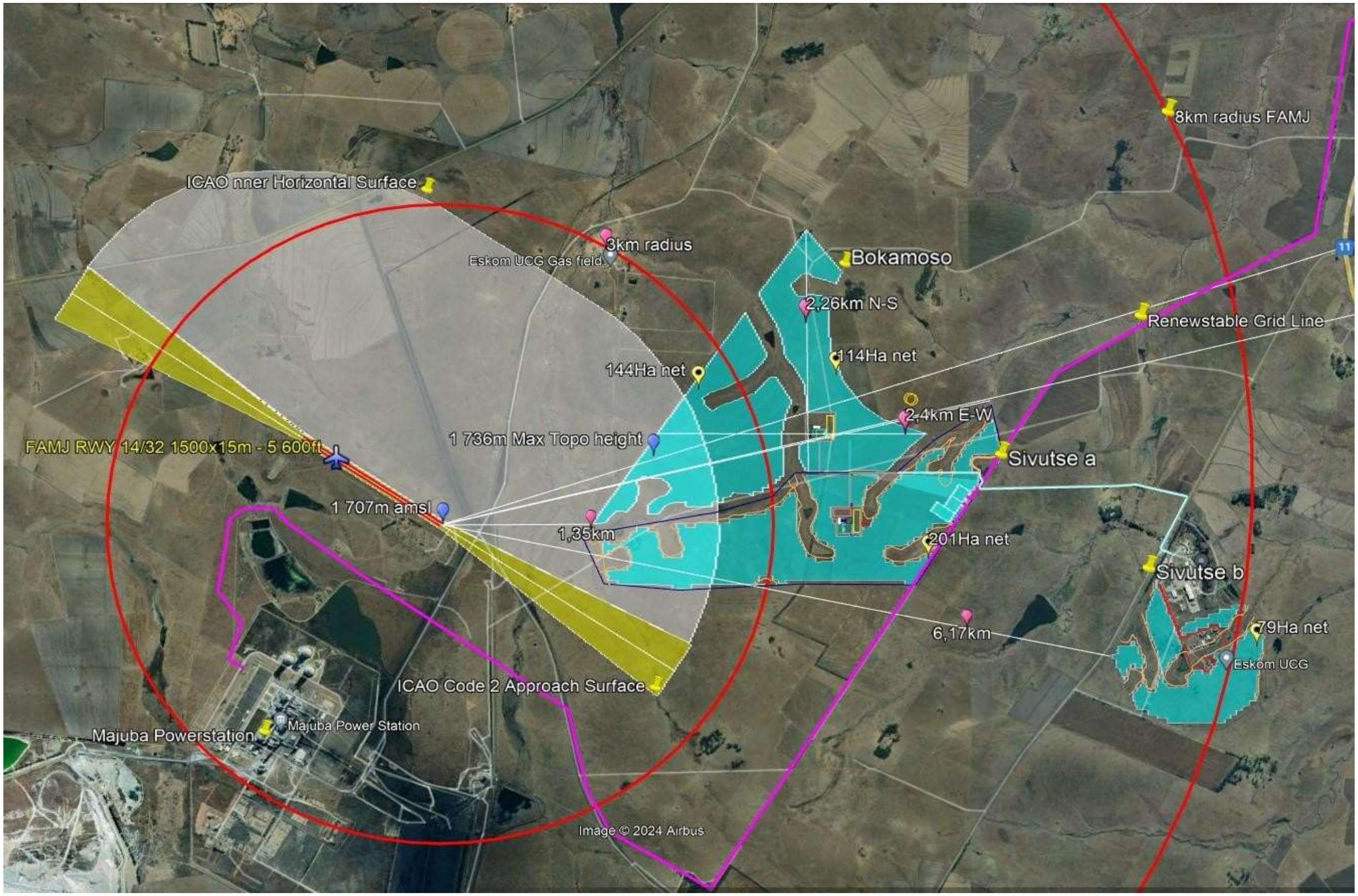



***Figure 1: General Location of* the Renewstable® Bokamoso *and Sivutse Sites relative to Majuba Aerodrome FAMJ***

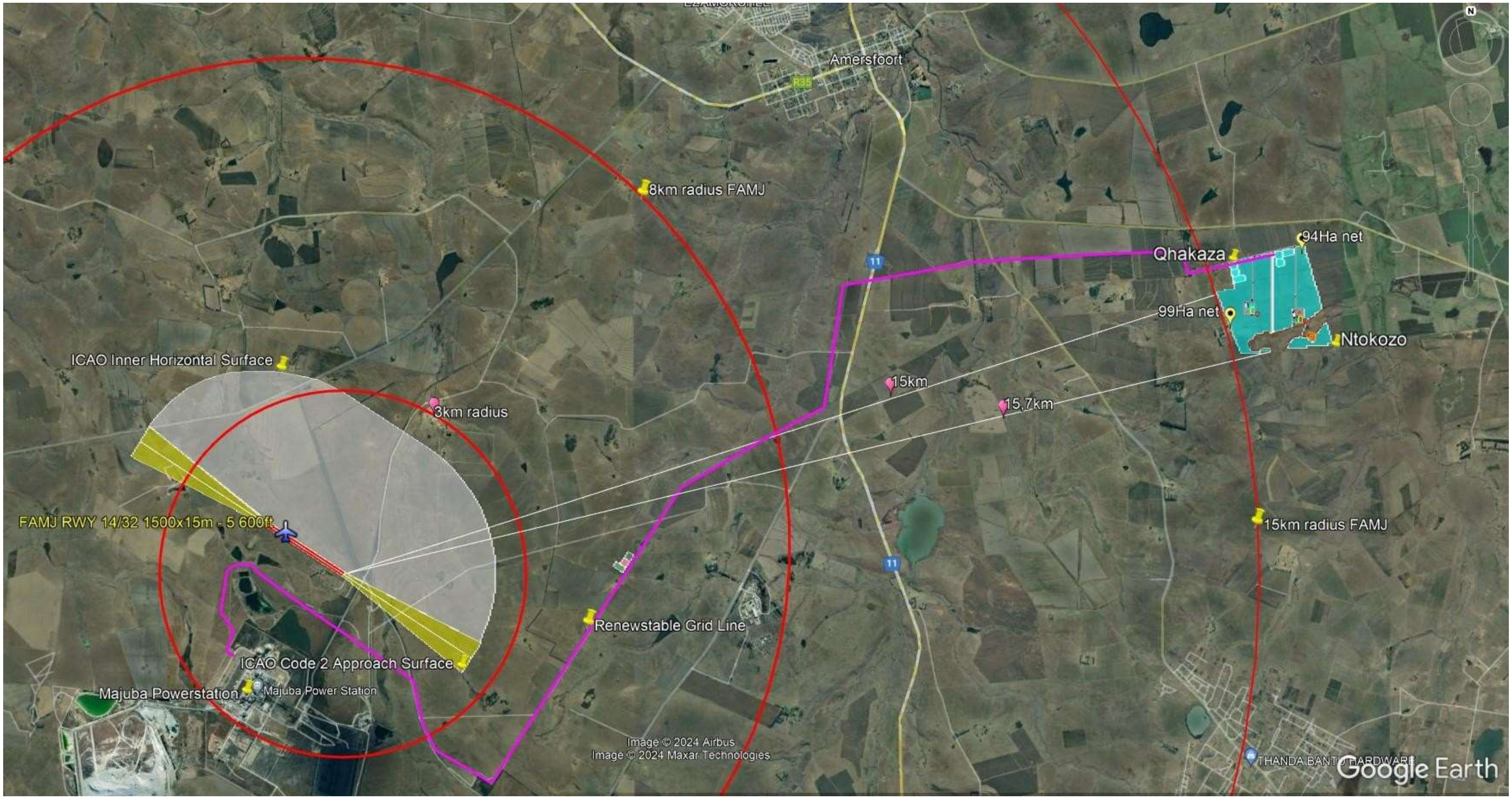



***Figure 2: General Location* of the Renewstable® Qhakaza and Ntokozo *Sites relative to Majuba Aerodrome FAMJ***

# 2 Executive Summary – Renewstable® Sivutse CASSV

### 2.1.1 Aeronautical Standards

The main findings of the CASSV are as follows:

- **Obstacles**

The detailed analysis contained in Section 5.1 concluded that there are no potential penetrations of any Obstacle Limitation Surfaces (OLS's) and the overall aviation safety risk is therefore low.

- **Radar and Navigational Infrastructure**

The proposed sub-project will not materially impact civil aviation radar, navigational, or communications infrastructure in the environs, nor present any material additional risks to operations at the affected aerodrome or within adjacent airspace.

There is no evidence of ground-based civil radar installations closer than 35km from the site. This is well outside the 500 ft guideline recommended by the US FAA (per Appendix 9), within which potential RF interference could occur. The risk of interference has been assessed as low.

There are no ground-based DVOR/DME (see Appendix 9: Glossary of Terms) installations within 8-15km of the sub-project site, and risk is assessed as low.

There are no ground-based NDB (see Appendix 9: Glossary of Terms) installations within 8-15km of the sub-project site, and risk is assessed as low.

- **Civil Aviation Routes: Radio and Communications Interference**

The proposed sub-project does not affect any conventional or satellite-based (GNSS and RNAV – see Glossary in Appendix 9) route under air traffic control (ATC) of ATNS centres at OR Tambo International Airport (FAOR) (Figure 7).

SACAA CAR Part 171.03.3, PROTECTION OF RADIO SITES states that:
"(ix) VHF / UHF Receivers / Transmitters

Ground-level safeguarding of a circle radius of 91 metres centred on the base of the main aerial tower (or equivalent structure). Additionally, from an elevation of 9 metres on this circle, a 2% (1:50) slope out to a radius of 610 metres."

Furthermore, the guideline minimum distances prescribed by the FAA for the siting of facilities away from radar, navigational, and other communications devices they could potentially impact range from 250ft to 500ft (Appendix 6.9), which are well below the distance of the proposed development from any ground-based communications infrastructure and radio equipment, the closest of which is beyond 15km, or overflying aircraft. The risk of such interference is thus low.

### 2.1.2 Environmental

The CASSV findings are that sensitivity is low, and no Civil Aviation Compliance Statement will, therefore, be required for the purposes of environmental authorization.

### 2.1.3 Glint and Glare Issues

Impacts vary from 'no impact' generally to 'low', with no risk mitigation required. The following recommendations are, however, included for the sake of compliance with standard SACAA protocols.

- **Early morning approaches to RWY 14:**

Low-angle sun from sunrise (05h30) to 07h30 in summer: NOTAMS should be published warning of potential glint risk on final approaches to RWY 14, and operational procedures at the (private) aerodrome should be amended accordingly by Eskom.

- **General mitigation proposed:**

It is recommended to redesign the aerodrome approach circuit from a 'left hand' to 'right hand' procedure, to avoid downwind approaches from overflying the solar PV sites to the west of the runway, at low altitude.

***Note 1**: Various potential risk scenarios and the geometric analysis undertaken in the study were qualitatively verified by physical modelling at scale 1:2500 utilising artificial light sources located at known solar azimuths and elevations for different times of the year, using laminated glass panels with tilt capability similar to the tracking system proposed, to simulate solar reflections.*

# 3 Project Description

Renewstable Mpumalanga (Pty) Ltd (RMPU) intends to develop several power plants based on hydrogen fuel-cell technology with supplementary solar PV panels on a 1782Ha land parcel granted by Eskom SOC Limited near the Majuba power station. This report covers the Sivutse a and b sites (Figures 1 and 6) and connecting transmission powerlines (denoted 'Renewstable gridline'), linking the development to a grid connection point adjacent to the power station.

The proposed development requires Environmental Authorisation in terms of the National Environmental Management Act (Act 107 of 1998), and Nsovo Environmental Consulting (Nsovo) is the independent Environmental Assessment Practitioner (EAP) appointed to conduct an Environmental Impact Assessment (EIA).

The Renewstable® Sivutse 'a' site at its closest point is 1,35km from Majuba Aerodrome (FAMJ). Using the DFFE screening tool, Nsovo has identified the site as having high aviation sensitivity. Accordingly, a specialist Civil Aviation Site Sensitivity Verification (CASSV) and a Glint and Glare (G&G) assessment is required, in accordance with the DFFE Protocol 320 of 2020. Should the CASSV conclude that the site is high risk, further consultation with the SA Civil Aviation Authority (SACAA) will be required to agree on the contents of a Civil Aviation Compliance Statement to be issued by the specialist for the purposes of environmental approval by the DFFE.

**Assumptions and Limitations**

The scope of this study is to undertake the CASSV and G&G assessments. While based primarily on the requirements of the DFFE Protocol and the minimum requirements of NEMA GNR 982 Appendix 6, the study also references various standards and recommended practices of the International Civil Aviation Organisation (ICAO), the SA Civil Aviation Authority (SACAA) and Air Traffic and Navigational Services SOC Limited (ATNS). These include, inter alia:

- The Civil Aviation Act No. 13 of 2009
- Draft White Paper on Civil Aviation Policy, 2017
- ICAO Annex 14, Volume 1: Aerodrome Design and Operations (see Appendix 9.4 & 9.5)
- SA Civil Aviation Regulations (CARS): Part 139 – Aerodromes and Heliports
- SA Civil Aviation Technical Standards (CATS): SACATS 139.01.30 (26$^{th}$ & 27$^{th}$ Amendments, 2023): Obstacle Limitations and Markings Outside Aerodromes or Heliports (Appendix 9.2)
- Associated provisions of SACATS 139.02.2 – Aerodrome Design Requirements
- ATNS Database of civil aviation airspace in South Africa, April 2024.

# 4 Scope and Methodology

## 4.1 Renewstable® Sivutse Study: Approach

The Renewstable® Sivutse CASSV was conducted by GWI in terms of the DFFE Protocol, but also references applicable SACAA guidelines. To meet this requirement, GWI Aviation Advisory utilises methodologies as outlined in SACAA document "Technical Guidance Material for conducting Aeronautical Studies or Risk Assessment" effective January 2022 (Appendix 9.3) and notes recent amendments (in March 2023 and April 2024) to the Civil Aviation Regulations, which will affect the operational phase of the project.

In essence, the study comprises the following elements:

- Initiation – Identification of potential impacts and risk issues
- Technical analysis
- Compliance assessment
- Risk Assessment – Estimation, Evaluation and Control
- Action and Monitoring, including Risk Mitigation (as required)
- Glint & Glare assessment in accordance with industry best-practice.

The study also incorporates various standards and recommended practices (SARPS) of the International Civil Aviation Organisation (ICAO) and the Air Traffic and Navigational Services SOC Limited (ATNS).

The study arises because the proposed development is within the trigger distances of Majuba aerodrome (FAMJ), for which the Screening Tool has indicated 'high' sensitivity. This relates mainly to potential risks associated with obstacle limitation surfaces and potential interference with communications and navigational equipment and infrastructure.

The G&G study was focused primarily on the impact of specular reflections from the solar PV panels that make up the arrays at the site, and particularly the potential impact of glint on operations at the Majuba aerodrome (FAMJ), rather than glare, as explained in more detail in Section 6.

## 4.2 Environmental Triggers

An Environmental Authorisation application is required in terms of the Environmental Impact Assessment Regulations (EIA Regulations, 2014) published in Government Notice (GN) No. 982 of 4 December 2014 (as amended by GN No. 571 of June 2021), based on Chapter 5 of the National Environmental Management

Act, 1998 (NEMA, Act No. 108 of 1998).

The EIA Regulations, 2014, provide for control over certain listed activities. These listed activities are detailed in Listing Notice 1 (LN1), Listing Notice 2 (LN2), and Listing Notice 3 (LN3), as amended by GN No. 517 of June 2021).

The undertaking of activities specified in the Listing Notices is prohibited until Environmental Authorisation has been obtained from the competent authority.

A full description of the listed activities applied for is included in the Application for Environmental Authorisation submitted by Nsovo Environmental Consultants, as appointed EAP, under Pre-Application Meeting Reference number 2024-03-0006.

## 4.3 DFFE Protocol of March 2020

A '*Protocol for the specialist assessment and minimum report content requirements for environmental impacts on civil aviation installations'* was gazetted by the DFFE as GN No.320 in the Government Gazette 43110 on 20th March 2020. The Protocol is attached as Appendix 9.6.

In terms of the Protocol, the EAP is required to undertake an initial review of the subject site, utilizing the Screening Tool developed by the DFFE, to assess the potential impact of the proposed development on adjoining civil aviation installations.
The Screening Tool uses distance as an indicator of sensitivity. If the proposed site is:

1. *Between 15 and 35km from a civil aviation radar, or*
2. *Between 15 and 35km from a major civil aviation aerodrome, or*
3. *Between 8 and 15km of other civil aviation aerodromes*

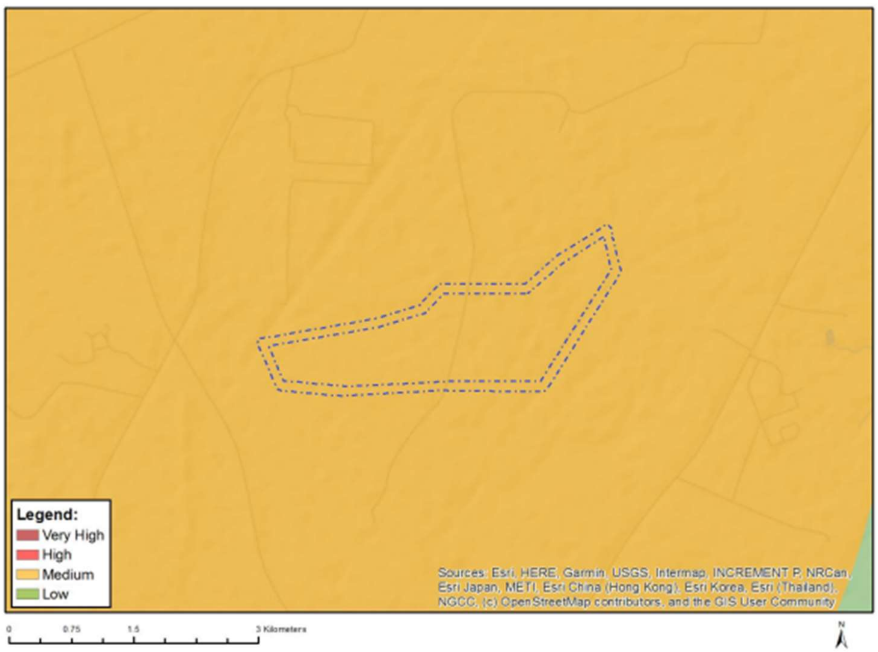
then a sensitivity rating of medium or high is assigned, which triggers a CASS. In terms of the Protocol:

- *If the outcome of (the Specialist's) site sensitivity verification justifies a sensitivity of medium or higher, then a Civil Aviation Compliance Statement is required.*
- *If the outcome of (the Specialist's) site sensitivity verification indicates low sensitivity, then there are no further requirements.*

## 4.4 Initial Assessment

The proposed development was assessed by Nsovo Environmental using the Screening Tool and a high sensitivity assigned on account of the proximity to Eskom's Majuba (FAMJ) aerodrome.

MAP OF RELATIVE CIVIL AVIATION (SOLAR PV) THEME SENSITIVITY

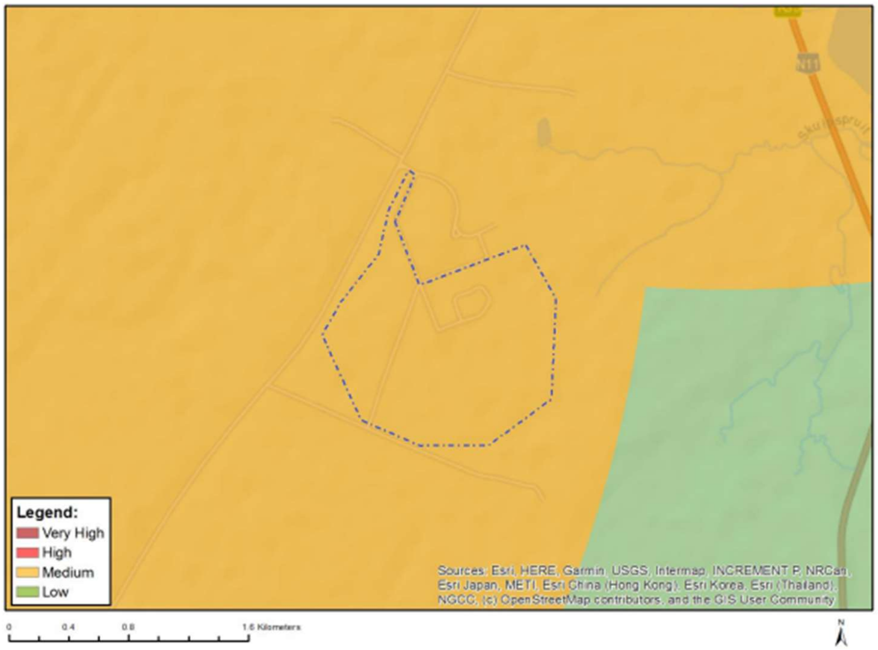



| Very High sensitivity | High sensitivity | Medium sensitivity | Low sensitivity |
|---|---|---|---|
| | | X | |

**Sensitivity Features:**

| Sensitivity | Feature(s) |
|---|---|
| Medium | Within 8 km of an other civil aviation aerodrome |

MAP OF RELATIVE CIVIL AVIATION (SOLAR PV) THEME SENSITIVITY




| Very High sensitivity | High sensitivity | Medium sensitivity | Low sensitivity |
|---|---|---|---|
| | | X | |

**Sensitivity Features:**

| Sensitivity | Feature(s) |
|---|---|
| Medium | Within 8 km of an other civil aviation aerodrome |

***Figure 3: DFFE Screening Tool Sensitivity Maps: Sivutse 'a' and 'b'***

Based on the preliminary sensitivity rating, GWI was appointed to undertake a CASSV to verify or motivate and adjusted rating. The credentials of GWI and relevant CV's of resources deployed on the study are attached to this report as Appendix 9.7.

If the CASSV determines that a Compliance Statement is required for environmental purposes, further consultation with the SACAA will be required, to agree the content and wording such Compliance Statement.

## 4.5 Specialist Study Elements

The study comprised the following elements:

### 4.5.1 Obstacle Assessment

Using ICAO Annex 14 and the relevant SACAA CARS/CATS standards, relevant OLS's were reviewed and the risk to these surfaces presented by the proposed development and associated infrastructure assessed.

### 4.5.2 Airspace Analysis

Using the SACAA Aerodrome Directory and the Aeronautical Information Publication (AIP) information on the aerodrome, airspace classification sourced from the Air Traffic and Navigational Services Corporation (ATNS) and available topographical data, the proposed development site was overlaid on the airspace classification map of the environs and risk posed to aircraft operating in the area assessed.

### 4.5.3 Radar, Navigation and RF Interference Assessment

Using information available from the SACAA and ATNS, the location of civil aviation radar and other navigational equipment and infrastructure within the guideline distances (per the US FAA) from the proposed development were determined and the risk posed to the operation of these installations assessed.

# 5 CASSV Outputs

## 5.1 Obstacle Limitation Surfaces

ICAO requires the determination of various obstacle limitation surfaces (OLS's), which vary according to the aerodrome reference code (ARC) for the affected aerodrome (Figure 4). Essentially, an OLS is an imaginary surface in the air beyond which an object may not penetrate unless otherwise motivated through a detailed Aeronautical Study. OLS's vary in size, slope, and extent according to the ICAO ARC of the affected aerodrome, which is typically based on runway length and width, referenced to standard atmospheric conditions at sea level (Figure 5).

Appendix 9.10 contains further details of the ICAO Annex 14 standards applicable to various ARC's under different infrastructural and operational conditions.

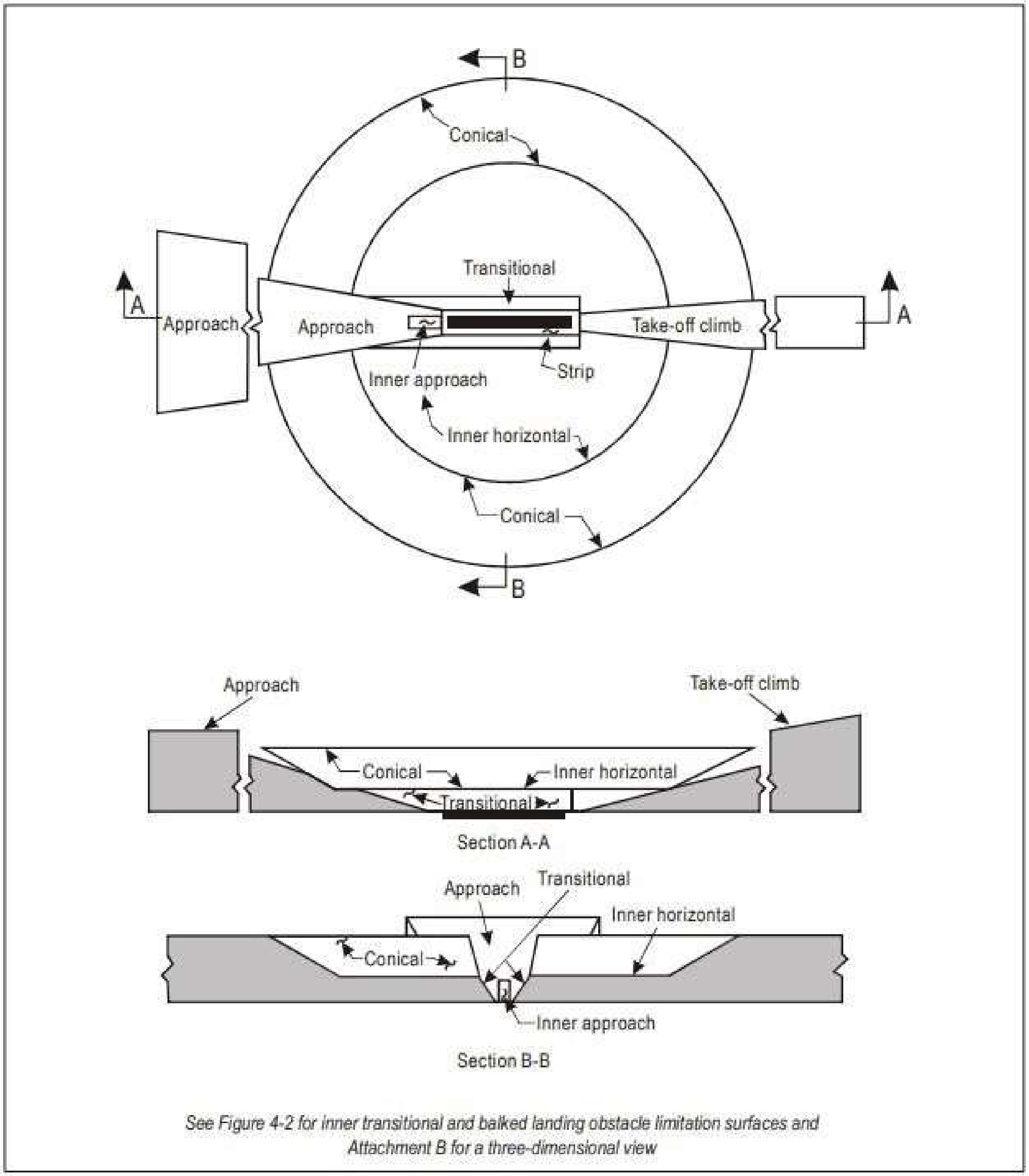



***Figure 4: ICAO Obstacle Limitation Surfaces***

**Table 1-1. Aerodrome reference code**
*(see 1.6.2 to 1.6.4)*

| Code element 1 | |
|---|---|
| **Code number** | **Aeroplane reference field length** |
| 1 | Less than 800 m |
| 2 | 800 m up to but not including 1 200 m |
| 3 | 1 200 m up to but not including 1 800 m |
| 4 | 1 800 m and over |
| **Code element 2** | |
| **Code letter** | **Wingspan** |
| A | Up to but not including 15 m |
| B | 15 m up to but not including 24 m |
| C | 24 m up to but not including 36 m |
| D | 36 m up to but not including 52 m |
| E | 52 m up to but not including 65 m |
| F | 65 m up to but not including 80 m |

*Note 1.— Guidance on planning for aeroplanes with wingspans greater than 80 m is given in the* Aerodrome Design Manual *(Doc 9157), Parts 1 and 2.*

*Note 2.— Procedures on conducting an aerodrome compatibility study to accommodate aeroplanes with folding wing tips spanning two code letters are given in the PANS-Aerodromes (Doc 9981). Further guidance can be found in the manufacturer's manual on aircraft characteristics for airport planning.*

***Figure 5: ICAO Aerodrome Reference Codes (ARC)***

The location of the Renewstable Sivutse site relative to the aerodrome (FAMJ) and regional airspace is illustrated in Figures 6 and 7, with Figure 8 illustrating the relevant topographical profile that determines obstacle penetrations.

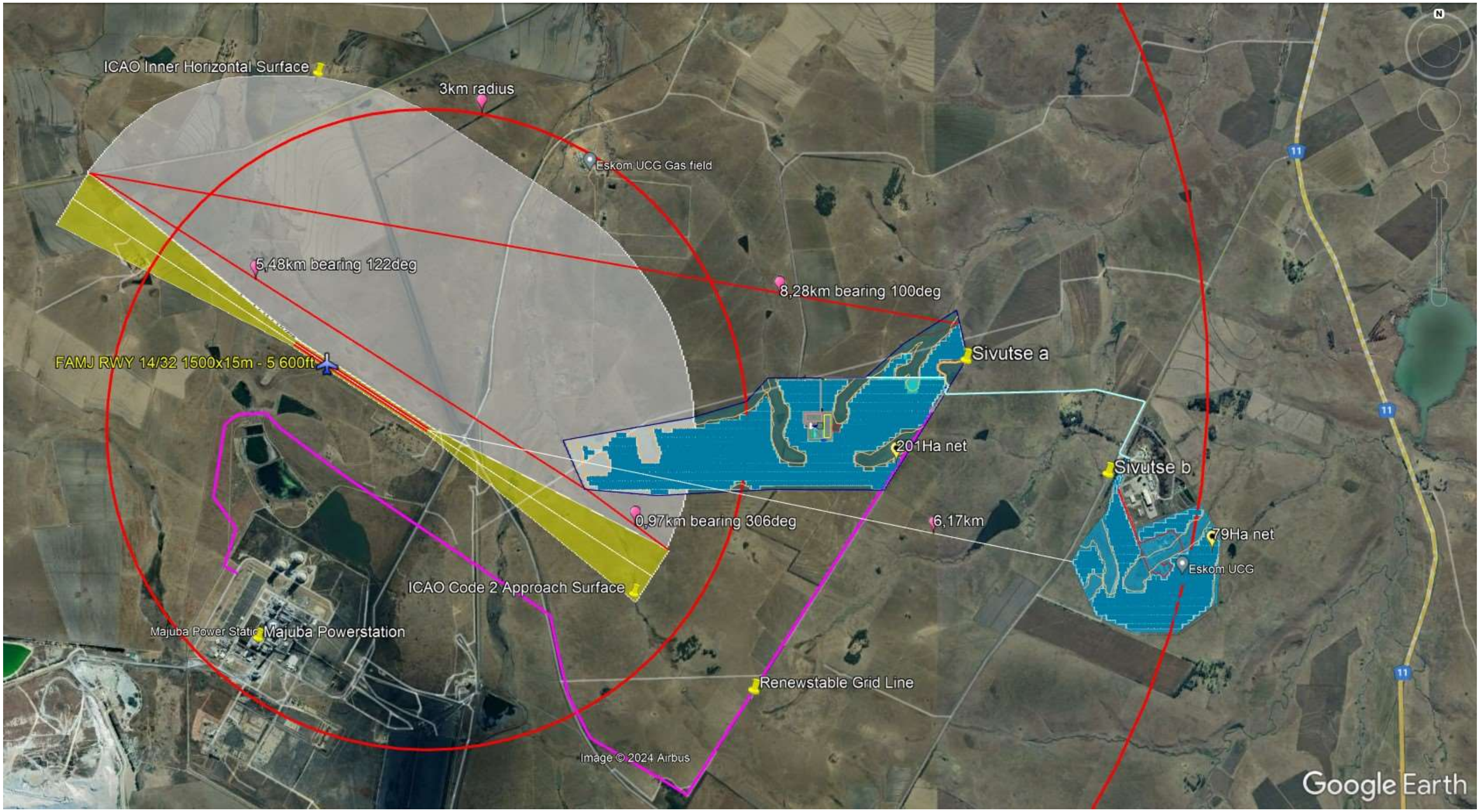



***Figure 6: Location of Renewstable® Sivutse Site relative to Majuba Aerodrome (FAMJ)***

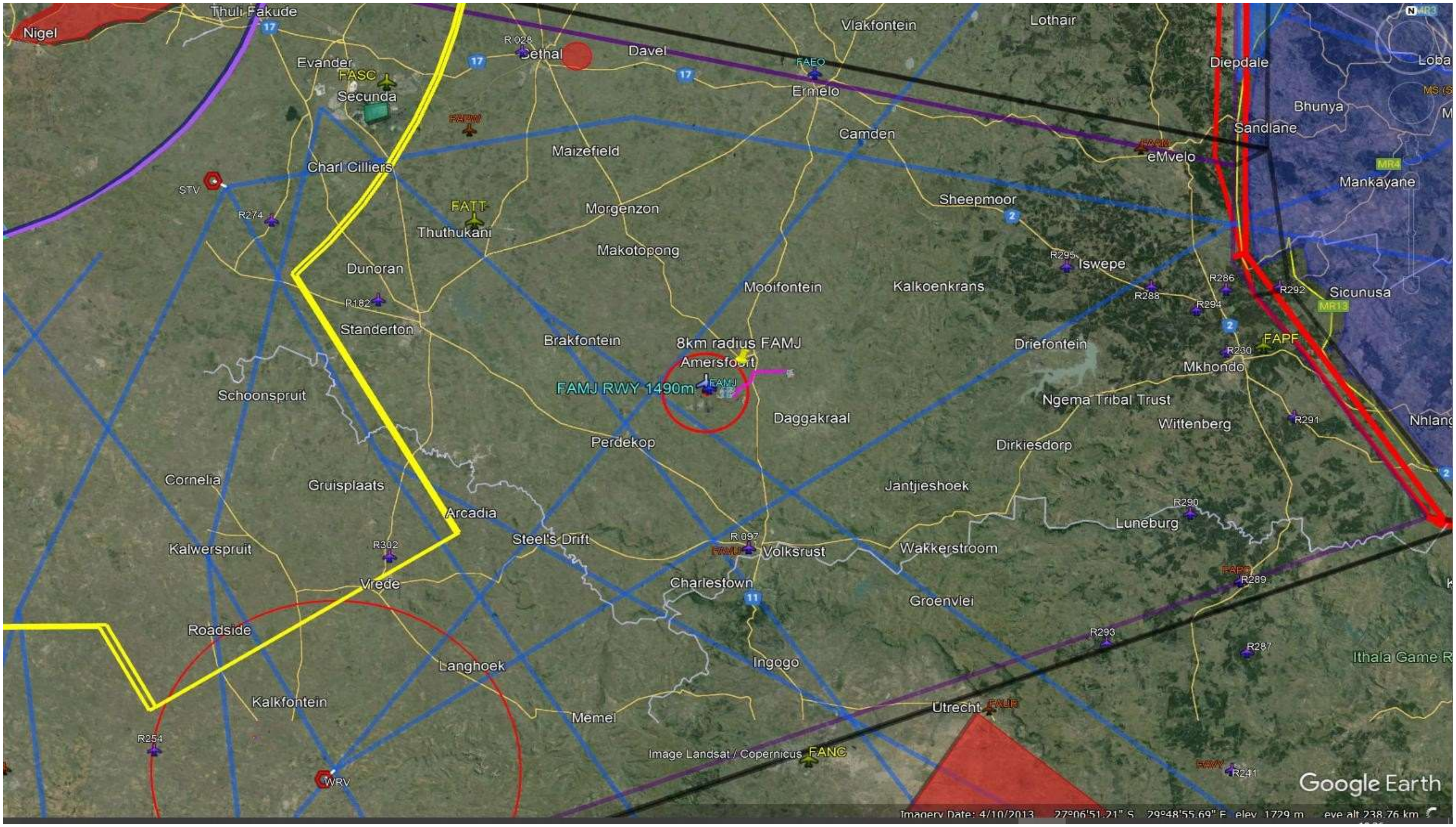



*Figure 7: Location of Renewstable® Sivutse Site relative to Regional Airspace*

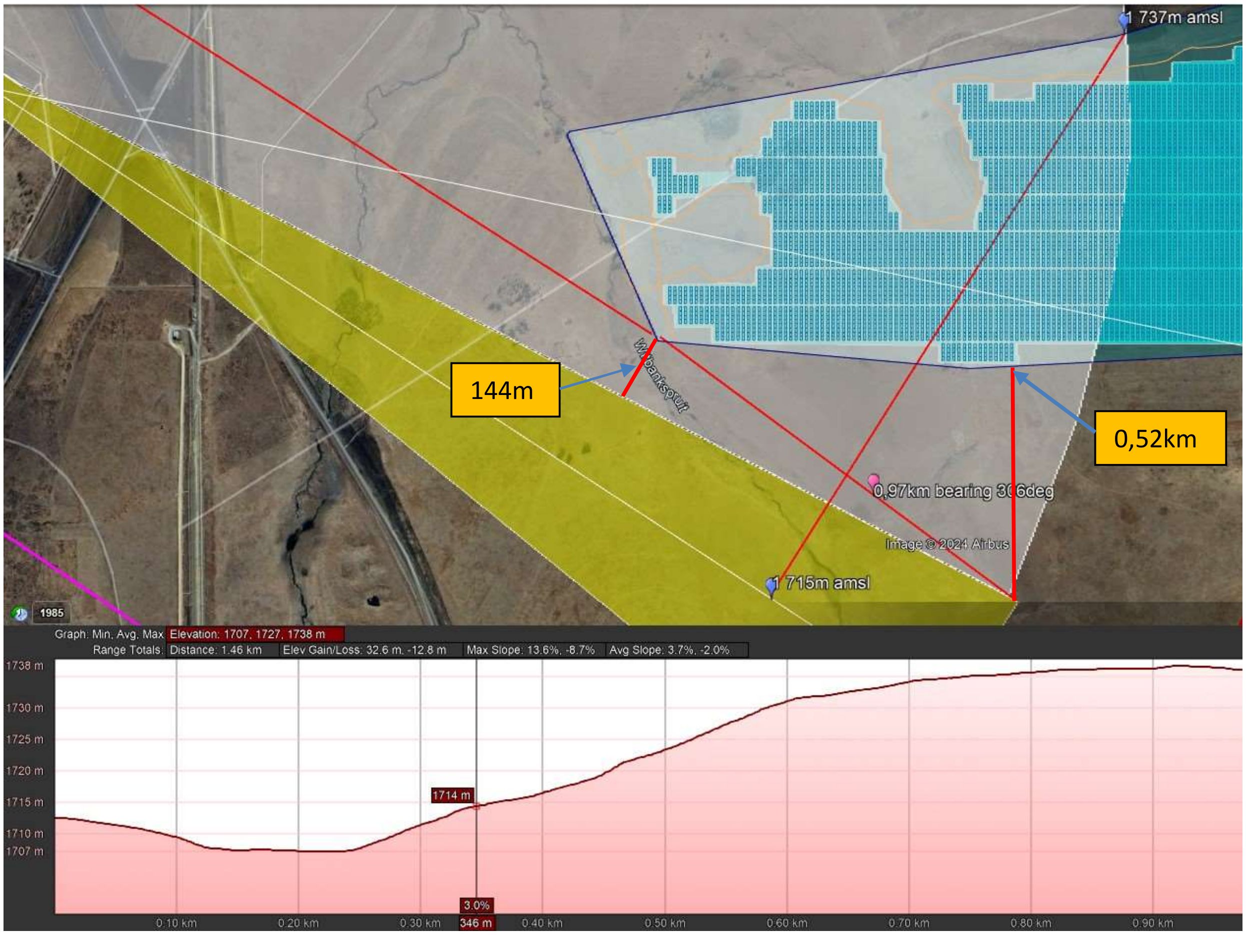



*Figure 8: Elevation Profile from Extended Runway Centreline across Sivutse Site*

### 5.1.1 Majuba Aerodrome (FAMJ) Classification

Based on site visits, SACAA AD and AIP information, the status of FAMJ is summarised below:

- The aerodrome is an unmanned aerodrome.
- FAMJ is licensed as a SACAA Category 2 aerodrome.
- Limited aerodrome services exist at FAMJ and there is no runway centreline or airfield lighting.
- The aerodrome operates under Visual Flight Rules (VFR).
- Majuba RWY 14/32 is 1 500x15m tar-surfaced with 2,5m gravel shoulders, classified as ICAO Code 2B since the RFL (reference field length) is slightly under 1 200m under optimal conditions.
- Reference altitude is 5 600ft amsl.
- Based on the Google Earth reference standards utilised for the study, the respective runway bearings are 124° and 304° with an allowance for a 10% variation in either direction on approaches or departures.
- It appears that the circuit at FAMJ is a 'left-hand' circuit, meaning that the downwind leg of all

approaches to the aerodrome will be over or close to the proposed site at a relatively low altitude

The SACAA-relevant Aerodrome Information Publication (AIP) information on FAMJ is as follows:

FAMJ AD 2.12 - 4 AERODROME DIRECTORY

FAMJ AD 2.12 RUNWAY PHYSICAL CHARACTERISTICS

| Designations RWY NR | TRUE & MAG BRG | Dimensions of RWY (M) | Strength (PCN) and surface of RWY and SWY | THR coordinates RWY end coordinates THR geoid undulation | THR elevation and highest elevation of TDZ of precision APP RWY | Slope of RWY-SWY |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 14 | NIL INFO AVBL | 1500 X 15 | ASPH LCN 40 | NIL INFO AVBL | NIL INFO AVBL | NIL INFO AVBL |
| 32 | NIL INFO AVBL | 1500 X 15 | ASPH LCN 40 | NIL INFO AVBL | NIL INFO AVBL | NIL INFO AVBL |
| SWY dimensions (M) | CWY dimensions (M) | Strip dimensions (M) | RESA dimensions (M) | Location (which runway end) and description of arresting system (if any); | OFZ | Remarks |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| NIL INFO AVBL | NIL INFO AVBL | NIL INFO AVBL | NIL INFO AVBL | NIL INFO AVBL | NIL INFO AVBL | NIL |
| NIL INFO AVBL | NIL INFO AVBL | NIL INFO AVBL | NIL INFO AVBL | NIL INFO AVBL | NIL INFO AVBL | NIL |

FAMJ AD 2.13 DECLARED DISTANCES

| RWY | TORA (M) | TODA (M) | ASDA (M) | LDA (M) |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| 14 | NIL INFO AVBL | NIL INFO AVBL | NIL INFO AVBL | NIL INFO AVBL |
| 32 | NIL INFO AVBL | NIL INFO AVBL | NIL INFO AVBL | NIL INFO AVBL |
| Remarks: NIL | | | | |

FAMJ AD 2.14 | APPROACH AND RUNWAY LIGHTING

| RWY Designator | APCH LGT Type, LEN and INTST | THR LGT Colour and WBAR | VASIS (MEHT) PAPI | TDZ, LGT LEN | RWY Centre Line LGT, LEN, Spacing, colour INTST | RWY Edge LGT, LEN, Spacing, Colour, INTST | RWY End LGT Colour and WBAR | SWY LGT LEN (m) Colour | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 14 | NIL | NIL | NIL | NIL | NIL | NIL | NIL | NIL | NIL |
| 32 | NIL | NIL | NIL | NIL | NIL | NIL | NIL | NIL | NIL |

Civil Aviation Authority 14 JUL 2022

***Figure 9: RSA AIP FAMJ Aerodrome Information***

For a Code 2 non-instrument runway ICAO Annex 14 Ch 4.2 requires the determination of Obstacle Limitation Surfaces (OLS's) as follows:

- Inner horizonal
- Conical
- Approach
- Transitional

By reference to Figures 1 to 6 and Appendices 9.4, 9.5 and 9.10 the only potentially influential ICAO OLS's are the inner horizontal and conical surfaces, since the site falls outside the approach surface. There are also other requirements imposed by the SACAA in terms of Part 139.01.30, which deals with the approval of obstacles above 45m high within 8km of aerodromes, which supersedes the ICAO conical surface.

### 5.1.2 Inner Horizontal, Conical, Transitional and SACAA 8km limitation Surfaces

Majuba (FAMJ) is a minor aerodrome at ICAO Code 2B. The nearest runway threshold of the aerodrome is located 1,35km from the Sivutse sub-project site at its nearest point (Figure 6,8).

**Inner Horizontal Surface (IHS)**

The site falls partially within the IHS footprint of FAMJ (a 2,5km radius per ICAO Annex 14 for an ICAO Aerodrome Reference Code (ARC) 2B aerodrome) and is subject to an obstacle height of 45m above the relevant runway level. Based on Figure 7, the maximum allowable height of proposed new structures will thus be 14m (1 707+45-1 738m). SACAA standards will also require the developer to comply in due course with Obstacle Approval procedures per CA139- 27, for all potential obstacles within 8km of FAMJ, once Environmental Authorisation is secured.

**Conical Surface (CS)**

The CS of FAMJ extends 1 200m beyond the inner horizontal surface (i.e. 3,7 km in total), to a total height of 105m above runway level, and therefore influences part of the subject site. However, the SACAA limit of 45m within 8km is more critical per CARS Part 139.01.30.

**Transitional Surface**

The Transitional Surface for FAMJ commences 40m from the runway centreline, at the edge of the (Code 2) runway strip, and slopes upwards at a grade of 20%, at right angles to the runway. This surface governs the height limit for any non-friable objects to a height of 45m above the runway level, beyond which the IHS governs. This occurs 265m from the runway centreline. The development site, being 1,35km east of the nearest runway threshold, is thus located outside the potential influence of the transitional surface, which generally impacts developments adjacent to the runway. At this point the SACAA object height limit of 45m governs, and there is low risk that the proposed development will penetrate this surface.

**Topographical Obstacles**

There are no significant obstacles between FAMJ and the proposed development (Figure 7,8), other than natural terrain, which has a maximum elevation of 1 737m amsl. This is 15m below the critical OLS per SACATS 139 of 1 752m amsl and there is thus no penetration of the OLS.

### 5.1.3 Approach and Take-off Climb Surfaces to RWY14/32

The critical approach surface is that to RWY32, which is 80m wide and begins 60m from the threshold of RWY32. It then extends east at a slope of 4% and a horizontal divergence of 10% for 2,5km (ICAO Annex 14 & Figure 6). The closest point of the site is 144m north of the approach surface (Figure 8) and the development will contribute no additional risk to operations at the aerodrome. Sensitivity is thus low.

### 5.1.4 Risk Assessment

Appendix 9.3 contains SACAA guidelines for assessment of risk, based on (a) the severity of risk associated with an event and (b) the likely consequence. In this case, the most severe event would be an aircraft impacting an obstacle on the project site or being affected by debris resulting from on-site activities, or the unlikely event of a major gas explosion. The assessment thus compares a 'with the development' against a 'without the development' scenario. Based on Table 3, the risk is assessed as '2A'.

***Table 3: Risk Assessment Matrix***

| RISK PROBABILITY | | RISK SEVERITY | | | | |
|---|---|---|---|---|---|---|
| | | **Catastrophic A** | **Hazardous B** | **Major C** | **Minor D** | **Negligible E** |
| **Frequent** | 5 | 5A | 5B | 5C | 5D | 5E |
| **Occasional** | 4 | 4A | 4B | 4C | 4D | 4E |
| **Remote** | 3 | 3A | 3B | 3C | 3D | 3E |
| **Improbable** | 2 | 2A | 2B | 2C | 2D | 2E |
| **Extremely Improbable** | 1 | 1A | 1B | 1C | 1D | 1E |

Appendix 9.3 also outlines the range of risk tolerability, as illustrated in Table 4. In this case, the risk tolerability is deemed 'tolerable', indicating that a degree of risk mitigation is required from the developer in terms of CATS 139.30, relating either to the development activities, the marking of obstacles and the issue of Aeronautical Information Circulars (AIC's) or NOTAM's. In the case of aircraft operating near FAMJ, the standard operating procedures (PANS/OPS) laid down in the CARS (mainly Part 91) provide for risk mitigation in the event of aircraft failure or other unexpected events, supplemented by the CATS relevant to operating of aircraft close to sites where blasting operations or other risk events are likely to occur. This scenario, however, is only likely in the future – i.e. during or after the development has been completed, when the relatively large area of the array (Table 1) informs a recommendation to amend the aerodrome operating procedures such that downwind legs no longer overfly the development.

*Table 4: Risk Tolerability Matrix*

| TOLERABILITY LEVEL | ASSESSED RISK INDEX | SUGGESTED CRITERIA |
|---|---|---|
| **Intolerable** | 5A, 5B, 5C, 4A, 4B, 3A | Unacceptable in the existing circumstances |
| **Tolerable** | 5D, 5E, 4C, 4D, 4E, 3B, 3C, 3D, 2A, 2B, 2C | Acceptable based on risk mitigation – may require a Management decision |
| **Acceptable** | 3E, 2D, 2E, 1A, 1B, 1C, 1D, 1E | Acceptable |

## 5.2 Airspace Analysis, Radar and Communications Assessment

From Fig 6, it was determined that:

- There are no civilian radar facilities within 35km of the proposed prospecting site.
- The airspace around FAMJ is uncontrolled.
- The airspace classification of the environs around FAMJ is as indicated in Fig 6.
- There are no civilian radar facilities at FAMJ.
- The closest ground-based navigational equipment is a VOR/DME array 'STV' near Standerton, some 100 km NW of the proposed facility.
- The closest commercial aerodrome is Newcastle (FANC), some 78km to the south.

The risk of any impact of the facility on nearby civilian radar installations is thus **low**.
The SACAA AIP information of FAMJ was also assessed and it was determined that there are no known ground-based navigational aids located within 15km of the development site. Risk is assessed as 1E.

*Table 5: Risk Assessment Matrix*

| RISK PROBABILITY | | RISK SEVERITY | | | | |
|---|---|---|---|---|---|---|
| | | Catastrophic<br>A | Hazardous<br>B | Major<br>C | Minor<br>D | Negligible<br>E |
| **Frequent** | 5 | 5A | 5B | 5C | 5D | 5E |
| **Occasional** | 4 | 4A | 4B | 4C | 4D | 4E |
| **Remote** | 3 | 3A | 3B | 3C | 3D | 3E |
| **Improbable** | 2 | 2A | 2B | 2C | 2D | 2E |
| **Extremely Improbable** | 1 | 1A | 1B | 1C | 1D | 1E |

Similarly, also using the Appendix 9.3 guidelines, the risk tolerability has been assessed as 'Acceptable'.

***Table 6: Risk Tolerability Matrix***

| TOLERABILITY LEVEL | ASSESSED RISK INDEX | SUGGESTED CRITERIA |
|---|---|---|
| **Intolerable** | 5A, 5B, 5C, 4A, 4B, 3A | Unacceptable in the existing circumstances |
| **Tolerable** | 5D, 5E, 4C, 4D, 4E, 3B, 3C, 3D, 2A, 2B, 2C | Acceptable based on risk mitigation – may require a Management decision |
| **Acceptable** | 3E, 2D, 2E, 1A, 1B, 1C, 1D, 1E | Acceptable |

# 6 Glint and Glare Analysis: Scope and Methodology

## 6.1 Background

The Glint and Glare (G&G) study arises because of potential risks to aviation operations at FAMJ posed by reflections of sunlight from the solar PV arrays to be installed on the Renewstable® Sivutse site. The types of reflections to be considered are specular reflections (as opposed to diffuse reflections), where the surface uniformity of the solar PV modules will result in the reflected light beams remaining relatively concentrated (Refer Appendix 9.11 for further background).

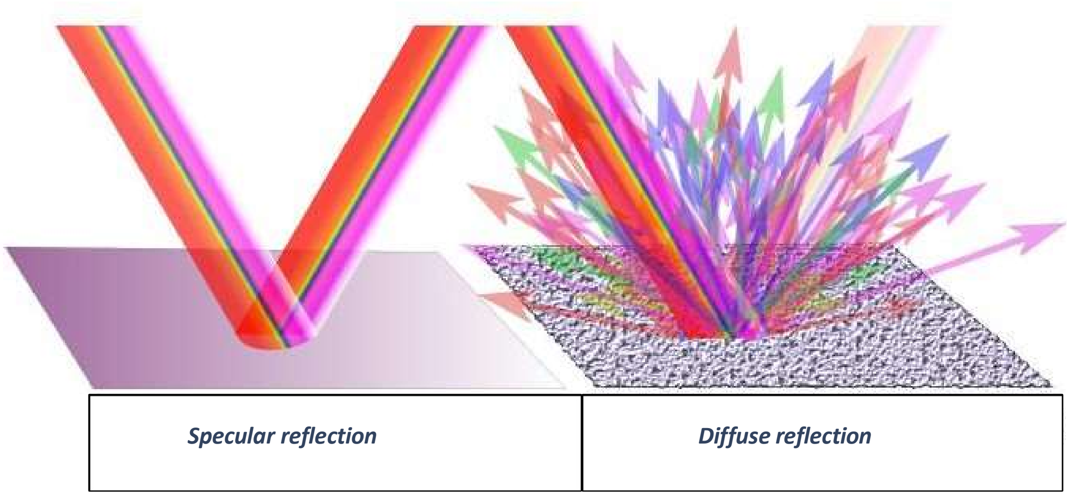



*Figure 10: Specular versus Diffuse Reflection*

'Glint' is distinguished from 'glare' based on the duration of the effect, glare being (by the generally accepted definition) a '***continuous source of bright light***' whereas glint is a '***momentary flash of bright light***'. In assessing the potential impact of the development on aviation operations at FAMJ or within proximate airspace, the main issue to consider is glint, owing to the relatively high speeds at which aircraft move.

## 6.2 G&G Methodology

The glint and glare assessment methodology has been derived from the information provided through consultation with stakeholders and by reviewing the available guidance (Appendix 9.11), summarised as follows:

- Identify aviation receptors in the area surrounding the proposed solar development.
- Consider existing direct solar impacts (glare) towards the identified receptors by undertaking geometric calculations based on the azimuth and altitude of the sun at various times of the year.

- Consider direct solar reflections (glint) from the proposed solar development towards the identified receptors by undertaking geometric calculations or scale modelling.
- Consider the visibility of the panels from the receptor's location. If the panels are not visible from the receptor, then no reflection can occur.
- Based on the results of the geometric calculations or modelling, determine whether a reflection can occur, and if so, the 'high risk' times at which it is likely to occur.
- Consider both the solar reflection from the development and the location of direct sunlight with respect to the receptor's position.
- Consider the potential reflectivity (percentage of incident light reflected) based on published studies and available industry guidance.
- Determine whether a significant detrimental impact is expected, by reference to Appendix 9.11.

## 6.3 G&G Analysis Elements

The Glint and Glare analysis comprised the following key elements:

### 6.3.1 Identification and Position of Receptors

Receptors that would potentially be affected by glint and glare effects were identified and their positions determined relative to the proposed Renewstable® Sivutse solar PV array.

### 6.3.2 Location of Site relative to Aerodrome FAMJ and Runway Alignment

The flight paths of aircraft approaching FAMJ and their movements in nearby airspace were also assessed relative to the location of the Renewstable® Sivutse solar PV array, based on additional geometric data on the bearing of the solar PV array relative to aircraft executing ICAO Code 2 approaches.

### 6.3.3 Assessment of Direct Solar Glare on Approaching Aircraft

Based on potentially 'high risk' positions of aircraft, the impact of direct solar glare on pilots of such aircraft at different times of year was determined, noting that these are pre-existing impacts that are already being mitigated and thus not related to the proposed solar PV development.

### 6.3.4 Size, Orientation and Geometric Assessment

Based on data supplied by HDF, the overall size, layout and horizontal alignment of the potentially reflective PV surfaces was determined, together with the range of vertical angular movements around an E-W axis provided for by the tracking mechanism to be implemented. This allowed a geometric assessment of the likely impacts of specular reflections on aircraft approaching FAMJ, based on the azimuth (angle between true north and the position of the sun) and elevation (vertical position of the sun relative to the horizon) at various times of day during the year, and variations in the angle of tilt of the solar arrays.

### 6.3.5 Reflective Properties and Risk Assessment

Based on precedent data and studies presented in Appendix 9.11 and a geometric analysis, the potential impact of solar reflections from proposed array was determined and compared with the risk of direct solar glare presently experienced and already being mitigated by pilots.

### 6.3.6 Surrounding land uses

The surrounding land uses for aviation purposes (any other aviation infrastructure) was also assessed in relation to potential G&G impacts.

## 6.4 Impact Assessment Standards

The following generally accepted industry standards were employed to assess the potential G&G impact on operations at FAMJ, based primarily on geometric analysis of the relative interaction between the sun and the solar PV installation at various times of day throughout the year, but also (where the geometric analysis indicates moderate or high potential impacts), other potentially contributing factors.

**Table 7: G&G Impact Standards**

| Impact Classification | Description | Mitigation |
|---|---|---|
| No Impact | A solar reflection is not geometrically possible or will not be visible by the assessed receptor. | No mitigation required |
| Low | A solar reflection is geometrically possible; however, any impact is considered to be small such that mitigation is not recommended e.g. intervening screening may limit the view of the reflecting solar panels significantly or the glint time per year is considered negligible. | No mitigation recommended |
| Moderate | A solar reflection is geometrically possible and visible; however, it occurs under conditions that do not represent a worst-case scenario e.g. a solar reflection originates from a less sensitive location. | Mitigation recommended, including screening, use of absorptive coatings, tilt angle management, restriction in hours of use of the aerodrome and suchlike. |
| High | A solar reflection is geometrically possible and visible under conditions that will produce a significant impact. | Mitigation will definitely be required as above. |

# 7 G&G Outputs

## 7.1 Receptors

Since this study is focussed specifically on the impacts of G&G on aviation activities, only aircraft operating in the vicinity of FAMJ were considered as receptors that would potentially be at risk.

Figures 6, 7, 8 and 15 reflect the location of the runway at FAMJ relative to the proposed solar PV array, plus the relevant ICAO standards, obstacle limitation surfaces and approach paths at ICAO Code 2, which commence at 2,5 km from the relevant runway threshold and assume a glide slope of 4%. Figures 15 and 16 also show the relative bearing and altitudes of identified receptors (aircraft) relative to the solar array, when commencing final approaches to FAMJ Runway 32 – based on the assumption that the primary operational mitigation available to pilots of aircraft before commencing a final approach at 2 500m from the runway threshold is to abort the approach if significant G&G risk is identified at that point i.e. when they are at an altitude of approximately 100m (300 ft) above ground level at that point (Figure 16).

Figure 15 illustrates the relative position and typical angles of incidence of the solar PV array to pilots of aircraft initiating Code 2 approaches to RWY 14. The geometric analysis following assesses the potential increase of risk attributable to G&G, over and above glare risk currently experienced by pilots operating to FAMJ.

## 7.2 General Arrangement, Location & Orientation of Solar Array

Key locational data from Table 1 applicable to the Renewstable® Sivutse site is summarised in Table 9 below. Figures 10 and 11 indicate the proposed method of linking the solar PV modules into their supporting frames and the layout of frames that make up the arrays on the site, to both reduce the shading effect of the frames on each other, and to facilitate the installation of an appropriate tracking mechanism.

***Table 8: Key Solar PV Array data for Sivutse***

| | |
|---|---|
| Closest Distance from RWY Threshold (Figure 15) | 0,52km north |
| Net Site Area excl. buffer zones (Ha) (Sivutse 'a') | 201 |
| PV Module numbers (each site) | 175 000 |
| Gross PV Array Area (Ha) @ 2,68m$^2$ / module | 94 |
| Site Coverage Ratio (%) | 34 |
| Orientation of frames | True North |

***Figure 11: Typical PV module arrangement in N-facing frame, with variable tilt about the E-W axis***

***Figure 12**: Typical Arrays oriented True North, with low angle setting sun in the*

## 7.3 Tracking Mechanism

Figures 11 – 13 illustrate the proposed tracking mechanism to be installed on the frames that make up the solar PV array, a diagram summarizing the applicable Laws of Reflection and key data relating to the position of the runway and ICAO Code 2 approaches (at 4%) relative to the solar PV array.

The array itself at each site ('a' and 'b') will comprise 175 000 modules of 2,68m$^2$ each, with several solar PV modules installed in each frame. The frames will be linked and operated by an electro-mechanical tracking mechanism that will allow the interlinked frames to be rotated about the E-W axis to a maximum angle of 60$^o$ (above the horizontal). Geometrically, at solar elevations higher than 30$^o$ (i.e. throughout the year, at this location) the tracking mechanism will allow the PV modules to directly face the sun at midday, i.e. the reflected image of the sun will be directed back towards the sun itself.

***Figure 13**: Tracking mechanism providing max 60° tilt angle to the north (i.e. about a fixed E-W axis)*

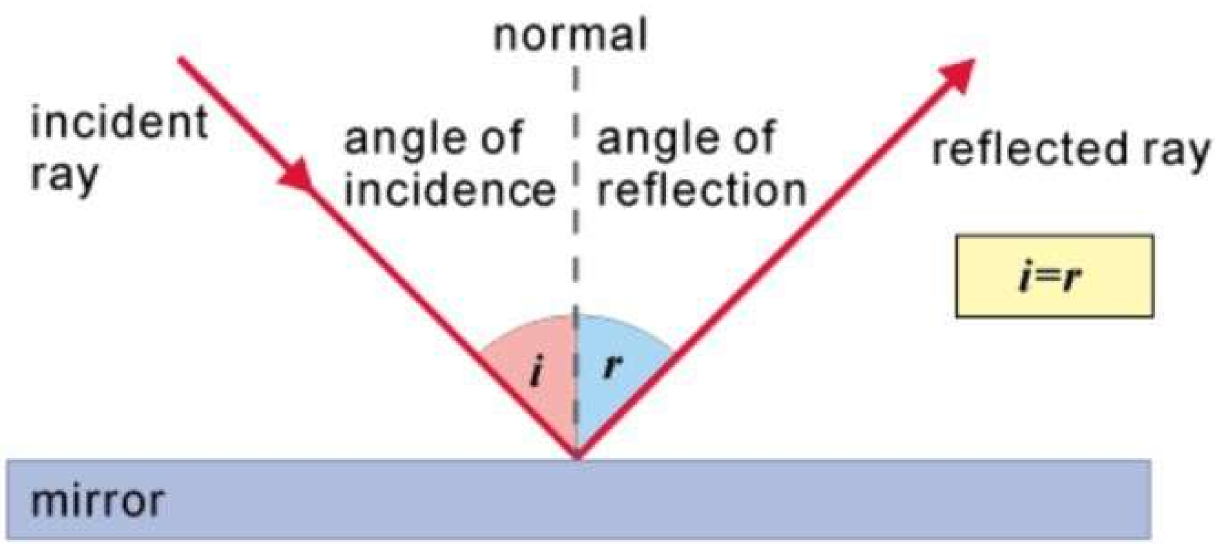



***Figure 14: Laws of Reflection***

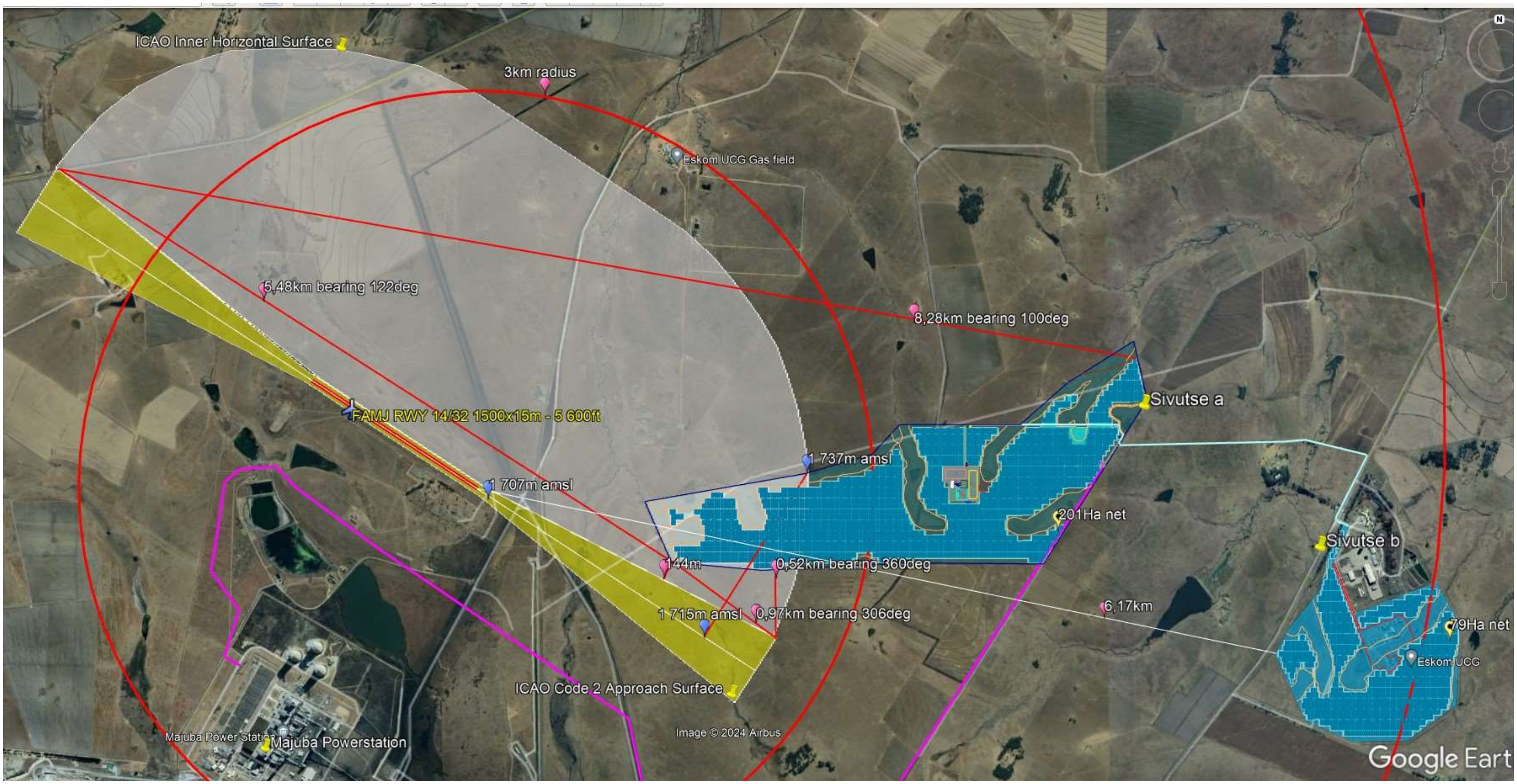



*Figure 15: Approach Surfaces to FAMJ RWY14/32 with key distances & bearings to Sivutse Solar Array*

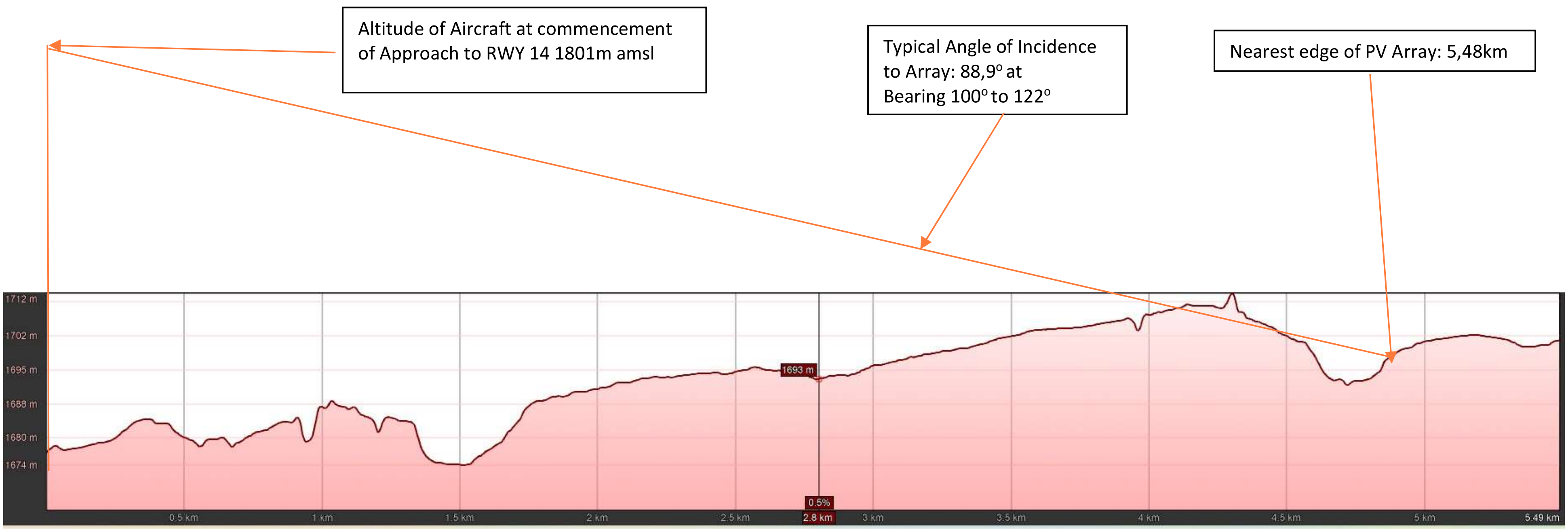



*Figure 16: Aircraft Approaching RWY 14 (W-E): Typical Geometry to Solar Array*

## 7.4 Sun Tracking

The Reference Coordinates for FAMJ are: **27° 4'43.68"** and **S 29°46'30.45"E.** Based on these coordinates, the positions of the sun at various key times of the year are tabulated in Table 9 below, the limits in the movement of the sun in the Southern Hemisphere occurring close to the summer and winter solstices. The azimuth (angle between true north and the position of the sun) and midday elevations of the sun relative to the horizontal are also recorded. Logically, the elevation of the sun at sunrise is zero, increasing to the values indicated by noon, and then decreasing again through the afternoon. Similarly, the azimuth of the sun varies throughout the morning from the indicated value at sunrise to a value of zero (true north) by noon, then back again through the afternoon to the indicated sunset value, as the sun tracks across the sky.

***Table 9: Sun Position Data at key dates during the year***

| Reference Season | Key Date | Length of Day | Sunrise/Azimuth | Midday Elevation | Sunset/Azimuth |
|---|---|---|---|---|---|
| | 6 Aug | 10:58 | 06:37 71,8° | 46,4° | 17:35 288,1° |
| Spring Equinox | 21 Sept | 12:05 | 05:51 89,8° | 62,4° | 17:56 269,9° |
| | 6 Nov | 13:16 | 05:06 108,6° | 78,5° | 18:22 251,2° |
| Summer Solstice | 21 Dec | 13:51 | 05:03 117,0° | 86,3° | 18h54 243,0° |
| | 5 Feb | 13:14 | 05:37 108,3° | 78,2° | 18h51 251,9° |
| Autumn Equinox | 21 March | 12:05 | 06:05 90,1° | 62,4° | 18h10 270,2° |
| | 6 May | 10:57 | 06:28 71,7° | 46,2° | 17h26 288,4° |
| Winter Solstice | 21 June | 10:25 | 06:49 63,9° | 39,5° | 17h15 296,1° |

## 7.5 Geometric Assessment

### 7.5.1 Approaches

Figure 15 illustrates that all approaches to FAMJ will occur along approach paths that are oriented essentially E-W, the respective runway headings being 124° (approximately southeast) and 304° (approximately northwest). The high-risk times for glint would therefore be close to sunrise and sunset, when the sun is at a low elevation and when the azimuth of the sun could place its reflected image close to the field of vision of the pilot of an approaching aircraft.

#### 7.5.1.1 Runway 14

**Direct Solar Glare:**

Approaches to RWY 14 are already affected by direct sunlight (glare) during early mornings, when the sun is close to the horizon and at azimuths that place it within the field of vision of pilots, which increase the risk of glare.

The approach path for RWY 14 is at a heading of 124$^{o}$ and the range of solar azimuths is (per Table 9) from 64 $^{o}$ (midwinter) to 117 $^{o}$ (midsummer), meaning the sun itself is offset (left) from the approach by between 60$^{o}$ and 7$^{o}$ (which is the worst case, in midsummer), when the sun is furthest south. Because of these offsets, the impact on pilot visibility of the runway threshold – and therefore risk of direct glare - is considered low and, being a pre-existing condition (since it is not affected by the future solar PV facility) is already being mitigated by pilots by wearing sunglasses and/or deploying visors in their aircraft. In isolated cases, additional mitigation is possible through a pilot decision to execute a missed approach.

**Glint:**

The question now is whether glint would materially increase pre-existing glare risk. The potential for glint depends on the position of an aircraft on approach, the azimuth of the rising sun and the reflected image of the sun off the solar PV array, which itself depends on the angle of tilt of the array to the north, which will affect the orientation of the reflected image of the sun.

Figure 15 illustrates that approaches to RWY 14 are only likely to be affected by glint during early mornings, when low angle specular reflections of the sun at high angles of incidence have the potential to create glint. However, as concluded in the references contained in Appendix 9.11.4, these high angles of incidence (typically 89$^{o}$) are likely to result in reflectivity of only about 10%, at similar offsets to those of the pre-existing solar glare, and therefore be significantly lower risk. Furthermore, approaches are initiated over 5km from the solar PV array, which is beyond the distances at which glint is generally considered high risk.

Once the solar PV array becomes operational, the tracking system will most likely be set initially at a maximum angle of 60$^{o}$, to ensure maximum possible solar gain onto the modules as the sun tracks upwards into the sky. Since the altitude of aircraft on approach (Figure 15,16) will be only approximately 100m above the level of the solar PV array, at relatively long distance and high angles of incidence, a pilot on approach would see the reflected image of the sun in the PV panels rotated 'clockwise' at an angle of twice the angle of tilt i.e. if the angle of tilt is 45deg the sun's image will be rotated by 90 deg in the opposite direction according to the laws of reflection, but always at lower intensity than and at an angle no more severe than the direct glare itself, which as discussed is already being mitigated.

A further effect of the tilting of the solar PV panels is that the range of reflected images is restricted and will become geometrically impossible at high angles of tilt, since the reflective surface of the panels increasingly is tilted away from the approaching aircraft.

Later in the mornings, as the sun climbs towards its peak elevation at noon (Table 9), the combination of increasing azimuth and high elevation will always combine to reduce any reflection (glint) concerns, especially when the array tracking mechanism is set at high angles of tilt.

#### 7.5.1.2 RWY 32

**Direct Solar Glare:**

Approaches to RWY 32 are already affected by direct sunlight (glare) during late afternoons, when the sun is close to the horizon and at azimuths that may place it within the field of vision of pilots and increase the risk of glare.

The approach path for RWY 32 is at a heading of 304° and the range of solar azimuths is (per Table 9) from 296° (midwinter) to 243° (midsummer), meaning the sun will be offset (left) from the approach by between 8° and 61°, the former being the worst case (in midwinter), when the sun is furthest north. Because of these offsets, the impact on pilot visibility of the runway threshold – and therefore risk of direct glare - is considered low and, being a pre-existing condition (since it is not affected by the future solar PV facility) is already being mitigated by pilots by wearing sunglasses or deploying visors in their aircraft. In isolated cases, additional mitigation is also possible by pilots through a decision to execute a missed approach.

**Glint:**

The potential for glint depends on the position of an aircraft on approach, the azimuth of the setting sun and the reflected image of the sun off the solar PV array, which itself will depend on the angle of tilt of the array to the north, which will affect the orientation of the reflected image of the sun.

Figure 15 illustrates that the geometry applicable to RWY 32 is significantly different to that of RWY 14 in that there are fewer situations under which glint is possible because of the location of the solar array relative to the runway threshold.

In the mornings, (Figure 15) the rising sun is effectively 'behind' any approaching aircraft until solar azimuths of nearly 90°, by which time the elevation of the sun, no matter the season, will be too high to cause any reflectivity concerns to aircraft commencing their approaches. Even under these circumstances the offsets are high enough that the reflected image of the sun would be outside the pilot's field of vision, to the right. For aircraft further away, glint reflections are not geometrically possible.

During afternoons, as the solar elevation decreases towards sunset and angles of incidence increase, glint is theoretically possible when the solar PV panels are at bearings of between 306° and 360° relative to approaching aircraft, resulting in the most severe potential offset of at least 10°. However, this would only be applicable to the extreme SW corner of the array (see Figures 8 & 15), at relatively low angles of incidence, since by later in the afternoon the sun would have moved beyond the array, making glint reflections geometrically impossible.

### 7.5.2 Take-off movements

The analysis of take-off movements is reciprocal to that of approach movements but does not warrant detailed analysis in this case because pilots operating under Part 91 of the Civil Aviation regulations always have the discretion to assess for a particular mission the likelihood of a glint event, before committing to a take-off manoeuvre. The only case where glint is geometrically possible is a departure from RWY 14 close to sunrise, where the sun itself is likely to present more of a glare obstacle to the movement than the possibility of a glint event after take-off at high angles of incidence, where the reflectivity percentage will be low.

In all cases under analysis glint impact, therefore, is considered to be low.

### 7.5.3 Overflights

#### Low Flying Aircraft and VFR operations

The proposed site is largely overflown by VFR aircraft transiting between Gauteng and the Northern parts of KZN, with a similar orientation to the FAMJ Runway. The operation of such aircraft is in accordance with the Rules of the Air as per below. Such aircraft could operate as low as 500Ft above the proposed structures and as high as FL195. Therefore, the risk for the predominant directions of flight of low flying aircraft is similar to those of RWY14 and RWY32, as per above.

#### High Flying Aircraft and IFR operations

The proposed site is at the confluence of the following RNAV (GPS defined) routes:

- Z8 – Connecting Gauteng to Northen KZN from FL200 up to FL245
- UZ8 – Connecting Gauteng to Northern KZN from FL245 up to FL460

- Q8 – Connecting Gauteng to Durban from FL200 up to FL245
- UQ8 – Connecting Gauteng to Durban from FL245 up to FL460
- Z36 – Connecting Mpumalanga to the Free State from FL200 up to FL245
- UZ36 – Connecting Mpumalanga to the Free State from FL245 to FL460
- T949 – Connecting the Free State to Mozambique from FL200 up to FL245
- UT949 – Connecting the Free State to Mozambique from FL245 up to FL460

The majority of aircraft operating in these corridors under IFR rules are typically at cruising altitudes of at least FL200 (20 000ft above mean sea level) or above when transiting in the vicinity of the proposed site and thus unlikely to be affected by Glint issues from the proposed site. The higher altitudes (the lowest being at least 14 000Ft/ 4km or higher, above all the sites) of these aircraft and the E-W orientation of this route make them unlikely to be affected by G&G issues from all the sites.

## 7.6 Glint and Glare Conclusions

The preceding analysis has clearly demonstrated that the relative position of the proposed solar PV array relative to the FAMJ runway, the sun position at various times of the year, and the potential of the proposed tracking mechanism to decrease the angles of incidence significantly, all combine to make the potential risk of glint reflections off the array significantly lower than the pre-existing glare risk presented by low angle sun itself, which is already low. The marginal risk is therefore also low and the impact under all scenarios analysed is thus considered as low, indicating that no mitigation will be required.

Notwithstanding this recommendation, mitigation options available in any event are:

- Actively utilising the tilt mechanism of the solar arrays to mitigate the risk of reflectivity by reducing the effective angle of incidence of reflections.
- Taking advantage of the common ownership of the airport property and the property on which the facility will be developed to restrict the hours of operation of the aerodrome if unforeseen concerns emerge in the future.
- Amending the approach procedures at the aerodrome to ensure that downwind approaches of the aerodrome circuit do not overfly the relatively large areas of the proposed facility.

# 8 General Recommendations

The analysis contained in this Civil Aviation Site Sensitivity Verification Study has determined:

1. The proposed development and associated ground-based infrastructure is compliant with all relevant ICAO Annex 14 and SACAA (CARS and CATS) standards with respect to obstacle limitation surfaces and can, therefore, be supported **for purposes of environmental approval**.

2. The proposed development will not materially impact civilian radar, navigation, or communications infrastructure in the environs, nor present any material additional risks to operations at Majuba Aerodrome, currently or in the future.

3. The impact of glint and glare is considered low, and no mitigation is deemed necessary other than the specific recommendations listed in 6.6.

On this basis, the recommendation of this CASSV is that the sensitivity status of the Sivutse site be amended to 'low'.

**The Way Forward**

Once Environmental Authorisation is in place and the detailed design process of the development commences, SACAA Obstacle Approval process per CA139.27 will need to be complied with and the mitigation measures recommended herein will need to be implemented, in consultation with both the Civil Aviation Authority and the owner/operators (Eskom SOC) of the Majuba Aerodrome.

# 9 Appendices

## 9.1 Glossary of Terms

The definitions listed below apply to this document.

| TERM | ACRONYM | DEFINITION |
|---|---|---|
| Aeronautical Flight Information Systems | AFIS | Wind, weather and other operational information available to aircraft operators at airfields that do not have fully-fledged control tower facilities |
| Aircraft Classification Number | ACN | An indication of runway strength requirements of aircraft, which must not exceed the corresponding Pavement Classification Number (PCN) of the airfield |
| Aeronautical Information Publication | AIP | A document published and regularly updated by the SA Civil Aviation Authority containing key details and parameters of licensed aerodromes, in accordance with the SA Civil Aviation Regulations. |
| Aeronautical Information Circular | AIC | A document 'for information only' issued by the SA Civil Aviation Authority containing basic details of aerodromes (usually) registered with the SACAA but not licensed. |
| Air Traffic Control | ATC | Air traffic control is a system of ground-based services that manages the safe and efficient movement of aircraft within controlled airspace and on the ground at airports. The primary objectives of air traffic control are to prevent collisions between aircraft, provide a safe and orderly flow of air traffic, and ensure efficient utilization of airspace and airport resources. |
| Air Traffic and Navigational Services SOC Limited | ATNS | A State-owned Enterprise formed in 1993, responsible for overall air traffic and airspace management in South Africa. |
| Airfield Ground Lighting | AGL | Lighting systems on runway, taxiways, and apron. |
| Above Mean Sea Level | AMSL | The vertical measurement of an aircraft's altitude or the elevation of a location with reference to the average sea level. It serves as a standard reference point for altitude calculations, providing a consistent baseline for navigation and airspace management. |
| Civil Aviation Regulations | CARS | A national aviation authority or civil aviation authority is a government statutory authority in each country that maintains an aircraft register and oversees the approval and regulation of civil aviation. |
| Civil Aviation Technical Standards | CATS | A set of technical standards and industry best practices to be read in conjunction with the CARS. |
| Distance Measuring Equipment | DME | Electronic distance measuring capability of VHF radio antennae. |

| | | |
|---|---|---|
| Flexible Use of Airspace | FUA | A policy of the SACAA in terms of which airspace is not unnecessarily restricted, allowing more effective use as long as safety standards are not compromised. |
| General Aviation | GA | Private, recreational, pilot training, and non-scheduled commercial air services |
| Global Navigational Satellite System | GNSS | Satellite based aircraft navigational systems relying on GPS technology |
| Integrated Development Plan | IDP | An Integrated Development Plan is a plan for an area that provides an overall framework for development. It aims to coordinate the work of local and other spheres of government in a coherent plan to improve the quality of life for all the people living in an area. |
| International Civil Aviation Organisation | ICAO | The International Civil Aviation Organization is a specialized agency of the United Nations. It changes the principles and techniques of international air navigation and fosters the planning and development of international air transport to ensure safe and orderly growth. |
| International Air Transport Association | IATA | The International Air Transport Association is a trade association of the world's airlines. Consisting of 290 airlines, primarily major carriers, representing 117 countries, the IATA's member airlines account for carrying approximately 82% of total available seat miles air traffic. |
| Instrument Meteorological Conditions | IMC | Weather conditions under which visual operation of aircraft is impossible due to industry visibility limits not being met, which require aircraft to be operated using instrument procedures. |
| Level of Service | LOS | Level of service to passengers as defined in IATA reference documents |
| Obstacle Limitation Surfaces | OLS | A set of imaginary planes or surfaces above the ground that sets limits beyond which ground-based objects may not penetrate, to preserve the operational safety of aircraft, as laid down in ICAO reference material, particularly Annex 14. |
| Passengers | PAX | Number of passengers |
| Performance Based Navigation | PBN | ICAO recommended policy to improve air traffic management through increased reliance on satellite-based navigation systems and thereby reduce aircraft-based carbon footprint through reduction in approach and 'hold' times of arriving aircraft. |
| South African Civil Aviation Authority | SACAA | The South African Civil Aviation Authority is the South African national aviation authority, overseeing civil aviation and governing investigations of aviation accidents and incidents. |
| Safety Health, and Environment | SHE | Safety Health and Environment |
| Service Level Agreement | SLA | A service-level agreement (SLA) is a commitment between a service provider and a client. The most common component of an SLA is that the services should be provided to the customer as agreed upon in the contract. |

| TERM | ACRONYM | DEFINITION |
|---|---|---|
| Request for Information | RFI | A request for information is a common business process whose purpose is to collect written information about the capabilities of various suppliers. Normally it follows a format that can be used for comparative purposes. An RFI is primarily used to gather information to help make a decision on what steps to take next. |
| Request for Proposal | RFP | A request for proposal is a document that solicits proposal, often made through a bidding process, by an agency or company interested in procurement of a commodity, service, or valuable asset, to potential suppliers to submit business proposals. |
| Remote Navigation | RNAV | Satellite based navigation systems similar to GNSS |
| Runway | RWY | According to the International Civil Aviation Organization, a runway is a "defined rectangular area on a land airport prepared for the landing and take-off of aircraft." |
| Standards and Recommended Practices | SARPS | A set of industry norms, published by ICAO and other recognised industry bodies, that determine best-practice processes and procedures as distinguished from strict regulatory requirements. |
| Threshold | THD | The defined end of a runway is marked in accordance with ICAO SARPS. |
| Visual Flight Rules | VFR | Visual flight rules are a set of regulations under which a pilot operates an aircraft in weather conditions generally clear enough to allow the pilot to see where the aircraft is going. |
| Very high-frequency omnidirectional radio antenna | VFOR | Radio antenna that provides position and directional vectoring capability to aircraft. NDB is a non-directional radio beacon. |
| Visual Meteorological Conditions | VMC | Meteorological conditions under which visual sight distances (per SACAA rules) allow flight operations to proceed under VFR without the necessity of resorting to instrument procedures. |
| Work Breakdown Structure | WBS | In project management and systems engineering, a work breakdown structure is a deliverable-oriented breakdown of a project into smaller components. It is a key project deliverable that organizes the team's work into manageable sections. |

## 9.2 26th Amendment – CATS 139.01.30

**139.01.30**

(1) A holder of an aerodrome licence shall monitor a concerned aerodrome and its surroundings to assess permanent or temporary obstacle limitation and penetration surfaces, to establish if any obstacle has an impact on the safety of aircraft operations at such aerodrome.

(2) If an assessment referred to in subregulation (1) identifies any obstacle that negatively impacts on aircraft safety, a holder of an aerodrome licence shall take appropriate action to mitigate the risk and restrict or remove such obstacle.

(3) A holder of an aerodrome licence shall not erect or allow to be erected, without the prior approval of the Director, a building, structure, or object which projects above a slope of 1 in 20 and which is within 3 000 m measured from the nearest point on a boundary of such aerodrome or heliport.

(4) An object, whether temporary or permanent, which projects above the obstacle limitation surfaces within a radius of 8 km as measured from an aerodrome reference point shall be marked as prescribed in Document SA-CATS 139.

(5) An object, whether temporary or permanent, which projects above the obstacle limitation surfaces beyond a radius of 8 km and constitutes a potential hazard to aircraft, shall be marked as prescribed in Document SA-CATS 139.

(6) A holder of an aerodrome licence shall not erect or allow to be erected, without the prior approval of the Director, a building or object which constitutes an obstruction or potential hazard to an aircraft operating in a navigable airspace in the vicinity of an aerodrome, or navigation aid, or which will adversely affect the performance of a radio navigation or ILS.

(7) A holder of an aerodrome licence shall not erect or allow to be erected, without the prior approval of the Director, an object higher than 45 m above the

mean level of a landing area or within 8 km measured from the nearest point on a boundary of an aerodrome.

(8) A holder of an aerodrome licence shall not erect or allow to be erected, without the prior approval of the Director a building, structure, or object which projects above a slope of 1 in 20 and which is within 3 000 m measured from the nearest point on a boundary of an aerodrome or heliport.

(9) A holder of an aerodrome licence shall not erect or allow to be erected, without the prior approval of the Director, a building, structure or other object which will project above the obstacle limitation surfaces of an aerodrome or heliport.

(10) A person or authority involved in land development, shall not compromise air safety by authorising or developing any land or erecting a building or obstacle on such land.";

(d) the insertion in Subpart 2 in the arrangements of regulations of the following Subpart:

**"SUBPART 2: LICENSING AND OPERATION OF AERODROMES**

139.02.1 Requirements for licence

139.02.2 Application for licence or amendment thereof

139.02.3 Processing of application for licence or amendment thereof

139.02.4 Adjudication of application for licence or amendment thereof

139.02.5 **[Issuing]** Issuance of licence

139.02.6 Period of validity

139.02.7 Transferability

139.02.8 Renewal of licence

139.02.9 Licence of intent

139.02.10 Aerodrome design requirements

182

## 9.3 SACAA Technical Guidance Material: Aeronautical Studies

SOUTH AFRICAN CIVIL AVIATION AUTHORITY

# TECHNICAL GUIDANCE MATERIAL
## for Conducting Aeronautical Studies or Risk Assessment Advisory Circular

**SUBJECT:** **GUIDANCE ON CODUCTING AERONAUTICAL STUDIES OR RISK ASSESSMENT**

**EFFECTIVE DATE:** **11 JANUARY 2022**

**APPLICABILITY**

An Aeronautical study or risk assessment may be carried out when aerodrome standards cannot be met as a result of development. Such a study is most frequently undertaken during the planning of a new airport or during the certification of an existing aerodrome.

**PURPOSE**

An aeronautical study is conducted to assess the impact of deviations from the aerodrome standards specified in Volume Ito Annex 14 to the Convention on International Civil Aviation, SACAR 139 and Part 11; to present alternative means of ensuring the safety of aircraft operations, to estimate the effectiveness of each alternative and to recommend procedures to compensate for the deviation.

**1. REFERENCE:**

i. ICAO Annex 14 – Volume 1
ii. ICAO Doc 9774 -Manual on Certification of Aerodromes
iii. ICAO Doc 9734 - Safety Oversight Manual
iv. ICAO Doc 9859 -Safety Management Manual
v. Civil Aviation Regulation Part 11- Subpart 4 Procedure for granting of Exemptions and Recognition of Alternative means of Compliance
vi. Civil Aviation Regulation Part 139 -Aerodromes and Heliports
vii. Civil Aviation Regulation Part 140 -Safety Management

**2. TERMS AND ABBREVIATIONS:**

| TERM | DEFINITION |
|---|---|
| **Risk mitigation** | The process of incorporating defences or preventive controls to lower the severity and/or likelihood of a hazard's projected consequence. |
| **Safety risk -** | The predicted probability and severity of the consequences or outcomes of a hazard. |

| ABBREVIATION | DESCRIPTION |
|---|---|

| TGM: Conducting aeronautical studies or risk assessment | New: 11 January 2022 | Page 1 of 8 |
|---|---|---|

| | |
|---|---|
| ATS | Air Traffic Services |
| CAR | Civil Aviation Regulation |
| DCA | Director of Civil Aviation |
| GA | General Aviation |
| ICAO | International Civil Aviation Authority |
| SACAA | South African Civil Aviation Authority |
| SACAR | South African Civil Aviation Regulation |
| M: ADO | Manager: Aerodrome Operations |
| E: AI | Executive: Aviation Infrastructure |
| SM: ADFA | Senior Manager: Aerodromes and Facilities |

## 3. TECHNICAL ANALYSIS

3.1 Technical analysis will provide justification for a deviation on the grounds that an equivalent level of safety can be attained by other means. It is generally applicable in situations where the cost of correcting a problem that violates a standard is excessive but where the unsafe effects of the problem can be overcome by some procedural means which offers both practical and reasonable solutions.

3.2 In conducting a technical analysis, inspectors will draw upon their practical experience and specialised knowledge or consult other specialists in relevant areas.

3.3 When considering alternative procedures in the deviation approval process, it is essential to bear in mind the safety objective of the CAR 139 and the applicable standards so that the intent of the regulations is not circumvented.

## 4. APPROVAL OF DEVIATIONS

4.1 In some instances, the only reasonable means of providing an equivalent level of safety is to adopt suitable procedures and to require, as a condition of certification, that cautionary advice be published in the appropriate AIS publications.

4.2 The determination to require caution will be primarily dependent on two considerations:

4.2.1 A pilot's need to be made aware of potentially hazardous conditions; and

4.2.2 The responsibility of the DCA to publish deviations from standards that would otherwise be assumed under certificate status.

## 5. AERONAUTICAL STUDY

5.1 An aeronautical study is a tool used to review aerodrome and airspace processes and procedures to ensure that safety criteria in place are appropriate. The study can be undertaken in a variety of ways using various analytical methods appropriate to the aeronautical study requirements. An aeronautical study should include the use of:

5.1.1 current state review (baseline position)

5.1.2 quantifiable data analysis

5.1.3 stakeholder interviews

5.1.4 safety/risk matrix

5.2 In general, an aeronautical study should be viewed as providing an overarching document giving a holistic view of an aerodrome's operational environment e.g., the macro perspective as compared to a safety case study which is a task specific document e.g., the micro view.

5.3 An aeronautical study may contain many elements; however, risk assessment, risk mitigation and risk elimination are key components.

5.4 An aeronautical study can be undertaken at any time. It is constructed to consider all relevant factors, including traffic volume, mix and distribution, weather, aerodrome role, aerodrome and airspace configuration, surface activity and the efficiency requirements of operators using the service. The scope of studies can range from minor adjustments to aerodrome configuration, e.g., from the widening of a taxiway to a complete review of aerodrome airspace with the introduction of a new runway.

5.5 The scope of an aeronautical study usually reflects one of three situations:

5.5.1 the existing operation, e.g., the aerodrome, airspace or ATS (or sometimes just a particular part of the operation);

5.5.2 a change to the existing operation;

5.5.3 a new operation.

5.6 Where the aeronautical study is used to consider a change to existing operations or a new operation, it may not initially be possible to provide all the safety assessment and evidence required. An aeronautical study can identify and evaluate aerodrome service options, including service increases or decreases or the introduction or termination of services (such as the introduction of a rapid exit taxiway or removal of a grass runway).

5.7 The goal of risk management in an aeronautical study is to identify risks and take appropriate action to minimise risk as much as is reasonably practicable. Decisions made in respect of risks must balance the technical aspects of risk with the social and moral considerations that often accompany such issues.

5.8 These decisions may have significant impact on an aerodrome's operation and for an effective outcome there should be a level of consensus as to their acceptability among the key stakeholders.

5.9 Aerodrome operators should also undertake aeronautical studies when the aerodrome operating environment changes. These changes are normally precipitated by a trigger event such as a change, or a proposed change in; airspace design, aircraft operations, aerodrome infrastructure or the provision of an air traffic service.

5.10 It is the aeronautical study process that determines the site-specific need for services, and identifies and recommends a course of action, or presents options for decision makers to act upon. In all cases the aeronautical study should document and demonstrate the site-specific need and rationale for the level of service, procedure design or operational requirements.

## 6. TRIGGER FACTORS

6.1 The aeronautical study is a tool for the aerodrome management to use as part of its operations and strategic planning and is an integral part of the aerodrome's Safety Management Systems.

6.2 One of the purposes of the aeronautical study is to determine levels of operational safety, service or procedures that should apply at a particular location. The decision to undertake this type of study may be triggered by any one or more of a wide range of factors.

6.3 These may include changes to:

6.3.1 The number of movements;

6.3.2 the peak traffic periods;

6.3.3 the ratio of IFR to VFR traffic;

6.3.4 the type of operations - scheduled, General Aviation (GA), training, etc.;

6.3.5 the types, and variety of types, of aircraft using the aerodrome (jet, turboprop, rotary, etc.);

6.3.6 aerodrome layout;

6.3.7 aerodrome management structure;

6.3.8 runway or taxiway and associated manoeuvring areas;

6.3.9 operations of a neighbouring aerodrome or adjacent airspace.

6.4 Feedback about any changes should be sought from aviation stakeholders including pilots, individuals, and other representative groups as part of the study.

6.5 An aeronautical study may be initiated by an aerodrome operator, or another interested party, such as an air traffic service provider or air operators.

## 7. THE CONCEPT OF RISK

7.1 Risk Management is a key area in an aeronautical study. ICAO Doc 9859: Safety Management Manual defines risk as following:

7.1.1 **Risk mitigation** - The process of incorporating defences or preventive controls to lower the severity and/or likelihood of a hazard's projected consequence.

7.1.2 **Safety risk** - The predicted probability and **severity** of the consequences or outcomes of a hazard.

## 8. SAFETY RISK

Safety risk management is also a key component of safety management system and aeronautical study. The term safety risk management is meant to differentiate this function from the management of financial risk, legal risk, economic risk and so forth. This section presents the fundamentals of safety risk and includes the following topics:

A. Definition of Safety Risk;
B. Safety Risk Probability;
C. Safety Risk Severity;
D. Safety Risk Tolerability; and
E. Safety Risk Management.

8.1 Definition of Safety risk:
Safety risk is the projected likelihood and severity of the consequence or outcome from an existing hazard or situation. While the outcome may be an accident, an "intermediate unsafe event/consequence" may be identified as "the most credible outcome".

8.2 Safety Risk Probability: (How likely is it that it will occur?)
The process of controlling safety risks starts by assessing the probability that the consequences of hazards will materialize during aviation activities performed by the organization. Safety risk probability is defined as the likelihood or frequency that a safety consequence or outcome might occur. The determination of likelihood can be aided by questions such as:

8.2.1 Is there a history of occurrences similar to the one under consideration, or is this an isolated occurrence?
8.2.2 What other equipment or components of the same type might have similar defects?
8.2.3 How many personnel are following, or are subject to, the procedures in question?
8.2.4 What percentage of the time is the suspect equipment or the questionable procedure in use?
8.2.5 To what extent are there organizational, managerial or regulatory implications that might reflect larger threats to public safety?

Any factors underlying these questions will help in assessing the likelihood that a hazard may exist, taking into consideration all potentially valid scenarios. The determination of likelihood can then be used to assist in determining safety risk probability. The table below presents a typical safety risk probability table, in this case, a five-point table. The table includes five categories to denote the probability related to an unsafe event or condition, the description of each category, and an assignment of a value to each category.

| LIKELIHOOD | MEANING | VALUE |
|---|---|---|
| Frequent | Likely to occur many times (has occurred frequently) | 5 |
| Occasional | Likely to occur sometimes (has occurred frequently) | 4 |
| Remote | Unlikely to occur, but possible (has occurred rarely) | 3 |
| Improbable | Very unlikely to occur (not known to have occurred) | 2 |
| Extremely Improbable | Almost inconceivable that the event will occur | 1 |

**Table1: Safety Risk Probability**

8.3 Safety Risk Severity

Once the probability assessment has been completed, the next step is to assess the safety risk severity, taking into account the potential consequences related to the hazard. Safety risk severity is defined as the extent of harm that might reasonably occur as a consequence or outcome of the identified hazard. The severity assessment can be based upon:

8.3.1 **Fatalities/Injury:** - How many lives may be lost (employees, passengers, bystanders, and the general public)?

8.3.2 **Damage:** - What is the likely extent of aircraft, property or equipment damage?

The severity assessment should consider all possible consequences related to an unsafe condition or object, taking into account the worst foreseeable situation. Table 2 presents a typical safety risk severity table. It includes five categories to denote the level of severity, the description of each category, and the assignment of a value to each category. As with the safety risk probability table, this table is an example only.

| SEVERITY | MEANING | VALUE |
|---|---|---|
| CATASTROPHIC | • Equipment destroyed<br>• Multiple deaths | A |
| HAZARDOUS | • A large reduction in safety margins, physical distress or a workload such that the operators cannot be relied upon to perform their task accurately or completely.<br>• Serious injury<br>• Major equipment damage | B |
| MAJOR | • A significant reduction in safety margins, a reduction in the ability of the operators to cope with adverse operating conditions as a result of increase in workload, or as a result of conditions impairing their efficiency.<br>• Serious incident<br>• Injury to persons | C |
| MINOR | • Nuisance<br>• Operating limitations<br>• Use of emergency procedures<br>• Minor incident | D |
| NEGLIGIBLE | • Little consequences | E |

**Table 2: Safety Risk Severity**

8.4 Risk assessment

Risks are the potential adverse consequences of a hazard and are assessed in terms of their severity and probability. Thus, for each hazard resulting from the non-compliance, one can now describe the risk by placing the combination of severity and probability in the Risk assessment matrix table shown below. If the risk comes out as medium or above, risk reduction measures must be identified.

| RISK PROBABILITY | | RISK SEVERITY | | | | |
|---|---|---|---|---|---|---|
| | | Catastrophic A | Hazardous B | Major C | Minor D | Negligible E |
| Frequent | 5 | 5A | 5B | 5C | 5D | 5E |
| Occasional | 4 | 4A | 4B | 4C | 4D | 4E |
| Remote | 3 | 3A | 3B | 3C | 3D | 3E |
| Improbable | 2 | 2A | 2B | 2C | 2D | 2E |
| Extremely improbable | 1 | 1A | 1B | 1C | 1D | 1E |

**Table 3: Risk Assessment Matrix Table**

As can be seen from the risk classification matrix, risk reduction measures can aim towards either reducing the likelihood of an occurrence or reducing the probability of an occurrence.

The first priority should always be to seek measures that will reduce the likelihood of an occurrence (i.e. accident prevention). When contemplating mitigating measures, it is always necessary to look to the intent of the requirement that is not (fully) complied with.

8.5 Risk mitigation strategies may include:

8.5.1 revision of the system design;

8.5.2 modification of operational procedures;

8.5.3 changes to staffing arrangements;

8.5.4 training of personnel to deal with the hazard;

8.5.5 development of emergency and/or contingency arrangements and plans;

8.5.6 ultimately, ceasing operation.

8.6 Safety Risk Tolerability

The safety risk probability and severity assessment process can be used to derive a safety risk index. The index created through the methodology described above consists of an alphanumeric designator, indicating the combined results of the probability and severity assessments. The respective severity/probability combinations are presented in the safety risk assessment matrix in table 3.

The third step in the process is to determine safety risk tolerability. First, it is necessary to obtain the indices in the safety risk assessment matrix. For example, consider a situation where a safety risk probability has been assessed as occasional (4), and safety risk severity has been assessed as hazardous (B). The composite of probability and severity (4B) is the safety risk index of the consequence.

The index obtained from the safety risk assessment matrix must then be exported to a safety risk tolerability matrix (Table 4) that describes the tolerability criteria for the particular organization. Using the example above, the criterion for safety risk assessed as 4B falls in the "unacceptable under the existing circumstances" category. In this case, the safety risk index of the consequence is unacceptable.

8.6.1 The organization must therefore:

a) Take measures to reduce the organization's exposure to the particular risk, i.e., reduce the likelihood component of the risk index;

b) Take measures to reduce the severity of consequences related to the hazard, i.e., reduce the severity component of the risk index; or

c) Cancel the operation if mitigation is not possible.

| TOLERABILITY DESCRIPTION | ASSESSED RISK INDEX | SUGGESTED CRITERIA |
| --- | --- | --- |
| Intolerable | 5A, 5B, 5C<br>4A, 4B, 3A | Unacceptable in the existing circumstances. |
| Tolerable | 5D, 5E,<br>4C, 4D, 4E,<br>3B, 3C, 3D,<br>2A, 2B, 2C | Acceptable based on risk mitigation. It may require Management decision. |
| Acceptable | 3E, 2D, 2E,<br>1B, 1C, 1D, 1E | Acceptable |

**Table 4: Safety Risk Tolerability Matrix**

8.7 Example of an Aeronautical Study Methodology

A generic model of an Aeronautical Study methodology consists of initiation, preliminary analysis, risk estimation; risk evaluation, risk control and action or monitoring.

8.7.1 **STEP 1:** Initiation

This step consists of defining the opportunity or problem and the associated risk issues; setting up the risk management team; and beginning to identify potential users who may be affected by any change.

8.7.2 **STEP 2:** Preliminary Analysis

The second step consists of defining the basic dimensions of the risk problem and undertaking an initial identification, analysis and evaluation of potential risks. This preliminary evaluation will help determine:

a) whether a situation exists that requires immediate action;
b) whether the matter requires further study prior to any action being taken; or,
c) whether the analysis should be ended as the risk problem is determined not to be an issue.

8.7.3 **STEP 3 and 4:** Risk Estimation

These steps estimate the degree of risk. Step 3 estimates the severity of the consequences and step 4 estimates the probability of their occurrence.

8.7.4 **STEP 5:** Risk Evaluation

The benefits and operational costs of the activity are integrated into the analysis and the risk is evaluated in terms of the safety implications of the activity and of the needs, issues, and concerns of affected users.

8.7.5 **STEP 6**: Risk Control

This step identifies feasible risk controls and mitigations which will act to reduce either the probability of the event or the consequence of the event should it occur.

8.7.6 **STEP 7:** Action or Monitoring

This step entails implementing the chosen risk control options, evaluating the effectiveness of the risk management decision process, and implementing an on-going monitoring program.

**9. Acceptance by the SACAA**

The Aeronautical Study and Risk assessment results need to be submitted to SACAA for the granting of exemptions.

| | | |
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| **DEVELOPED BY:** | | |
| | **VICTRESS MASHAVA** | **11 JANUARY 2021** |
| **SIGNATURE OF M: ADO** | **NAME IN BLOCK LETTERS** | **DATE** |
| **REVIEWED & VALIDATED BY:** | | |
| | **NELSON NKABITI** | **11 JANUARY 2021** |
| **SIGNATURE OF SM: ADFA** | **NAME IN BLOCK LETTERS** | **DATE** |
| **APPROVED BY:** | | |
| | **GAWIE BESTBIER** | **11 JANUARY 2021** |
| **SIGNATURE OF E: AI** | **NAME IN BLOCK LETTERS** | **DATE** |

**END**

## 9.4 ICAO Annex 14: Table 4-1

**Table 4-1. Dimensions and slopes of obstacle limitation surfaces — Approach runways**

APPROACH RUNWAYS

| | RUNWAY CLASSIFICATION | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Non-instrument Code number | | | | Non-precision approach Code number | | | Precision approach category I Code number | | Precision approach category II or III Code number |
| Surface and dimensions[a] | 1 | 2 | 3 | 4 | 1,2 | 3 | 4 | 1,2 | 3,4 | 3,4 |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
| CONICAL | | | | | | | | | | |
| Slope | 5% | 5% | 5% | 5% | 5% | 5% | 5% | 5% | 5% | 5% |
| Height | 35 m | 55 m | 75 m | 100 m | 60 m | 75 m | 100 m | 60 m | 100 m | 100 m |
| INNER HORIZONTAL | | | | | | | | | | |
| Height | 45 m | 45 m | 45 m | 45 m | 45 m | 45 m | 45 m | 45 m | 45 m | 45 m |
| Radius | 2 000 m | 2 500 m | 4 000 m | 4 000 m | 3 500 m | 4 000 m | 4 000 m | 3 500 m | 4 000 m | 4 000 m |
| INNER APPROACH | | | | | | | | | | |
| Width | — | — | — | — | — | — | — | 90 m | 120 m[e] | 120 m[e] |
| Distance from threshold | — | — | — | — | — | — | — | 60 m | 60 m | 60 m |
| Length | — | — | — | — | — | — | — | 900 m | 900 m | 900 m |
| Slope | | | | | | | | 2.5% | 2% | 2% |
| APPROACH | | | | | | | | | | |
| Length of inner edge | 60 m | 80 m | 150 m | 150 m | 140 m | 280 m | 280 m | 140 m | 280 m | 280 m |
| Distance from threshold | 30 m | 60 m | 60 m | 60 m | 60 m | 60 m | 60 m | 60 m | 60 m | 60 m |
| Divergence (each side) | 10% | 10% | 10% | 10% | 15% | 15% | 15% | 15% | 15% | 15% |
| First section | | | | | | | | | | |
| Length | 1 600 m | 2 500 m | 3 000 m | 3 000 m | 2 500 m | 3 000 m | 3 000 m | 3 000 m | 3 000 m | 3 000 m |
| Slope | 5% | 4% | 3.33% | 2.5% | 3.33% | 2% | 2% | 2.5% | 2% | 2% |
| Second section | | | | | | | | | | |
| Length | — | — | — | — | — | 3 600 m[b] | 3 600 m[b] | 12 000 m | 3 600 m[b] | 3 600 m[b] |
| Slope | — | — | — | — | — | 2.5% | 2.5% | 3% | 2.5% | 2.5% |
| Horizontal section | | | | | | | | | | |
| Length | — | — | — | — | — | 8 400 m[b] | 8 400 m[b] | — | 8 400 m[b] | 8 400 m[b] |
| Total length | — | — | — | — | — | 15 000 m | 15 000 m | 15 000 m | 15 000 m | 15 000 m |
| TRANSITIONAL | | | | | | | | | | |
| Slope | 20% | 20% | 14.3% | 14.3% | 20% | 14.3% | 14.3% | 14.3% | 14.3% | 14.3% |
| INNER TRANSITIONAL | | | | | | | | | | |
| Slope | — | — | — | — | — | — | — | 40% | 33.3% | 33.3% |
| BALKED LANDING SURFACE | | | | | | | | | | |
| Length of inner edge | — | — | — | — | — | — | — | 90 m | 120 m[e] | 120 m[e] |
| Distance from threshold | — | — | — | — | — | — | — | c | 1 800 m[d] | 1 800 m[d] |
| Divergence (each side) | — | — | — | — | — | — | — | 10% | 10% | 10% |
| Slope | — | — | — | — | — | — | — | 4% | 3.33% | 3.33% |

a. All dimensions are measured horizontally unless specified otherwise.
b. Variable length (see 4.2.9 or 4.2.17).
c. Distance to the end of strip.
d. Or end of runway whichever is less.
e. Where the code letter is F (Table 1-1), the width is increased to 140 m except for those aerodromes that accommodate a code letter F aeroplane equipped with digital avionics that provide steering commands to maintain an established track during the go-around manoeuvre.

*Note.— See Circulars 301 and 345, and Chapter 4 of the PANS-Aerodromes, Part I (Doc 9981) for further information.*

## 9.5 ICAO Annex 14: Table 4-2

**Table 4-2. Dimensions and slopes of obstacle limitation surfaces**

RUNWAYS MEANT FOR TAKE-OFF

| Surface and dimensions[a] (1) | Code number 1 (2) | 2 (3) | 3 or 4 (4) |
|---|---|---|---|
| TAKE-OFF CLIMB | | | |
| Length of inner edge | 60 m | 80 m | 180 m |
| Distance from runway end[b] | 30 m | 60 m | 60 m |
| Divergence (each side) | 10% | 10% | 12.5% |
| Final width | 380 m | 580 m | 1 200 m<br>1 800 m[c] |
| Length | 1 600 m | 2 500 m | 15 000 m |
| Slope | 5% | 4% | 2%[d] |

a. All dimensions are measured horizontally unless specified otherwise.
b. The take-off climb surface starts at the end of the clearway if the clearway length exceeds the specified distance.
c. 1 800 m when the intended track includes changes of heading greater than 15° for operations conducted in IMC, VMC by night.
d. See 4.2.24 and 4.2.26.

## 9.6 DFFE Protocol 320

Published in Government Notice **No. 320** GOVERNMENT GAZETTE **43110** 20 MARCH 2020

GAZETTED FOR IMPLEMENTATION

### CIVIL AVIATION

**PROTOCOL FOR THE SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS FOR ENVIRONMENTAL IMPACTS ON CIVIL AVIATION INSTALLATIONS**

**1. SCOPE**

This protocol provides the criteria for the specialist assessment and minimum report content requirements for impacts on civil aviation installations for activities requiring environmental authorisation. This protocol replaces the requirements of Appendix 6 of the Environmental Impact Assessment Regulations[1].

The assessment and reporting requirements of this protocol are associated with the level of sensitivity identified by the national web based environmental screening tool (screening tool).

The screening tool can be accessed at: https://screening.environment.gov.za/screeningtool.

**2. SITE SENSITIVITY VERIFICATION AND MINIMUM REPORT CONTENT REQUIREMENTS**

Prior to commencing with a specialist assessment, the current use of the land and the potential environmental sensitivity of the site under consideration as identified by the screening tool must be confirmed by undertaking a **site sensitivity verification**.

2.1. The site sensitivity verification must be undertaken by an environmental assessment practitioner or specialist with expertise in radar.

2.2. The site sensitivity verification must be undertaken through the use of:
- (a) a desk top analysis, using satellite imagery;
- (b) a preliminary on-site inspection; and
- (c) any other available and relevant information.

2.3. The outcome of the site sensitivity verification must be recorded in the form of a report that:
- (a) confirms or disputes the current use of the land and environmental sensitivity as identified by the screening tool, such as new developments or infrastructure etc.;
- (b) contains a motivation and evidence (e.g. photographs) of either the verified or different use of the land and environmental sensitivity; and
- (c) is submitted together with the relevant assessment report prepared in accordance with the requirements of the Environmental Impact Assessment Regulations.

**3. SPECIALIST ASSESSMENT AND MINIMUM REPORT CONTENT REQUIREMENTS**

| TABLE 1: ASSESSMENT AND REPORTING OF IMPACTS ON CIVIL AVIATION INSTALLATIONS |
| --- |
| **1. General Information**<br><br>1.1. An applicant intending to undertake an activity identified in the scope of this protocol for which a specialist assessment has been identified on the screening tool:<br>1.1.1. on a site identified as being of: |

1.1.1.1. "very high", "high" or "medium" sensitivity for civil aviation, must submit a **Civil Aviation Compliance Statement;** or

1.1.1.2. "low" sensitivity, no further assessment requirements are identified.

1.1.2. on a site where the information gathered from the site sensitivity verification differs from the designation of "very high", "high" or "medium" sensitivity on the screening tool and it is found to be of a "low" sensitivity, no further assessment requirements are identified;

1.1.3. similarly, on a site where the information gathered from the initial site sensitivity verification differs from the designation of "low" sensitivity on the screening tool and it is found to be of a "very high", "high" or "medium" sensitivity, a **Civil Aviation Compliance Statement** must be submitted; and

1.1.4. If any part of the proposed development footprint falls within an area of "very high", "high" or "medium" sensitivity, the assessment and reporting requirements prescribed for the "very high", "high" and "medium" sensitivity apply to the entire footprint. In the context of this protocol, development footprint means the area on which the proposed development will take place and includes any area that will be disturbed.

<table>
<tr>
<td>VERY HIGH SENSITIVITY RATING - high likelihood for significant negative impacts on the civil aviation installation that cannot be mitigated. In-depth assessment of the potential impacts are likely to be required before development can be considered in these areas.<br><br>HIGH SENSITIVITY RATING - potential for negative impacts on the civil aviation installation that can potentially be mitigated. Further assessment may be required to investigate potential impacts and mitigation measures.<br><br>MEDIUM SENSITIVITY RATING - low potential for negative impacts on the civil aviation installation, and if there are impacts there is a high likelihood of mitigation. Further assessment of the potential impacts may not be required.</td>
<td>2. Civil Aviation Compliance Statement<br><br>2.1. The compliance statement must be prepared by an environmental assessment practitioner or a specialist with expertise in radar.<br><br>2.2. The compliance statement must:<br>2.2.1. be applicable to the preferred site and the proposed development footprint;<br>2.2.2. confirm the sensitivity rating for the site; and<br>2.2.3. indicate whether or not the proposed development will have an unacceptable impact on civil aviation installations.<br><br>2.3. The compliance statement must contain, as a minimum, the following information:<br>2.3.1. contact details of the environmental assessment practitioner or the specialist, their relevant qualifications and expertise in preparing the statement, and a curriculum vitae;<br>2.3.2. a signed statement of independence by the environmental assessment practitioner or specialist;<br>2.3.3. a map showing the proposed development footprint (including supporting infrastructure) overlaid on the civil aviation sensitivity map generated by the screening tool;<br>2.3.4. a comment, in writing, from the South African Civil Aviation Authority (SACAA), which may include inputs from the Obstacle Evaluation Committee (OEC), if appropriate, confirming no unacceptable impact on civil aviation installations; and<br>2.3.5. should the comment from the SACAA indicate the need for further assessment, a copy of the assessment report and mitigation measures is to be attached to the compliance statement and incorporated into the Basic Assessment Report or Environmental Impact Assessment Report with mitigation and monitoring measures identified included in the EMPr. The assessment must be in accordance with the requirements stipulated by the SACAA.</td>
</tr>
</table>

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| | 2.4. A signed copy of the compliance statement must be appended to the Basic Assessment Report or Environmental Impact Assessment Report. |
| **LOW SENSITIVITY RATING** - No significant impacts on the civil aviation installation are expected in low sensitivity areas. It is unlikely for further assessment and mitigation measures to be required. | No requirement identified. |

## 9.7 Resumes of Key Resources

**Mr Basil Karstadt** – PrCPM, BTech (SACPCMP). Basil is a professional project and construction manager who has specialized for nearly 30 years in the delivery of infrastructure projects, mainly for Public Sector clients in remote and developing areas. In aviation, from 2013 he led the KZN Provincial Treasury 'Crack Team' that was responsible for Provincial intervention in the municipal airport space and drove the KZN Regional Airport strategy, which ensured appropriate expenditure on upgraded infrastructure at many of KZN's municipal airports.

**Mr Jon Heeger** – Pr Eng, MBA, BSc (Eng). Formerly a property development manager in the RMB Group and Group Development Manager at ACSA from 1996, Jon has since become widely recognized as a leading 'regional airport' expert, specializing in turnaround strategies for former Municipal and GA airports. He also regularly acts as Guest Lecturer for the University of KZN and is active in the seminar and conference space as a host and moderator on a wide variety of airport development strategies and aviation topics.

**Mr Sibusiso Nkabinde** – PD (SA), Dip (BA), Air Traffic Control. Sibusiso is a seasoned professional with over 23 years experience in Air traffic Management, including Aeronautical Information Management, Aerodrome and Approach Air Traffic Control, Air Traffic Control Instruction & Examination, Air Traffic Services Management, Executive Leadership in Aeronautical Search & Rescue, Aerospace Medicine (ATC Ergonomics) and Governance. He is a full Professional Member of the Director's Association of South Africa and has notably represented South Africa in CANSO Task Teams, ICAO meetings, and South Atlantic ATM/CNS forums, focusing on Air Traffic Management System harmonization and interoperability.

**Also refer: www.gwi.co.za | www.av-innovate.com**

## Curriculum Vitae (CV): JBC Heeger

| | | |
|---|---|---|
| 1 | PROPOSED POSITION FOR THIS PROJECT | *Aviation and Airport Specialist* |
| 2 | NAME OF PERSON | *Heeger, Jon* |
| 3 | DATE OF BIRTH | *2 May 1955* |
| 4 | NATIONALITY | *South African* |
| 5 | MEMBERSHIP IN PROFESSIONAL SOCIETIES | *Member, Engineering Council of South Africa -ECSA No. 820365 (1982 - 2008)* |
| 6 | EDUCATION | *MBA (Construction Management), University of the Witwatersrand, 1985*<br>*GDE (Construction Management), University of the Witwatersrand, 1985* |

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| | | *BSc. Civil Engineering, University of the Witwatersrand, 1977*<br>*BCom modules (part time): Micro and Transport Economics, UNISA 1978-1980* | | | |
| 7 | OTHER TRAINING | *ACSA/IATA/ICAO- Internal Training & Development programmes (1994-2000)*<br>*Presentor/Attendee at various Aviation Conferences/Seminars (Aviadev, ATNS, BARSA)*<br>*Guest Lecturer for Aerotropolis Institute Africa, UKZN (202-2023)* | | | |
| 8 | LANGUAGES & DEGREE OF PROFICIENCY | Language | Speaking | Reading | Writing |
| | | *English* | *Excellent* | *Excellent* | *Excellent* |
| | | *Afrikaans* | *Good* | *Excellent* | *Good* |
| 9 | COUNTRIES OF WORK EXPERIENCE | South Africa, Botswana, Ghana, Mozambique, Nigeria, Liberia, China, Kenya, Brazil and Rwanda. | | | |
| 10 | EMPLOYMENT RECORD | | | | |
| | Independent Expert/Consultant: Airport Planning and development | FROM:<br>*2000* | TO:<br>*2022* | | |
| | Airport Planning/Development Division - Airports Company South Africa<br>Position: Group Manager – Airport developments | FROM:<br>*1996* | TO:<br>*1999* | | |
| | RMB Group (now Eris Properties)<br>Position: General Manager: Developments | FROM:<br>*1984* | TO:<br>*1996* | | |

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|---|---|---|---|
| | SA Transport Services<br><br>Position: Civil Engineer – Rail Infrastructure | FROM:<br><br>*1977* | TO:<br><br>*1983* |
| 11 | WORK UNDERTAKEN THAT BEST ILLUSTRATES YOUR CAPABILITY TO HANDLE THIS ASSIGNMENT | | |
| | | ***2022/3 Airport/Aviation Specialist (ongoing)***<br><br>*Feasibility Study for a possible freight Aerotropolis in Sedibeng Municipality.*<br><br>Passenger and freight demand assessment and catchment area determination; engagement with airline/charter operators and freight forwarders. Status quo review of existing airport infrastructure and compliance check with ICAO Annex 14, IATA and SACAA SARP's (safety, security, health and safety). | |
| | | Assessment of non-aeronautical revenue opportunities.<br><br>Surface connectivity assessment and pre-planning for improved access onto Provincial roads system, based on Provincial Master Plans and IDP's.<br><br>Identification of gaps and opportunities for innovation in airlift development, particularly RPAS (Remote Piloted Aircraft Systems, UAV's or drones) in commercial and law enforcement operations.<br><br>Reference: Mr Tebogo Mutlaneng, Project Manager, Vaal Aerotropolis Study, Sedibeng District Municipality – **tebogom@sedibeng.gov.za** | |

| | | |
|---|---|---|
| | | ***2022/3 Airport/Aviation Specialist (ongoing)***<br><br>*Master and Land-use plan Review and Pre-Feasibility Study for the re-development of Plettenberg Bay Airport, Bitou Local Municipality.*<br><br>Route analysis and passenger demand assessment; engagement with airline/GA operators. Status quo review of airport infrastructure and compliance check with ICAO Annex 14, IATA and SACAA SARP's (safety, security, health and safety). Diversification strategy for non-aeronautical revenue development.<br><br>Surface connectivity assessment and pre-planning for new airport entrance and improved access onto Provincial roads system, including e-hailing options.<br><br>Identification of gaps and opportunities for innovation in airlift development, particularly RPAS (Remote Piloted Aircraft Systems, UAV's or drones) in maritime patrol, commercial and law enforcement operations.<br><br>Reference: Mr M Memani, Municipal Manager, Bitou Local Municipality – **mmemani@plett.gov.za** |
| | | ***2022 Airport/Aviation Specialist (ongoing)***<br><br>*Master and Land-use plan Review and Pre-Feasibility Study for the re-development of Margate Airport, Ray Nkonyeni Local Municipality.*<br><br>Route analysis and freight/passenger demand assessment; engagement with airline/charter |

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| | | operators. Status quo review of airport infrastructure and compliance check with ICAO Annex 14, IATA and SACAA SARP's (safety, security, health and safety). Diversification strategy for non-aeronautical revenue development.<br><br>Multi-modal connectivity assessment and pre-planning for new airport entrance and improved access onto Provincial road system, including public transport options.<br><br>Identification of gaps and opportunities for innovation in airlift development, particularly RPAS (Remote Piloted Aircraft Systems, UAV's or drones) in maritime patrol and law enforcement operations.<br><br>Reference: Ms Volanda van Rensburg, Airport Manager, Margate Airport, Ray Nkonyeni Local Municipality – **yolanda.vanrensburg@rnm.gov.za** |
| | | ***2022 Aviation Specialist (ongoing)***<br><br>*Benchmarkinig Study and Strategy Development for Airlift as a Catalyst for Tourism Growth and Development in the SADC region. (SADC Ministers Council, Secretariat)*<br><br>Route analysis and passenger surveys, route/frequency assessment with airline/charter operators. Assessment of scheduled and non-scheduled fleet mix and status quo review of airport infrastructure within the SADC region and compliance with ICAO Annex 14, IATA and client service levels standards/policies (security, health and safety).<br><br>Review of Bilateral Air Service Agreements for International and Regional movements within SADC, identification of gaps and opportunities for innovation in airlift development.<br><br>Status assessment of the progress of the SAATM initiative through the African Civil Aviation Commission and assessment of the status of the Yammousoukro Protocol.<br><br>Reference: Dr Salifou Siddo, AFC Agriculture and Finance Consultants GmbH – **salifou.siddo@afci.de** |

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| | | ***2019/2022 Airport Specialist***<br><br>*Redevelopment Options for Majuba Airport, Majuba (Anglo American, SMEC Engineers)*<br><br>Passenger surveys, traffic forecasting and route/frequency assessment with airline/charter operators. Assessment and agreement of critical design aircraft, runway and terminal planning to ICAO Annex 14, IATA and client service levels standards/policies (security, health and safety) for three site options; commercial land use options for airport precinct, Airport Master Plan including assessment of growth potential for aeronautical and commercial revenues. Assessment of airspace class and options development for navigational and ATC protocols. Input into EIA and noise footprint; Feasibility Study for integrated airport precinct and site options analysis.<br><br>Reference: Mr B Strauss (Kumba) – 082 904 9300<br><br>**abraham.strauss@angloamerican.com** |
| | | ***2019/2020: Airport Specialist***<br><br>*Pre-Feasibility Study for Proposed Ghana Airports Company Limited Regional Airport, Takoradi, Ghana.*<br><br>Airport catchment area determination, traffic forecasting and route/frequency assessment. Engagement with GACL on Airport Master Plan and critical aircraft determination. Data gathering including meteorological/wind, runway length calculations and specification, obstacle limitation surface assessment, assessment of land use options for airport precinct, Airport Master plan including assessment of growth potential for aeronautical and JIT freight revenues. Terminal planning including peak hour assessment. Feasibility Study for integrated airport precinct. |
| | | ***Airport Specialist and Business Analyst***<br>*Revitalization Options for Ulundi Airport, South Africa. Zululand District Municipality. (2017)*<br><br>Land use options for airport precinct, update of the Airport Master plan including traffic analysis and |

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| | | assessment of growth potential for aeronautical and freight revenues. Feasibility Study for integrated airport precinct.<br><br>Reference: Ms Thembi Hadebe - 082 902 6029 |
| | | ***Commercial/Airport Specialist***<br><br>*Precinct Planning of Port Elizabeth and East London Airports, ACSA (2018/2020)*<br><br>Advise on commercial land use options for airport precinct, assessment of current traffic in relation to previous forecasts insofar as this may impact on commercial and cargo potential/growth. Assessment of other exogenous developments that may impact growth at both airports (e.g. Coega and ELIDZ).<br><br>Reference: Mr L Tilana (ACSA) |
| | | ***Airport Specialist and Business Analyst***<br>*Redevelopment Options for Grand Central Airport, Midrand. Ivora Capital, Old Mutual Properties (2018/9)*<br><br>Land use options for airport precinct, update of the Airport Master plan including traffic analysis and assessment of growth potential for aeronautical and non-aeronautical revenues. Pre-Feasibility Study for integrated airport precinct and potential for use of drones for fast-moving commodity/freight delivery.<br><br>Reference: Mr C Duminy - 083 633 6909 |
| | | ***Aviation Specialist***<br><br>*Republic of Kenya National Tourism Strategy (2017)*<br><br>Analysis of existing route networks and traffic distribution and associated potential for international and domestic traffic/freight. Alignment of tourism priorities with airport and airlift strategies as between Ministry of Tourism, KAA, KCAA and stakeholder airlines including Kenya Airways, Fly540, Kenya Express and many non-scheduled operators.<br><br>Assessment of likely impact of early adoption of SAATM on traffic within Kenya.<br><br>Ref: Hon Najib Balala, Cabinet Secretary, Tourism |

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| | | ***Airport Specialist and Business Analyst (SMEC)***<br><br>*Richards Bay Airport Master Plan, South Africa. City of uMhlathuze (Richards Bay). (2009, 2017, 2021)*<br><br>Site assessment, land use options and Airport Master plan including traffic forecast, critical aircraft determination and assessment of growth potential for aeronautical, freight and non-aeronautical revenues. Pre-Feasibility Study for new airport.<br><br>Reference: Ms B Strachan – **strachanb@umhlathuze.gov.za** |
| | | ***Airport Specialist and Business Analyst***<br>*Redevelopment Options for PC Pelser AIrport, Klerksdorp. Matlosana Municipality (2011,2017-19)*<br><br>Land use options for airport precinct, update of the Airport Master plan including traffic analysis and assessment of growth potential for aeronautical and non-aeronautical revenues. Pre-Feasibility Study for integrated airport precinct.<br><br>Reference: Mr A Khutlhwayo - 062 692 0590 |
| | | ***Aviation/Airport Specialist and Business Analyst***<br>*KZN Treasury Crack Team. KZN Treasury. (2012 – 2013).*<br><br>Airport Master planning including traffic forecasts and assessment of growth potential for aeronautical and non-aeronautical revenues; Pietermaritzburg, Margate, Wonderboom National, Ladysmith, Ulundi and Richards Bay Airports.<br><br>Reference: Mr F Alberts, ED Director, Wonderboom National Municipality – 082 802 0382 |
| | | ***Airport Specialist and Business Analyst***<br><br>*Proposed New Mkuze Airport. Umhlosinga Development Agency. (2008 to 2013).*<br><br>Feasibility study for the Mkuze Regional Airport as a catalyst for socio-economic upliftment of the |

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|---|---|---|
| | | Umkhanyakude District, including potential for local airfreight of agricultural produce. |
| | | ***Business/Aviation Specialist***<br><br>*Maun Airport Expansion. Botswana Civil Aviation Authority. (2005-2010).*<br><br>Preparation and validation of traffic forecasts, developing a business model, scenario planning and economic cost-benefit analysis for period 2005-2030. Development of new terminal concept designs and detailed landside Master planning including parking areas and non-scheduled operator FBOs |
| | | ***Consultant Team Leader***<br><br>*Development of new Passenger Terminals and Cargo Facilities at Maputo. Aeroporto du Mozambique. (2007-2012).*<br><br>Design review and construction supervision consultant for the new Domestic and International Terminals at Maputo International Airport. Review of contractor-produced traffic forecast, design brief and design proposals, level-of-service analysis and value management.<br><br>Reference: Mr A Tuendue, CEO, ADM |
| | | ***Summary of other airport assignments pre 2007. (1980-2007).***<br><br>• *Team leader – Kruger Mpumalanga International Airport:* Commercialisation Study Proposal.<br>• *Lead Joint Venture partner - Mafikeng Airport IDZ (NW Provincial Government):* Proposed Minerals Cluster and commercial development.<br>• *Team leader – Ghana Civil Aviation Authority*: Accra and Kumasi International airport Master Plans; air platform and non-aeronautical commercialisation (proposal).<br>• *Joint Venture consultant – Ghana Civil Aviation Authority:* Implementation of parking equipment |

<table>
<tr><td></td><td></td><td>
and systems, Kotoka International Airport, Accra, Ghana.
<ul>
<li>Transport Economist/Business Analyst – World Bank - Monrovia, Liberia: Assessment of emergency works required at Roberts International Airport. Validation of traffic forecast, development of business model, scenario planning and economic cost-benefit analysis.</li>
<li>Team Leader – Department of Civil Aviation, Gaborone, Botswana: Design review and development of alternate designs for new passenger terminal, including development and validation of traffic forecasts and preparation of facilities/ architectural design brief.</li>
<li>Aviation Specialist – Bi Courtney Consortium, Lagos, Nigeria: Preparation of Master Plan proposals for expansion of domestic terminal</li>
</ul>
As Client Development Team Leader
<ul>
<li>International Terminal Retail Project – ORTIA Johannesburg (1997)</li>
<li>Design Team Leader – Domestic terminal ORTIA (1997)</li>
<li>4 300 bay Multi-storey parkade, ORTIA (1996)</li>
<li>Chairman, Airport Steering Committee, La Mercy Airport (1997)</li>
<li>General Aviation Centre, East London (1998)</li>
<li>Terminal upgrades, East London & Port Elizabeth (1998)</li>
<li>Refrigerated cargo facility, Cape Town (1997)</li>
<li>Precious Commodities handling facility, JIA (1997)</li>
<li>In-flight catering facility, Cape Town (1997)</li>
</ul>
</td></tr>
</table>

**CERTIFICATION**

I, the undersigned, certify that to the best of my knowledge and belief, this CV correctly describes myself, my qualifications, and my experience. I understand that any wilful misstatement described herein may lead to my disqualification or dismissal, if engaged.

Date: 25/07/2024

*[Signature of staff member or authorized representative of the staff]*

*Day/Month/Year*

Full name of authorized representative: JONATHAN BARRY CLIVE HEEGER

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|---|---|---|
| 1 | PROPOSED POSITION FOR THIS PROJECT | *Air Traffic Management Specialist* |
| 2 | NAME OF PERSON | *Nkabinde, Sibusiso* |
| 3 | DATE OF BIRTH | *1 July 1981* |
| 4 | NATIONALITY | *South African* |
| 5 | MEMBERSHIP IN PROFESSIONAL SOCIETIES | *Professional Member, Director's Association of South Africa. No 2303/18. 2023 to current* |
| 6 | EDUCATION | *MBA, University of Witwatersrand, 2020 - current*<br><br>*Diploma (Business Administration), Management College of South Africa, 2014*<br><br>*Cert (Executive Management), University of La Verne, 2022* |
| 7 | OTHER TRAINING | *Introduction to Safety Management Systems for ATNS Operational Personnel, 2021*<br><br>*Approach Control (Procedural and Radar) Rating, SACAA, 2012*<br><br>*Approach Control (Procedural) Rating, SACAA, 2007*<br><br>*Aerodrome Control Rating, SACAA, 2004*<br><br>*PBN Implementation, ICAO, 2013*<br><br>*Presenter/Attendee at various Aviation Conferences/Seminars/Committees (ATNS, ACSA, SACAA, CANSO, ICAO, AFRAA, SASAR, OPSCOM, CARCOM )* |

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|---|---|---|---|---|---|
| | | *Guest Lecturer on ATC Ergonomics in Aerospace Medicine, SACAA (2018 - current)* | | | |
| 8 | LANGUAGES & DEGREE OF PROFICIENCY | Language | Speaking | Reading | Writing |
| | | *English* | *Excellent* | *Excellent* | *Excellent* |
| | | *Afrikaans* | *Fair* | *Fair* | *Fair* |
| | | *Zulu* | *Good* | *Good* | *Fair* |
| 9 | COUNTRIES OF WORK EXPERIENCE | South Africa | | | |
| 10 | EMPLOYMENT RECORD | | | | |

| | | | |
|---|---|---|---|
| | Manager: Air Traffic Services – OR Tambo International Airport, ATNS | FROM:<br>*2016* | TO:<br>*2023* |
| | Head: Aeronautical Search and Rescue, South African Search and Rescue Organization (DoT) | FROM:<br>*2016* | TO:<br>*2019* |
| | Manager Air Traffic Services – King Shaka International Airport, ATNS | FROM:<br>*2012* | TO:<br>*2016* |
| | Air Traffic Controller, ATNS | FROM:<br>*2005* | TO:<br>*2012* |
| 11 | WORK UNDERTAKEN THAT BEST ILLUSTRATES YOUR CAPABILITY TO HANDLE THIS ASSIGNMENT | | |
| | | ***2020/3 Project Manager***<br>*Air Traffic Management Operational Performance Dashboard at OR Tambo Air traffic Services Unit.*<br>Dashboard Development: Lead the design, development, and implementation of an Air Traffic Management Operational Performance Dashboard for OR Tambo Air Traffic Services Unit. Collaborate with stakeholders to define key performance indicators (KPIs) and metrics for operational, safety, and administrative aspects of air traffic services.<br>Data Integration: Integrate data from various sources to create a unified and real-time view of operational performance. Ensure seamless integration of metrics related to safety, efficiency, and administrative processes for comprehensive reporting. | |

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|---|---|---|
| | | Metrics Analysis: Analyse performance metrics to identify trends, areas for improvement, and opportunities for optimization. Provide actionable insights to enhance operational efficiency, safety protocols, and administrative procedures.<br><br>Management Reporting: Develop regular and ad-hoc reports for management, presenting key findings and performance metrics. Collaborate with leadership to communicate complex data in a clear and concise manner.<br><br>Quality Assurance: Implement quality assurance processes to validate data accuracy and reliability within the Operational Performance Dashboard. Conduct regular audits to ensure the integrity of the performance metrics.<br><br>Stakeholder Collaboration: Collaborate with air traffic controllers, safety officers, and administrative staff to gather relevant data and insights. Engage with management to understand their reporting needs and provide tailored solutions.<br><br>Reference: Josia Manyakoana, COO - ATNS<br><br>**josiam@atns.co.za** |
| | | ***2012/233 Manager: Air Traffic Services***<br><br>*Air Traffic Service Unit Approval of Obstacles in Controlled Airspace*<br><br>Obstacle Assessment: assessment of each obstacle applied for in terms of its height, location, and potential impact on air traffic operations, considering factors such as the obstacle's proximity to flight paths, airports, and navigation aids.<br><br>Safety Standards and Regulations: Ensuring that the proposed obstacles comply with safety standards and regulations set by the aviation authorities including adherence to height restrictions, lighting requirements, and other safety measures aimed at preventing collisions.<br><br>Risk Mitigation Strategies: Development and implementation of ATM strategies to mitigate risks posed by any existing obstacles. |

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| | | Documentation and Approval Process: Documenting the obstacle assessment process, including details of each obstacle, the corresponding risk assessment, and any mitigation strategies employed.<br><br>Monitoring and Compliance: Following approvals, ensuring that implemented measures are consistently maintained, including the identification of any changes in the airspace environment that impacts on the Obstacle limitations.<br><br>Communication with Air Traffic Controllers: Communicating obstacles to air traffic controllers, ensuring that they have up-to-date information about the controlled airspace.<br><br>Reference: Josia Manyakoana, COO - ATNS<br><br>**josiam@atns.co.za** |
| | | ***2005/12 Air Traffic Controller***<br><br>*Aerodrome, Approach Procedural and Approach Radar Air Traffic Control.* |

**CERTIFICATION**

I, the undersigned, certify that to the best of my knowledge and belief, this CV correctly describes myself, my qualifications, and my experience. I understand that any wilful misstatement described herein may lead to my disqualification or dismissal, if engaged.

ate: 25/07/2024

*[Signature of staff member or authorized representative of the staff]*

*Day/Month/Year*

Full name of authorized representative: SIBUSISO WELCOME NKABINDE

## 9.8 Statement of Independence

I, Jonathan Barry Clive Heeger declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. "the Protocols") and in Government Notice No. 1150 of 30 October 2020.
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and;
- the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 48 and is punishable in terms of section 24F of the NEMA Act.

Signature of the Specialist

GWI Aviation Advisory:

26 Jul 2024

Date

I, Sibusiso Welcome Nkabinde declare that –

- I act as the independent specialist in this application;
- I am aware of the procedures and requirements for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (NEMA), 1998, as amended, when applying for environmental authorisation which were promulgated in Government Notice No. 320 of 20 March 2020 (i.e. "the Protocols") and in Government Notice No. 1150 of 30 October 2020.
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing –
  - any decision to be taken with respect to the application by the competent authority; and;
  - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 48 and is punishable in terms of section 24F of the NEMA Act.

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Signature of the Specialist

GWI Aviation Advisory:

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26 Jul 2024

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Date

## 9.9 FAA Guidelines on EM Interference

For proposed projects off, but close to airport property, the methodology considers three key questions:

### Does the project height penetrate airspace?

The FAA has certain criteria to determine this, but in the SA scenario we substitute ICAO Annex 14 and any additional provisions of the SACAA Regulations (CATS 139.30), where these are more onerous. This would typically involve a desktop analysis of the aerodrome or airfields closest to the project site – in this case only FAWB. Airfields further than 8km away are generally not affected, unless approach or departure corridors pass directly over the site and there are precision navigation approaches in play, where aircraft have very 'flat' approach paths of 2,0%. (There might be military considerations here, too, but these in fact are excluded from the provisions of the DFFE Protocol).

### Is the Project Design/Orientation likely to cause reflectivity concerns?

For solar PV projects consideration is given to 'glint' and 'glare' issues that might cause 'flash blindness' arising from both specular and diffused reflections. This is important for solar PV projects, but for the other proposed facilities it may be necessary to consider any potential effects of construction materials (roof) and other potentially reflective components.
Depending on the proposed site layout, a geometric analysis based on the changing azimuth and bearing of the sun through the year, at key times during the day where air traffic is likely to be impacted, is sufficient for this purpose.

### Is the Project likely to Interfere with Communications Systems, Operations and/or Flight Standards/Procedures?

The DFFE Protocol for environmental civil aviation studies refers specifically to 'radar'; however the FAA precedent document also looks at potential interference on all types of communications equipment, which is prudent. Thus, consideration is given to, inter alia:
Location of radar facilities Location of Control Tower(s)
Location of (remaining) ground based NDB's (since these are being phased out)
Location of VOR/DME installations that could be affected by the potential of the project (or key components thereof) to generate EM radiation that could perhaps affect these. Based on FAA guidelines, these distances are generally quite small, and are not usually a cause for concern.
Finally, as part of the 'operational' aspect, a review would be undertaken of existing flight corridors, RNAV and VFR routes, approaches in the area and published airport/airfield procedures, circuits, etc., to assess the potential of the proposed project to negatively impact on any of these at a material risk level i.e. more severe than 'low'. If so - and only in such case – would the matter need to be escalated to the SACAA for further analysis or review, in terms of the DFFE Protocol.

## 9.10 ICAO Standards and Recommended Practices (SARPS)

All infrastructure proposals and developments will be implemented in accordance with standards and recommended practices of the International Civil Aviation Organisation (ICAO) and the SA Civil Aviation Authority (SACAA), as contained in the Civil Aviation Regulations (CARS), as well as relevant SANS standards, planning policies and by-laws.

Other stakeholders in the civil aviation space may need be consulted including the SACAA and ATNS.

Airport geometrics are determined in accordance with International Standards and Recommended practices (SARPS). These standards are included in the following documents (as updated by ICAO from time to time):

**Relevant ICAO Annexes**

| | |
|---|---|
| Annex 14 | Airport Planning |
| Annex 10 | Aeronautical communications |
| Annex 17 | Security |
| Doc 8991 | Manual on Air Traffic Forecasting |
| Doc 8261 | Airport Economics Manual |

- ICAO, Annex 14 "International Standards and Recommended Practices for Airports";
- ICAO, Airport Design Manual part 1: Runways;
- ICAO, Airport Design Manual part 2: Taxiways, Aprons and Holding Bays;
- ICAO, Airport Design Manual part 3: Pavements;
- ICAO, Airport Design Manual part 4: Visual Aids;
- ICAO, Airport Design manual part 5: Electrical Systems;
- ICAO, Airport Design Manual part 6: Frangibility;
- ICAO, Airport Services Manual, part 1: Rescue and Fire Fighting;
- ICAO, Airport Services Manual, part 3: Bird Control and Reduction;
- ICAO, Airport Services Manual, part 6: Control of Obstacles.

**Airport Reference Code**

ICAO Annex 14 assigns an Airport Reference Code (Code number and letter), which is a simple method for matching the characteristics of airport facilities to those of aircraft intended to operate at the airport. The code number is used to classify the runway length, referenced to sea level under 'standard' atmospheric conditions; the code lette is used to classify the main part of the airside layout, based mainly on aircraft wingspan, although more recent editions also use landing gear geometry as a reference.

| CODE ELEMENT 1 | | CODE ELEMENT 2 | |
|---|---|---|---|
| **Code number** | **Aeroplane Reference Field Length** | **Code Letter** | **Wing span** |
| **1** | Less than 800 | **A** | Up to but not including 15m |
| **2** | 800m up to but not including 1200m | **B** | 15m up to but not including 24m |
| **3** | 1200m up to but not including 1800m | **C** | 24m up to but not including 36m |
| **4** | 1800m and over | **D** | 36m up to but not including 52m |
| | | **E** | 52m up to but not including 65m |
| | | **F** | 65m up to but not including 80m |

## 9.11 Overview of Glint and Glare Best Practice

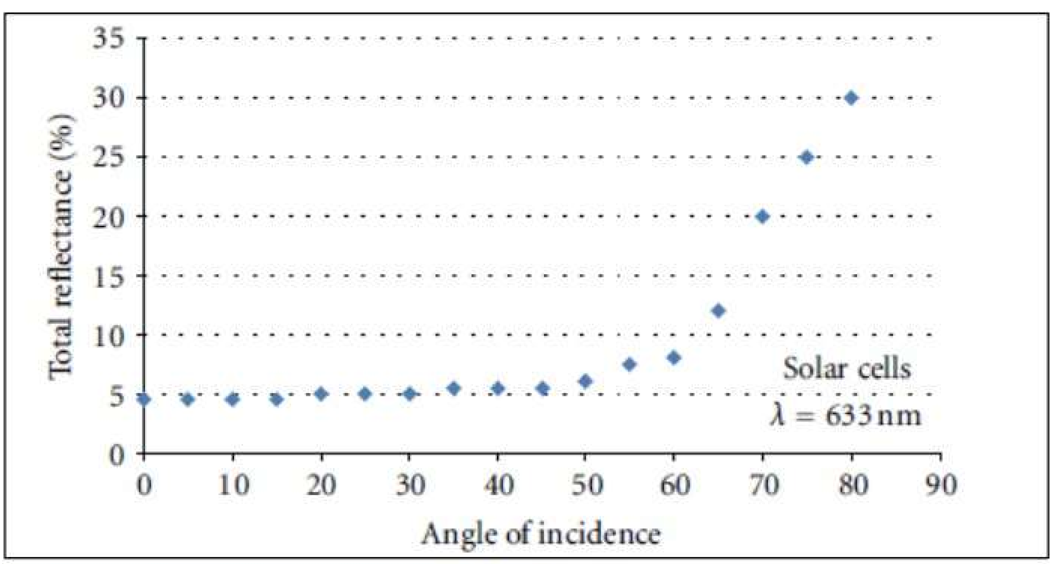
### Ground-based or Low Altitude Receptors: Assessment process

There is no standard process for determining and contextualising the effects of glint and glare on identified receptors, particularly aircraft or aviation infrastructure. Therefore, the GWI approach is to determine whether a reflection from the proposed solar development is geometrically possible and then to compare the results against the relevant guidance/studies to determine whether the reflection is significant. This approach has been informed by known international policy (US FAA and UK CAA), current studies (presented herein) and stakeholder consultation.

### Precedent Solar Reflection Studies

Evan Riley and Scott Olson, *"A Study of the Hazardous Glare Potential to Aviators from UtilityScale Flat-Plate Photovoltaic Systems"* [1]

Evan Riley and Scott Olson published their study in 2011. In it, they researched the potential glare that a pilot could experience from a 25° fixed tilt PV system located outside of Las Vegas, Nevada. The theoretical glare was estimated using published ocular safety metrics which quantify the potential for a post-flash glare after-image. This was then compared to the post-flash glare after-image caused by smooth water. The study demonstrated that the reflectance of the solar cell varied with angle of incidence, with maximum values occurring at angles close to 90 degrees. The reflectance values varied from approximately 5% to 30%. This is shown on the figure below.




*Total reflectance % when compared to angle of incidence*

The conclusions of the research study were:

- The potential for hazardous glare from flat-plate PV systems is similar to that of smooth water;
- Portland white cement concrete (which is a common concrete for runways), snow, and structural glass all have a reflectivity greater than water and flat plate PV modules.

*1: Evan Riley and Scott Olson, "A Study of the Hazardous Glare Potential to Aviators from Utility-Scale Flat-Plate Photovoltaic Systems," ISRN Renewable Energy, vol. 2011, Article ID 651857, 6 pages, 2011. doi:10.5402/2011/65185*

**FAA Guidance – "Technical Guidance for Evaluating Selected Solar Technologies on Airports"**

The 2010 FAA Guidance included a diagram which illustrates the relative reflectance of solar panels compared to other surfaces. The figure shows the relative reflectance of solar panels compared to other surfaces. Surfaces in this figure produce reflections which are specular and diffuse. A specular reflection (those made by most solar panels) has a reflection characteristic similar to that of a mirror. A diffuse reflection will reflect the incoming light and scatter it in many directions. A table of reflectivity values, sourced from the figure within the FAA guidance, is presented below.

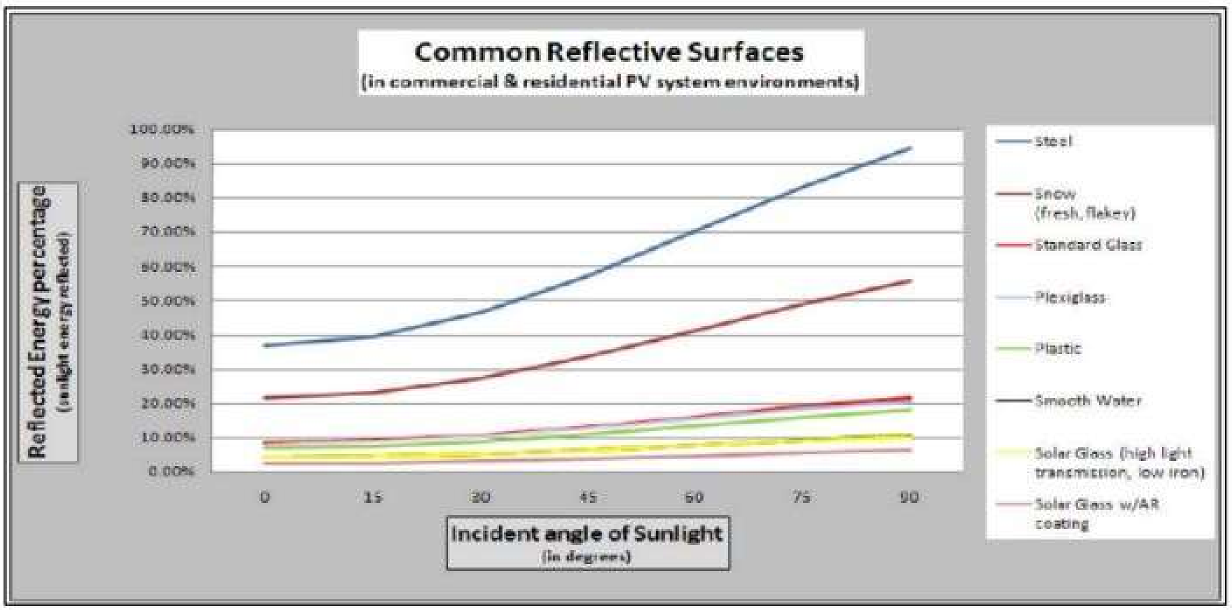
| Surface | Approximate Percentage of Light Reflected[17] |
|---|---|
| Snow | 80 |
| White Concrete | 77 |
| Bare Aluminium | 74 |
| Vegetation | 50 |
| Bare Soil | 30 |
| Wood Shingle | 17 |
| Water | 5 |
| Solar Panels | 5 |
| Black Asphalt | 2 |

*Relative reflectivity of various surfaces*

The data above does not appear to consider the reflection type (specular or diffuse). An important comparison in this table is the reflectivity compared to water which will produce a reflection of very similar intensity when compared to that from a solar panel. The study by Riley and Olsen study (2011) also concludes that still water has a very similar reflectivity to solar panels.

**SunPower[2] Technical Notification (2009)**

SunPower published a technical notification[1] to 'increase awareness concerning the possible glare and reflectance impact of PV Systems on their surrounding environment'. The figure presented below shows the relative reflectivity of solar panels compared to other natural and manmade materials including smooth water, standard glass and steel.




*Common reflective surfaces*

The results, similar to those from Riley and Olsen study (2011) and the FAA (2010), show that solar panels produce a reflection that is less intense than those of 'standard glass and other common reflective surfaces'. With respect to aviation and solar reflections observed from the air, SunPower has developed several large installations near airports or on Air Force bases. It is stated that these developments have all passed FAA or Air Force standards with all developments considered "No Hazard to Air Navigation". The note suggests that developers discuss any possible concerns with stakeholders near proposed solar farms.

*1: Source: Technical Support, 2009. SunPower Technical Notification – Solar Module Glare and Reflectance.*
*2.Sunpower [https://us.sunpower.com](https://us.sunpower.com) is a leading US-based solar company which provides best practice data to the industry from time to time.*