APPENDIX D: IMPACT ASSESSMENT

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

PREFERRED ALTERNATIVE IMPACT ASSESSMENT

PLANNING AND DESIGN PHASE

TABLE OF CONTENTS

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Identification (and assessment) of impacts and risks for the preferred alternative

3(1) A EIA report… must include –

(h) a full description of the process followed to reach the proposed development footprint within the approved site, as contemplated in the accepted scoping report, including;

(v) the impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts- (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated;

(vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;

(viii) the possible mitigation measures that could be applied and level of residual risk;

Appendix 3 (Content of the EIA Report) of the EIA Regulations, 2014 as amended

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Planning and Design Phase

Receiving Environment: Legal System

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Legal compliance - Acquiring authorisations, permits and/or licenses for activities/uses undertaken during construction and operation	Protected Species	NPNCA, 2009/NFA, 1998/NEMBA 2004	**Impact:** Picking a protected, specially protected or indigenous* plant without the applicable permits and/or license constitutes an offence. * within an area bordering a natural water course, whether wet or dry, up to and within a distance of 100 metres from the middle of a river on either side of the natural water course. **Consequence:** - A person convicted of an offence in terms of this Act is liable to a fine, or to imprisonment for a period not exceeding 10 years, or to both a fine and such imprisonment (Section 67(1) of Northern Cape Nature Conservation Act, 2009 (Act No. 09 of 2009). - A person who is guilty of a first category offence (such as contravening the prohibition on picking any protected tree except under a license) may be sentenced to a fine or imprisonment for a period of up to 3 years, or to a fine and such imprisonment (S58(1) of NFA, 1998). - A person convicted of an offence is liable to a fine not exceeding R10 million, or an imprisonment for a period not exceeding ten years, or to both such a fine and such imprisonment (S102 read with 101 of NEMBA, 2004).	N/A	01

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

	Invasive Species	NEMBA, 2004	**Impact:** National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) – Section 73(2) "A person who is the owner of land on which a listed invasive species occurs must- (a) notify any relevant competent authority, in writing, of the listed invasive species occurring on that land; (b) take steps to control and eradicate the listed invasive species and to prevent it from spreading; and (c) take all the required steps to prevent or minimise harm to biodiversity." **Consequence:** Non-compliance. A person who contravenes or fails to comply with a provision of Section 73(2) of NEMBA, 2004 is not guilty of an offence under Section 101 of the Act.	N/A	01
	Water Use S21(c) and (i)	NWA, 1998	**Impact:** Any unauthorised activity within the Department's (DWS) regulated area of a watercourse constitutes an offence. Those activities associated with the development which require a S21(c) and (i) authorisation, include: 1. Upgrading three existing road crossings (including installing culverts); 2. Erecting a perimeter fence (and creating a fire-break road) that may cross a watercourse in two potential locations; 3. Developing a solar PV system within 100m of a watercourse and/or 500 m from a wetland or pan (including the possible wetland system near Corner C); 4. Installing underground water pipes, aboveground storage tanks and a deionization plant in proximity to both boreholes (with pans); and 5. Three potential watercourse crossings for underground cables (used to take electricity from the field transformers to the on-site substation). **Consequence:** - Any person who is guilty of an offence is liable, on the first conviction, to a fine or imprisonment for a period not exceeding five years, or to both a fine and such imprisonment and, in the case of a second or subsequent conviction, to a fine or imprisonment for a period not exceeding ten years or to both a fine and such imprisonment (S151 of NWA, 1998 as amended).	N/A	01

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

	Water Use S21 (a)	NWA, 1998	**Impact:** Taking of water without a license for purposes other than reasonable domestic use and livestock watering, and which exceed the limits provided in the General Authorisation, constitutes an offence. **Consequence:** - Any person who is guilty of an offence is liable, on the first conviction, to a fine or imprisonment for a period not exceeding five years, or to both a fine and such imprisonment and, in the case of a second or subsequent conviction, to a fine or imprisonment for a period not exceeding ten years or to both a fine and such imprisonment (S151 of NWA, 1998 as amended).	N/A	01
	Water Use S21 (b)	NWA, 1998	**Impact:** Storing water without a license for purposes other than rainfall run-off from a roof, and which exceed the limits provided in the General Authorisation, constitutes an offence. **Consequences:** - Any person who is guilty of an offence is liable, on the first conviction, to a fine or imprisonment for a period not exceeding five years, or to both a fine and such imprisonment and, in the case of a second or subsequent conviction, to a fine or imprisonment for a period not exceeding ten years or to both a fine and such imprisonment (S151 of NWA, 1998 as amended).	N/A	01
	Water Use S21 (g)	NWA, 1998	**Impact:** The unauthorised disposal of waste in a manner which may detrimentally impact on a water resource, and storage of domestic and biodegradable industrial wastewater for the purpose of re-use, constitutes an offence. **Consequences:** - Any person who is guilty of an offence is liable, on the first conviction, to a fine or imprisonment for a period not exceeding five years, or to both a fine and such imprisonment and, in the case of a second or subsequent conviction, to a fine or imprisonment for a period not exceeding ten years or to both a fine and such imprisonment (S151 of NWA, 1998 as amended).	N/A	01

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

	Water Use S21 (e)	NWA, 1998	**Impact:** Engaging in a controlled activity such as irrigation with wastewater generated through a waterwork without an authorisation, constitutes an offence. **Consequences:** - Any person who is guilty of an offence is liable, on the first conviction, to a fine or imprisonment for a period not exceeding five years, or to both a fine and such imprisonment and, in the case of a second or subsequent conviction, to a fine or imprisonment for a period not exceeding ten years or to both a fine and such imprisonment (S151 of NWA, 1998 as amended).	N/A	01
	Mining (Borrow pit)	MPRDA, 2002	**Impact:** Borrow pit licensing is classified as small-scale mining under the Mineral and Petroleum Resources Development Act, 28 of 2002 (Act No. 28 of 2002) and is administered by the Department of Minerals and Energy, through whom any permit applications must be lodged. **Consequence:** - Any person convicted of a offence in terms of this Act is liable - (a) in the case of an offence referred to in section 98 (a) (i), to a fine not exceeding R100 000 or to imprisonment for a period not exceeding two years or to both such fine and such imprisonment (Section 99 (1) of MPRDA, 2002).	N/A	01
	Eskom 132kV servitude	Servitude Agreement and Letter of Consent	**Impact:** Upgrading Eskom's existing service road and the construction of a 132 kV distribution line will impact Eskom's 132 kV power lines servitude. Construction without permission will constitute an offence in terms of the relevant legislation. **Consequence:** - The applicant can be fined and/or imprisoned as a result of damage to Eskom's apparatus (Section 27(3) of Electricity Act, 1987 (Act No. 41 of 1987), as amended in 1994).	N/A	01

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

	Construction of the 20 m high 66 - 132 kV distribution line & 10-15m lightning mast	Civil Aviation Act (Act No. 13 of 2009)	**Impact:** Construction of the 20 m high 66 - 132 kV distribution line represents a potential obstacle to aviation. In South Africa all structures higher than 15 m above ground level must be assessed and registered as potential obstacles to aviation in the Electronic Terrain and Obstacle Database (eTOD). The Obstacle Evaluation Committee (OEC) which consists of members from both the SA CAA and South African Air Force (SAAF) fulfils the role of streamlining and coordinating the assessment and approvals of proposed developments or activities that have the potential to affect civil aviation, military aviation, or military areas of interest. **Findings:** Obstacle Notice 1/2022 – Appointment of New Windfarm and Solar Obstacle Application Service Provider Kindly be advised, Air Traffic and Navigation Services (ATNS) has been appointed as the Obstacle application Service Provider for Windfarms on 1 May 2021. They will be also responsible for Solar Obstacle Applications from the 1'st of February 2022. All new Solar applications must be lodged to obstacles@atns.co.za. Their responsibility would pertain to the assessments, maintenance, and all other related matters in respect to Windfarms and Solar assessments. http://www.caa.co.za/Pages/Obstacles/Urgent-notices.aspx [Email from ATNSwas copied directly into "Assessment of Alternatives" file] **Consequence:** - Approval is required from the SA CAA and SAAF for 20 m high 66 - 132 kV distribution line and 10 - 15 m high lightning mast.	N/A	01
	Development of substation infrastructure and distribution infrastructure	GN No. 435 of 22 March 2019 in terms of Section 24(5) of NEMA, 1998	**Impact:** In terms of GN No. 435 of 22 March 2019, applications for environmental authorisation for substation and overhead electricity transmission and distribution infrastructure, when such facilities trigger- • activity 11 or 47 of Environmental Impact Assessment Regulations Listing Notice 1 of 2014, as amended, and any other listed and specified activities necessary for the realisation of such facilities; or • activity 9 of Environmental Impact Assessment Regulations Listing Notice 2 of 2014, as amended and any other listed or specified activities necessary for the realisation of such facilities; must use the generic Environmental Management Programme, contemplated in Regulations 19(4), 23(4) and Appendix 4 to the Environmental Impact Assessment Regulations, 2014, as	N/A	01

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

			amended. **Consequences:** - In terms of 49A (Offences) of NEMA, 1998 as amended, "(1) A person is guilty of an offence if that person -(c) fails to comply with or contravenes a condition of an environmental authorisation granted for a listed activity or specified activity or an approved environmental management programme;"		
	Development of a 400 MW Solar PV Facility	Astronomy Geographic Advantage (AGA) Act (Act No. 21 of 2007)	**Impact:** Potential radio frequency interference to astronomical activities including MeerKAT and SKA. The Northern Cape Province is declared an Astronomy Advantage Area (AAA) under the AGA Act, 2007 **Consequence:** - Approval of the development is required in terms of the AGA Act, 2007.	N/A	01
	Compliance Monitoring (ECO Appointment)	Environmental Authorisation	**Impact:** 49A (1) A person is guilty of an offence if that person - (c) fails to comply with or contravenes a condition of an environmental authorisation granted for a listed activity or specified activity or an approved environmental management programme; **Consequence:** - 49B (1) A person convicted of an offence in terms of section 49A (1) (c) is liable to a fine not exceeding R10 million or to imprisonment for a period not exceeding 10 years, or to both such fine or such imprisonment.	N/A	01

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Change in Land Use	Rezoning Land use application for a "Renewable Energy Plants Zone" submitted through the Emthanjeni LM for a decision by the District Municipal Planning Tribunal	SPLUMA and the ELM Land Use Scheme 2022	**Impact:** The curremt land use zone (Agriculture 1) does not permit the development or operation of Solar PV facilities. **Consequence:** - Uses other than the primary rights of use and consent uses would constitute an offence.	N/A	01
	Land Acquisition and Access to Site	Physical and economic displacement of individuals and households.	**Impact:** Unplanned movement of vehicles could damage households/Eskom infrastructure. **Consequence:** Disturbance to households/infrastructure.	N/A	01
Planning	Agreements	Eskom	**Impact:** Solar photovoltaic structures within a 2 km radius of the closest point of a transmission or distribution substation (66kV to 765kV) may impede Eskom's future planning. **Consequence:** Disturbance to Eskom infrastructure.	N/A	01
Layout and Design	Lighting		**Impact:** Lighting at sub-stations are an Eskom requirement (pers. comm. JP) **Consequence:** Disturbance to vehicles driving/animals	N/A	01

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

	Roads		**Impact:** LN 1, Listed Activity 24 The development of a road - (ii) … where the road is wider than 8 metres; but excluding a road - (c) which is 1 km or shorter. LN 1, Listed Activity 56 The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre - (ii) ... where the existing road is wider than 8 metres; LN 3, Listed Activity 4 The development of a road wider than 4 metres ... (not applicable as study area is not in an identified geographical area). INCLUDED IN APPLICATION - LN3, Listed Activity 18 The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre (applicable because within or within 100 m of a watercourse or wetland). **Consequence:** - (1) A person convicted of an offence in terms of section 49A (1) (e) and (f) is liable to a fine not exceeding R10 million or to imprisonment for a period not exceeding 10 years, or to both such fine or such imprisonment (NEMA, 1998 as amended)	N/A	01
	Buffers	Specialist Assessment Reports	**Impact:** An EIA report ... must include - (m) based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation (Appendix 3 of the EIA Regulations, 2014 as amended) **Consequence:** - (1) A person convicted of an offence in terms of section 49A (1) (e) and (f) is liable to a fine not exceeding R10 million or to imprisonment for a period not exceeding 10 years, or to both such fine or such imprisonment (NEMA, 1998 as amended)	N/A	01
	Flood lines		**Impact:** In terms of Section 144 of the National Water Act of 1998 (Act 36 of 1998), a flood line, representing the highest elevation that would probably be reached during a storm with a return interval of 100 years, must be indicated on all plans for the establishment of townships. The term, “establishment of townships” includes the subdivision of stands or farm portions in existing townships/development, if the 100-year flood lines are not already indicated on these plans, or when the land-use category of a particular portion of land is	N/A	01

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

			changed. **Consequences:** - Any person who is guilty of an offence is liable, on the first conviction, to a fine or imprisonment for a period not exceeding five years, or to both a fine and such imprisonment and, in the case of a second or subsequent conviction, to a fine or imprisonment for a period not exceeding ten years or to both a fine and such imprisonment (S151 of NWA, 1998 as amended).		
	Building Plans	Municipal Bylaws	**Impact:** Building plans for the solar PV facility must be submitted to the Emthanjeni Local Municipality for approval in terms of Section 4(1) of National Building Regulations and Building Standards Act, 1977 (Act No. 103 of 1977) as amended. **Consequences:** Any person erecting any building in contravention of the provisions of subsection (1) shall be guilty of an offence and liable on conviction to a fine not exceeding R100 for each day on which he was engaged in so erecting such building (Section 4 (4) of NBR and BSA, 1977).	N/A	01
	Building Lines	Agriculture Zone 1	**Impact:** Soventix SA (Pty) Ltd will need to adhere to the applicable building line controls for their proposed land use.	N/A	01
		Eskom servitude	**Impact:** The extent and width of the servitude is 15,5 m on either side of the centre line of the (132kV) power lines.	N/A	01

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 01 (Geographical Areas of Strategic Importance)

- The study area is not located within a (REDZ).
- The proposed development which is the subject of this application does fall within a Strategic Transmission Corridor, specifically the "Central Corridor." - **but it does not trigger LA 9 of LN2 and is therefore not subject to the process to be followed for large scale electricity transmission and distribution facilities in terms of GN No. 113 in GG No. 41445 of 16 February 2018 and GN No. 383, GG No. 44504 of 29 April 2021**.
- Although the site area falls within an Astronomy Advantage Area (AAA) under the Astronomy Geographic Advantage (AGA) Act, 2007 (Act No. 21 of 2007), the South African Radio Astronomy Observatory (SARAO) undertook a high-level impact assessment and determined that the

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

project represents a low risk of interference to the SKA radio telescope (including MeerKAT) with a compliance surplus of 57.02 dBm/Hz. (Response Letter from Mr Selaelo Matlhane, Spectrum & Telecommunication Manager of the South African Radio Astronomy Observatory (SARAO) and dated 16 March 2022) – **no mitigation is required**.

Impact 01 (Protected Plants)

- There are no threated vegetation types or specialised plant communities present within the site *(Plant Species Compliance Statement – Soventix Phase 3 Pv Project (Second Draft) prepared by Simon Todd of 3 Foxes Biodiversity Solutions dated September 2022).*
- No plant species of conservation concern were observed within the site and overall, the site is considered low sensitivity from a Plant Species Theme perspective *(Plant Species Compliance Statement – Soventix Phase 3 Pv Project (Second Draft) prepared by Simon Todd of 3 Foxes Biodiversity Solutions dated September 2022).*

Impact 01 (Listed Invasive Plants)

- Develop an alien vegetation management plan *(Plant Species Compliance Statement – Soventix Phase 3 Pv Project (Second Draft) prepared by Simon Todd of 3 Foxes Biodiversity Solutions dated September 2022).*

Impact 01 (Water Uses)

- Upgrading six existing two-track road crossings within a watercourse shall not impound water, and as such, constitute Section 21(c) and (i) water uses only.
- The water use license application pertaining to the abstraction of groundwater (Section 21(a) of the National Water Act) from both properties combined, including all boreholes contained thereon, shall be for **216 m3/ day** during the construction period (including when it overlaps with operation), and **150 m3/day** during operation.
  However, abstraction may not exceed the sustainable abstraction yield at the recommended pumping rate of 8 hrs per day for each borehole, that is 6,58 l/s @ 8hrs (or 189,5 m3/8hr day) for BH4 and 5,11 l/s @ 8 hrs (or 147,17 m3/8hr day) for BH5.
- The water use license application pertaining to the storage of water (Section 21 (b) of the National Water Act) is as follows:
  - The construction and operational phases will overlap. Consequently, the combined storage of groundwater on the Remainder of Farm Goede Hoop 26C during construction and operation shall not exceed 100 m³.
  - The construction and operational phases will overlap. Consequently, the combined storage of groundwater on Portion 3 of the Farm Goede Hoop 26C during construction and operation shall not exceed 240 m³ (S21(b)), the combined storage of untreated effluent shall not exceed 100 m3, the combined storage of treated effluent shall not exceed 90 m3, and the storage of contaminated soil shall not exceed 10 m3.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

- The water use license application pertaining to the impeding/diverting the flow of water in a watercourse and altering the bed, banks, course of characteristics of a watercourse (Section 21 (c) and (i) of the National Water Act) is as follows:
    - The PV system, roads, underground cables, underground pipelines and overhead distribution line will cross watercourses.
- The water use license application pertaining to disposing of waste in a manner which may detrimentally impact on a water resource (Section 21 (g) of the National Water Act) is as follows:
    - The principal sanitation system during construction shall be a sewerage treatment package plant, specifically the NEWGen100. The NewGen100 sanitation system will be supplemented by portable chemical toilets for use by the work front further away from the construction camp. The principal sanitation system during operation shall be a sewerage treatment package plant, specifically the Biorock package plant.
    - Treated effluent may be reused during construction and operation for toilet flushing and/or dust suppression on gravel roads.
    - Up to five (5) tanks or **50 m3** will be used for storing treated wastewater (and rainwater) from the Multirock 60 on-site disposal facility for reuse (toilet flushing and/or dust suppression) and/or disposal.
    - Up to four (4) tanks or **40 m3** will be used for storing treated effluent that is the disinfected recycled water for flushing toilets, on top the toilet containers connected to the NEWGen100 wastewater treatment system. Another four (4) tanks or **40 m3** will be used for storing the excess treated effluent, that is not recycled for flushing toilets, but rather either reused for dust suppression or disposed of via a sub-surface soakaway.
    - Up to ten (10) 10 m3 containers or **100 m3** will be used to store concrete slurry for reuse or disposal.
    - A **10 m3** container will be made available for the storage and bioremediation of soil contaminated with hydrocarbon spills or storage and collection for disposal at the De Aar licensed landfill site.

Impact 01 (Mining)

- A mining permit is not required for mining road material from the property(ies) in terms of Section 106(3) of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) - **no mitigation is required in terms of legal compliance.**

Impact 01 (Obstacles to Aviation)

- In South Africa all structures higher than 15 m above ground level must be assessed and registered as potential obstacles to aviation in the Electronic Terrain and Obstacle Database (eTOD). The Obstacle Evaluation Committee (OEC) which consists of members from both the SA CAA and South African Air Force (SAAF) fulfils the role of streamlining and coordinating the assessment and approvals of proposed developments or activities that have the potential to affect civil aviation, military aviation, or military areas of interest.
- **Obstacle Notice 1/2022 – Appointment of New Windfarm and Solar Obstacle Application Service Provider:** Kindly be advised, Air Traffic and Navigation Services (ATNS) has been appointed as the Obstacle application Service Provider for Windfarms on 1 May 2021. They will be also responsible for Solar Obstacle Applications from the 1'st of February 2022. All new Solar applications must be lodged to

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

obstacles@atns.co.za. Their responsibility would pertain to the assessments, maintenance, and all other related matters in respect to Windfarms and Solar assessments. http://www.caa.co.za/Pages/Obstacles/Urgent-notices.aspx

- "Kindly note that ATNS charge for the assessment, and before the process start our Business Development department will forward a proposal to the client.
  The proposal and payment process are as follows if applicable:
  You will receive the proposal from our Business Development department, it will contain the work that will be done as well as what it will cost.
  They will provide you with all the information needed to make payment. For this reason, please provide a billing address and the details of the person to whom the proposal should be addressed.
  We will start with the assessments when our Business Development department received an accepted and signed proposal back from the client.
  We will conduct an assessment to evaluate whether the proposed structures will affect the safety of flight for aerodromes in close vicinity as well as communication, navigation and surveillance (CNS) equipment.
  Please see required information below before we can proceed with our assessment:
    - Elevation above mean sea level
    - Coordinate list for each structure - WGS84 (degrees, min and sec – S302515.32 E0180102.52)
    - A KMZ file with the positions of the proposed structures.
    - We also require the dimensions/specs of the structures.
    - Height to the top of structure.
    - A Glint and Glare assessment report.
    - If there will be power lines erected, and/or a substation the position and heights for each structure (Pole/substation) must be provided.

  This whole process can take up to 90 working days' minimum that will commence after the proposal is accepted, signed and received by our Business Development department.
  Please note that ATNS also liaise with the South Africa Civil Aviation Authority (SACAA) and will provide the client with the conditional/final approval from the SACAA.
  The client will have to liaise with SACAA to finalise the "As build" and for any queries with the lighting." (Yanga Nofuma, Obstacle Administrator, COO Air Traffic services, obstacles@atns.co.za)

Impact 01 (Generic EMPrs)

- In terms of GN No. 435 of 22 March 2019, applications for environmental authorisation for substation and overhead electricity transmission and distribution infrastructure, when such facilities trigger activity 11 or 47 of Environmental Impact Assessment Regulations Listing Notice 1 of 2014, as amended, and any other listed and specified activities necessary for the realisation of such facilities; or activity 9 of Environmental Impact Assessment Regulations Listing Notice 2 of 2014, as amended and any other listed or specified activities necessary for the realisation of such facilities; must use the generic Environmental Management Programme, contemplated in Regulations 19(4), 23(4) and Appendix 4 to the

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Environmental Impact Assessment Regulations, 2014, as amended. – **listed activity 11 of listing notice 1 is amongst the activities forming part of this application for environmental authorisation.**

- Generic EMPr are attached as **Appendix F: Annexure A** of the Draft EIA report.

Impact 01 (Land Use)

- The properties are zoned as Agriculture 1. The primary use involves, "the cultivation of crops and plants and/or the breeding of animals, the running of a game farm on an extensive scale on natural veld or land, stock- or auction pens and at most one residential house and other buildings, including residential units for bona-fide labourers, which are reasonably relevant to the main agricultural activity on the farm." Consent uses (with the consent of the council) include, a second residential unit, farm stall, nursery, riding school, tourist facilities, animal clinic, animal hospital, guest house and bird or animal cages. (Scheme Regulations for Emthanjeni Municipality) – **the current land use zoning is incompatible with a Solar PV facility therefore the properties would need to be rezoned to *Renewable Energy Plant zone* or other appropriate zoning in terms of the Spatial Planning and Land Use Management Act (Act 16 of 2013).**

Impact 1 (Roads)

- The existing network of two-track farm roads is not wider than 2 m

Impact 01 (Lighting)

- Lighting at sub-stations is an Eskom requirement (pers. comm. JP, Director of Soventix SA)

Impact 01 (Ecological Buffers and Flood Lines)

- A 250m buffer from the two southern neighbouring properties and a 70m buffer along the western receptors.
- A 50 m wide buffer on both sides of the central drainage line delineation is required during the construction and operational phases.
- 100m buffer zone from the crest of the rocky outcrop to limit any potential impact on possible roosting sites and commuting routes.
- All Verreaux's and Tawny Eagle nests must be buffered by at least a 1 km exclusion zone of ALL project activities with a preferable "non-disturbance" exclusion of 1.5 km during breeding season.
- In all areas where service road intersect with semi natural or natural habitat, all fences must be set back at least (strictly) 75 metres from the edge of every service road in order to allow for vulnerable species such as cranes and korhaans to obtain adequate height after being flushed by vehicle traffic. Alternative 2 and where a 75 metre buffer is not possible, new fences must be set back no more than 2 metres (directly adjacent) from the edge of service roads.
- 50 m no-go buffer proposed around small artificial water points (borehole pans and livestock watering troughs).

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

- All large impoundments (dams) require a 1000 metre buffer from any infrastructure activity although this may be reduced to 800 metres if no new powerline infrastructure impacts the 1000 metre threshold. The 1000 metre buffer will not apply to roads and fences.
- The flood line determination suggests a low flooding risk as no clearly defined drainage lines occur. As such, no clearly defined exclusion zones or protection buffer areas could be mapped or recommended.

Impact 01 (Building Lines)

- The farms are zoned as Agriculture Zone 1 (pers. comm. Ms Shereave T Felix, Manager: Development & Strategic Services, Dept. Corporate Services, Emthanjeni LM). The building lines for Agriculture Zone 1 are "the street is 4,5 m, rear- and side building lines are 3,0 m for the primary residential house. No building or part thereof, with the exception of the primary residential house and farm stalls, boundary walls or boundary fences, may where the premise borders another premise with a different zoning, be erected closer than 30 m from the said boundary of the premise and these building lines are 5 m where the premise borders another premise also zoned as 'Agriculture zone 1'" (Scheme Regulations for Emthanjeni Municipality in terms of Sect. 36(1) of the Northern Cape Planning and Development Act (1998) (2004)). **The current land use zoning is incompatible with a Solar PV facility therefore the properties would need to be rezoned to Renewable Energy Plant zone or other appropriate zoning in terms of the Spatial Planning and Land Use Management Act (Act 16 of 2013).**

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
01	NA	NA	NA	-I	NA	NA	NA	H	H	1

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Reg: 2006/023163/23

Reversibility	NA	**Irreplaceability**	NA	**Mitigatory Potential**	H

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- Construction may not commence without a water use license from the regional office of the Department of Water and Sanitation.
- Undertake a Glint and Glare Assessment before submitting a Solar Obstacle Application.
- Lodge a Solar Obstacle Application for assessment with ATNS to obstacles@atns.co.za at least 120 days before the commencement of construction, preferably during the Planning and design phase.
- The proposed activities do not include operational aspects. Consequently, the environmental authorization is required for development only, including the following phases: planning and design, pre-construction, construction, and post-construction (rehabilitation and monitoring).The validity period of the environmental authorisation shall be the maximum permissible period given the scale of the project, anticipated time to complete construction, and the uncertainty of when a water use license will be granted.
- All recommended buffering is to be strictly adhered to.
- No development, other than linear activities authorised in terms of the environmental authorisation such as crossings for roads, fencelines, electrical cables and water pipes, may take place within the demarcated ecological buffers.
- The applicant shall submit a Rezoning Land use application for rezoning from Agricultural Zone 1 to "Renewable Energy Plants Zone" through the Emthanjeni LM for a decision by the District Municipal Planning Tribunal.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Astronomy Geographic Advantage (AGA) Act (Act No. 21 of 2007)
- National Environmental Management: Biodiversity Act (Act No. 10 of 2004); Chapter 4 Threatened or Protected Ecosystems and Species
  - A person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7 (S57(1)).
- National Forest Act, 1998 (Act No. 84 of 1998); Part 3 Protection of Trees
  - No person may cut, disturb, damage or destroy any protected tree except under a license granted by the Minister (S15(1)(a)).
- Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009); Section 51(1) “No person may, without a permit, pick an indigenous plant - (c) within an area bordering a natural water course, whether wet or dry, up to and within a distance of 100 metres from the middle of a river on either side of the natural water course.”
  - “**pick**” includes to collect, to cut, to chop off, to take, to gather, to pluck, to uproot, to break, to damage or to destroy;

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004); Section 73(2) "A person who is the owner of land on which a listed invasive species occurs must- (a) notify any relevant competent authority, in writing, of the listed invasive species occurring on that land; (b) take steps to control and eradicate the listed invasive species and to prevent it from spreading; and (c) take all the required steps to prevent or minimise harm to biodiversity."
- National Water Act, 1998 (Act No 36 of 1998) published in Government Notice No. 1091 of Gazette No. 19182 as amended, including Section 144 and Chapter 4: Use of water.
    - General Authorisation for S21(c) & (i) published in GN 509 of 26th August 2016 in GG No. 40229.
    - General Authorisation for S21(a) & (b) published in GN 538 of 02nd September 2016 in GG No. 40243
    - General Authorisations for S21(g) & (e) published in GN 665 of 06th September 2013 in GG No. 36820
- Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
    - **106. Exemptions from certain provisions of Act** - (3) Any landowner or lawful occupier of land who lawfully, takes sand, stone, rock, grave or clay for farming or for effecting improvements in connection with such land or community development purposes, is exempted from the provisions of in subsection (1) as long as the sand, stone, rock, gravel or clay is not sold or disposed of.
- Electricity Act, 1987 (Act No. 41 of 1987), as amended in 1994)
- Civil Aviation Act, 2009 (Act No. 13 of 2009)
- Generic EMPrs published in GN No. 435 of 22 March 2019 in terms of Section 24(5) of NEMA, 1998
- National Environmental Management Act, 1998 (Act No. 107 of 1998); Section 49A (1) A person is guilty of an offence if that person - (c) fails to comply with or contravenes a condition of an environmental authorisation granted for a listed activity or specified activity or an approved environmental management programme
- Scheme Regulations for Emthanjeni Municipality in terms of Sect. 36(1) of the Northern Cape Planning and Development Act (1998) (2004)
- Renewable Energy Generation Plant Setbacks to Eskom Infrastructure Revision 02 compiled on 15/09/2020 (Unique Identifier 240-65559775)
- Environmental Impact Assessment Regulations, 2014 as amended including EIA Regulations Listing Notice 1 (and 3) of 2014, as amended
- Avifauna Specialist Assessment (Final) prepared by Enviro-Insight CC (Sam Laurence and A.E. van Wyk) dated October 2022).
- Hydrological Assessment (Version – Final 3) 01 September 2022 GCS Project Number: 22-0076 by Hendrik Botha.
- Aquatic Biodiversity Impact Assessment, Section 21(c) & (i) Risk Assessment and Wetland Delineation Verification Report prepared by Dr Andrew Deacon dated August 2022.
- Chiropteran Specialist Report for Phase 3 of the Proposed Soventix-Solar Africa Solar PV Facility, Hanover, Northern Cape Prepared by: Dawn Cory Toussaint dated July 2022.
- Visual Impact Assessment Report (Final v_2) dated 19th September 2022, prepared by Stephen Stead of Visual Resource Management Africa cc.
- National Building Regulations and Building Standards, 1977 (Act No. 103 of 1977) as amended

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Reg: 2006/023163/23

- **4 Approval by Local Authorities of Applications in Respect of Erection of Buildings** (1) No person shall without the prior approval in writing of the local authority in question, erect any building in respect of which plans and specifications are to be drawn and submitted in terms of this Act.

Mitigations:

Impact Management Outcome(s):

- Lawful activities involving any threatened, protected, and/or indigenous flora.
- Duty of Care relating to Listed Invasive Species.
- Lawful commencement of Section 21 water uses in terms of the NWA, 1998.
- Lawful commencement of construction activities within Eskom's 132 kV powerlines servitude.
- Lawful erection of potential obstacles to aviation.
- Compliance with the applicable generic EMPrs.
- Compliance with the conditions of an environmental authorisation.
- Lawful commencement of land development in terms of the "Scheme Regulations for Emthanjeni Municipality in terms of Sect. 36(1) of the Northern Cape Planning and Development Act (1998) (2004)".
- Combine solar photovoltaic power generation and Agriculture.
- Minimize disturbance to local individuals.
- Eskom's existing infrastructure and future planning is not impeded.
- Maintain project operational safety and security without causing light pollution.
- Compliance with listed activities relating to development and widening of roads.
- Protect sensitive areas by avoidance.
- Lawful planning and development of the Solar PV facility with respect to buffers and building lines.

Targets:

- A written notification of listed invasive species sent to the relevant Competent Authority.
- An Integrated Water Use License for Section 21 water uses, including:
    - S21(c) and (i) for (1) Upgrading three existing road crossings (including installing culverts); (2) Erecting a perimeter fence (and creating a fire-break road) that may cross a watercourse in two potential locations; (3) Developing a solar PV system within 100m of a watercourse and/or 500 m from a wetland or pan (including the possible wetland system near Corner C); (4) Installing underground

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

water pipes, aboveground storage tanks and a deionization plant in proximity to both boreholes (with pans); and (5) Three potential watercourse crossings for underground cables (used to take electricity from the field transformers to the on-site substation).
    - S21(a) – taking water.
    - S21(b) – storing water.
    - S21(g) – disposing of waste in a manner which may detrimentally impact on a water resource (and storage of domestic and biodegradable industrial wastewater for the purpose of re-use)
    - S21(e) – engaging in a controlled activity, specifically irrigation with wastewater generated by a waterwork.
- A Letter of Consent from Eskom.
- Written approval from the SACAA.
- Two generic EMPrs completed by the contractor and accepted (signed) by the Holder.
- ECO Appointment.
- A decision by the District Municipal Planning Tribunal.
- Recognition of the Agrivoltaic system as a legitimate land use.
- Access Agreement.
- Eskom Agreement.
- Substation lighting meets Eskom's Requirements without causing light pollution, light spillage, and distracting glare.
- Layout of the Solar PV facility, including road Designs with specifications, overlaid on map of the sensitive areas identified by specialists.
- Layout of the Solar PV facility overlaid on predicted "ponded flood occurrence zones"
- Approved building plans, including approved building lines from the property boundary.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
01	Legal Compliance	Unlawful activities involving any threatened or protected flora.	Lawful activities involving any threatened or protected flora.	A license under the NFA, 1998, a permit under NCNCA, 2009 and/or a permit under NEMBA, 2004.	(1) Construction may not commence without the applicable permit(s) and/or license to carry out a restricted activity involving, or picking, or cutting, disturbing, damaging or destroying any threatened or protected flora.	SEO or ECO	Prior to commencement of clearing and grubbing.	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					(2) Only apply for permit(s) and/or a license to "pick" a threatened or protected plant if it is not possible to relocate the footprint.			
01	Legal Compliance	Failure to comply with Duty of Care relating to Listed Invasive Species	Duty of Care relating to Listed Invasive Species	Written Notification	The landowner or person in control of the land must notify the Minister (DFFE) and/or MEC (DENC), in writing, of any listed invasive species occurring in the project area.	Landowner or Holder	Continuous	Compliance to be verified by ECO and IEA.
01	Legal Compliance	Unlawful commencement of section 21 (c) and (i) water uses in terms of the NWA, 1998.	Lawful commencement of section 21 (c) and (i) water uses in terms of the NWA, 1998.	A water use license for Section 21(c) and (i) water uses.	Construction may not commence without a water use license for Section 21(c) and (i) water uses.	Holder	Prior to commencement of those construction activities relating to S21 (c) and (i) water uses.	Compliance to be verified by ECO and IEA.
01	Legal Compliance	Unlawful abstraction of water for use during construction, e.g., mixing concrete, dust suppression and potable usage.	Lawful commencement of Section 21 (a) water uses in terms of the NWA, 1998.	A water use license for Section 21(a) water uses.	Construction may not commence without a water use license for Section 21(a) water use.	Holder	Prior to commencement of those construction activities relating to a S21(a) water use, e.g., taking water for mixing concrete, dust suppression and potable water usage.	Compliance to be verified by ECO and IEA.
01	Legal Compliance	Unlawful storage of water.	Lawful commencement of Section 21	A water use license for	Construction may not commence without a water	Holder	Prior to commencement of those	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
			(b) water uses in terms of the NWA, 1998.	Section 21(b) water uses.	use license for Section 21(b) water use		construction activities relating to S21(b) water uses, e.g., installing storage tanks.	
01	Legal Compliance	Unlawful disposal of wastewater (and storage of treated effluent for reuse).	Lawful commencement of Section 21 (g) water uses in terms of the NWA, 1998.	A water use license for Section 21(g) water uses.	Construction may not commence without a water use license for Section 21(g) water use.	Holder	Prior to commencement of those construction activities relating to S21(g) water uses, e.g., installing an on-site disposal facility and storage tanks for treated effluent.	Compliance to be verified by ECO and IEA.
01	Legal Compliance	Unlawful activities relating to heritage resources	Lawful commencement of Section 35 of the NHRA	NHRA Permit	Permits in terms of section 35 of the National Heritage Resource Act (NHRA) must be applied for from SAHRA for the collection of archaeological material prior to construction. No construction may commence without a permit in this regard.	Holder	Prior to commencement	Compliance to be verified by ECO and IEA.
01	Legal Compliance	The construction of the 66 - 132 kV powerline and upgrading the servitude	Lawful commencement of construction activities affecting Eskom's 132 kV	A Letter of Consent from Eskom	(1) The applicant must apply for co-use of Eskom's 132 kV powerline servitude by submitting a formal application entitled "Annex A Application for the co-use	Holder	At least 30 days before the intended date of commencing with constriction	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		access road will impact Eskom's 132 kV powerline servitude	powerline servitude.		of an Eskom right or restriction area", as well as all required supporting documents that are indicated in the form. The application should be submitted to Nomzamo Mdunyelwa ST(SA)0991, Land & Rights Officer, Land Development, Northern Cape Operating Unit, Eskom (Tel: 053 830 5947, Mobile: 081 046 5341, Email:MdunyeNC@eskom.co.za) at least 30 days before the intended date of commencement to prevent any unnecessary delays. (2) Separate applications will need to be submitted for (1) upgrading the existing two-track service road to a 5m to 6m-wide road by grading it, importing material, reshaping it, and compacting it, and (2) constructing the 132 kV powerline from the on-site substation on Phase 3 across/underneath Eskom's 132 kV powerline. (3) The application for upgrading Eskom's service road beneath the 132 KV		within Eskom's servitude.	

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					powerline should also include the following: (a) Location of upgraded, including which line and towers will be affected. (b) Final designs for road, showing the final elevation and road surface level. (c) Construction methodology for road . (d) Details on how surface will be made, graders, blasting etc. (e) Timelines for road construction. (f) Conduct survey to gather current conductor positions of line being crossed and current surface levels of servitude.			
01	Legal Compliance	Construction of the 20 m high 66 - 132 kV distribution line and 10 to 15 m lightning mast represents a potential obstacle to aviation.	Lawful erection of potential obstacles to aviation.	Glint and Glare Assessment Report. Written approval from SA CAA and SAAF.	(1) Undertake a Glint and Glare Assessment before submitting a Solar Obstacle Application for assessment as the report is required before Air Traffic and Navigation Services (ATNS) can proceed with their assessment. (2) Lodge a Solar Obstacle Application for assessment with ATNS to obstacles@atns.co.za at least 120 days before the commencement of	Holder	Planning and design phase. At least 120 days prior to commencing with construction.	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					construction, preferably during the Planning and design phase once the engineers have determined the specifications of the structures (e.g., dimensions, co-ordinates, etc.) and completed the final layout plan. Refer queries to Yanga Nofuma, Obstacle Administrator | COO - Air Traffic Services, Bruma, T: 011 607 1474 E: obstacles@atns.co.za (3) The assessment will only proceed one ATNS' Business Development department has received an accepted and signed proposal back from the client as well as additional information, using their "Template for Solar PV information", including • Elevation above mean sea level • Coordinate list for each structure - WGS84 (degrees, min and sec – S302515.32 E0180102.52)			

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					• A KMZ file with the positions of the proposed structures • the dimensions/specs of the structures • Height to the top of structure • A Glint and Glare assessment report • If there will be power lines erected, and/or a substation the position and heights for each structure (Pole/substation) must be provided. (4) ATNS will liaise with the SACAA and will provide the client (Soventix SA (Pty) Ltd) with the conditional/final approval from the SACAA. (5) The client (Soventix SA (Pty) will have to liaise with SACAA to finalise the "As build" and for any queries with the lighting.			
01	Legal Compliance	A person is guilty of an offence if that person fails to comply with or contravenes a	Compliance with the applicable generic EMPrs	Two generic EMPrs completed by the contractor and accepted	(1) Adopt the generic EMPr for the development and expansion of substation infrastructure for the transmission and distribution of electricity,	Holder and Contractor	Prior to the commencement of construction of the on-site substation and	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		condition of an approved environmental management programme.		(signed) by the Holder.	during development of the on-site substation. (2) Adopt the generic EMPr for the development and expansion for overhead electricity transmission and distribution infrastructure, during development of the 66 to 132 kV distribution line to the on-site substation on Phase 2.		66 – 132 kV powerline.	
01	Legal Compliance	A person is guilty of an offence if that person fails to comply with or contravenes a condition of an environmental authorisation.	Compliance with the conditions of an environmental authorisation.	ECO Appointment	Appoint an ECO as prescribed in the Environmental Authorisation.	Holder	Prior to the pre-construction (and contractor readiness) phase.	Compliance to be verified by IEA.
01	Change in Land Use	Proposed land use is incompatible with current zoning.	Compliance with the Municipal Scheme Regulations.	A decision by the District Municipal Planning Tribunal	(1) The applicant shall submit a Rezoning Land use application for rezoning from Agricultural Zone 1 to "Renewable Energy Plants Zone" through the Emthanjeni LM for a decision by the District Municipal Planning Tribunal (contact person: Ms Lucy Billy lbilly@emthanjeni.co.za)	Holder	Prior to the pre-construction (and contractor readiness) phase.	Compliance to be verified by ECO & IEA.
01	Change in Land Use	Proposed land use is incompatible with current zoning.	Combine solar photovoltaic power generation and Agriculture.	Recognition of the Agrivoltaic system as a legitimate land use.	The Rezoning Land use application shall involve an Agrivoltaic system, which combines solar	Holder	Prior to the pre-construction (and contractor readiness) phase.	Compliance to be verified by ECO & IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					photovoltaic power generation and Agriculture.			
01	Change in Land Use	Unplanned movement of vehicles could damage households/Eskom infrastructure	Minimize disturbance to local individuals.	Access Agreement	An access agreement must be formalised and signed by the Contractor and landowner before commencing with the activities (DEA Generic EMPr)	Holder	Planning & Design Phase	Compliance to be verified by ECO & IEA.
01	Planning	Solar photovoltaic structures within a 2 km radius of the closest point of a transmission or distribution substation (66kV to 765kV) may impede Eskom's future planning.	Eskom's existing infrastructure and future planning is not impeded.	Eskom Agreement	(1) Where solar photovoltaic structures fall within a 2 km radius of the closest point of a transmission or distribution substation (66kV to 765kV), a written agreement with Eskom is recommended during the planning phase of such plant or structures to ensure Eskom's future planning is not impeded (Renewable Energy Generation Plant Setbacks to Eskom Infrastructure Revision 02 compiled on 15/09/2020 (Unique Identifier 240-65559775)).	Holder	Planning & Design Phase.	Compliance to be verified by ECO & IEA.
01	Layout & Design	Legitimate lighting can be a nuisance to neighbours.	Maintain project operational safety and security without causing light pollution.	Substation lighting meets Eskom's Requirements without causing light pollution, light spillage, and distracting glare.	Provide lighting at the on-site substation as per Eskom's requirements, but whilst incorporating effective light management into the design of the lighting to ensure that the visual influence (such as light pollution, light spillage	Holder	Planning & Design Phase.	Compliance to be verified by ECO & IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					and distracting glare) is limited to the solar PV facility, without jeopardising project operational safety and security.			
01	Layout & Design	Unlawful development or widening of roads.	Compliance with listed activities relating to development and widening of roads.	Road Designs with specifications overlaid on sensitive areas identified by specialists.	Incorporate the following elements into the design of the roads: (a) Minimise the extent of new and upgraded roads as far as is practical, (b) Only two-track roads shall be used between solar arrays, (c) New roads may be wider than 4m, but they should not be wider than 5-6 m, (d) Upgrading existing two-track roads should not be wider than 5-6 m, (e) Sections of new road with a passing lane should not be wider than 8 m or if wider than 8 m then the cumulative length of passing lanes shall not exceed 1 km, (f) Sections of existing road with a passing lane may be wider than 8 m if justified by the Engineer, and (g) Passing lanes shall not be constructed within the ecological buffer of a watercourse.	Holder	Planning & Design Phase.	Compliance to be verified by ECO & IEA.
01	Layout & Design	Degradation of sensitive environments	Protect sensitive areas by avoidance.	Layout of the Solar PV facility overlaid on map	(1) No development, other than linear activities authorised in terms of the	Holder, Engineer	Planning & Design Phase.	Compliance to be verified by ECO & IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		identified by specialists		of the sensitive areas identified by specialists.	environmental authorisation such as crossings for roads, fencelines, electrical cables and water pipes, may take place within the demarcated ecological buffers. (2) Buffers must be demarcated by the ECO.			
01	Layout & Design	Ignorance of flood lines can cause significant damage to the environment and infrastructure.	Lawful planning of development with respect to flood lines.	Layout of the Solar PV facility overlaid on predicted "ponded flood occurrence zones"	(1) Care should be taken in areas where development does take place within the likely flooding zones. The Engineers should during the design of the development identify the predicted "ponded flood occurrence zones" (Hydrology Assessment Report) and prescribe, where applicable, proper flooding protocols (e.g., ensure drainage and stormwater systems are put in place to minimize flooding potential) and erosion prevention measures. (2) If PV panels and array assemblages are proposed in areas of high flood risk, the depth of flooding should be predicted for those areas, e.g., depth of surface water flooding predicted during the 1:100	Holder, Engineer	Planning & Design Phase.	Compliance to be verified by ECO & IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					year flood event (refer to Hydrology Assessment Report). (3) All electrical connectors and other items vulnerable to flood water should be located at a minimal level of the maximum flood depth plus a 0,3 m free board above ground level to ensure that they are protected from the design flood event (1:100yr).			
01	Layout & Design	Unlawful planning and development of land, that is without approved building plans.	Lawful planning and development of land.	Building plans approved by the Emthanjeni Local Municipality.	Building plans for the solar PV facility must be submitted to the Emthanjeni Local Municipality for approval in terms of Section 4(1) of National Building Regulations and Building Standards, 1977 (Act No. 103 of 1977) as amended.	Holder, Engineer	Planning & Design Phase.	Compliance to be verified by ECO and IEA.
01	Layout & Design	Unlawful planning and development of land, that is without regard of prescribed building lines.	Lawful planning and development of land.	Building Plan indicating approved building lines from the property boundary.	The applicant can stipulate in the Rezoning Land use application, what they need in terms of building lines and motivate as to why. The applicant will apply the building line restrictions from the boundary of the premise they need to for the land use they are applying for.	Holder	Planning & Design Phase.	Compliance to be verified by ECO and IEA.
01	Layout & Design	Poor planning and development	Eskom's existing infrastructure	Proof of correspondence	(1) No construction or excavation work shall be executed within Eskom's	Holder	Planning & Design Phase.	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		of land, that is without regard of Eskom's Infrastructure.	and future planning is not impeded.	with Eskom Grid Access Unit.	servitude without their consent. (2) Solar photovoltaic plant setbacks away from substations are required to prevent substations from being boxed in by these renewable generation plants limiting line route access to the substations and possible future substation expansion.(Renewable Energy Generation Plant Setbacks to Eskom Infrastructure Revision 02 compiled on 15/09/2020 (Unique Identifier 240-65559775)) (3) A written request should be sent to Eskom via the Grid Access Unit regarding any proposed solar photovoltaic activity within a 5 km radius of a substation for Eskom to comment on.(Renewable Energy Generation Plant Setbacks to Eskom Infrastructure Revision 02 compiled on 15/09/2020 (Unique Identifier 240-65559775)) (4) All private roads used for access to the servitude must be maintained and upon completion of the			

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					works, be left in at least the original condition (DEA generic EMPr).			

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
01	NA	NA	NA	+I	NA	NA	NA	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
01	NA	NA	NA	+I	NA	NA	NA	L	L	0

Residual Risk (feeds back into "Mitigations"):

- The residual risk of undertaking unlawful activities (**01**) after mitigation is assumed to be Low.
- A person may feel compelled to commence with construction without a water use license if an environmental authorisation has been granted by the competent authority and the validity period requires the applicant to conclude the authorised activity within a restrictive timeframe that is limited to one dry season.

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Receiving Environment: Terrestrial fauna

Description of potential impacts:

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Reg: 2006/023163/23

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Heat Island Effect	Solar PV Facility	Atmospheric warming	**Impact:** The PV "heat island" (PVHI) effect would be the result of a detectable increase in sensible heat flux (atmospheric warming). A neighbouring game farmer is concerned that the "...wall of black, hot, reflective solar panels (will) ... repel wild game and livestock, thereby affecting their utilisation of all available grazing pasture, ..." **Consequences:** - Less available grazing would result in a loss of body condition if stocking densities are not adjusted accordingly. - Under grazing does have a deleterious effect on veld condition.	Quantity	02
Layout and Design	Lighting		**Impact:** Light pollution can negatively affect bat species. **Consequence:** Alter species composition, foraging patterns and predation rate of bats.	Quantity	02
	Installing Perimeter Fence and Access Control	Terrestrial barrier	**Impact:** Collisions of avifauna with fencing **Consequence:** injury/death to avifauna	Quantity	02
Layout and Design	Installing panel arrays and associated infrastructure (from racks to field transformers) including within 100 m of a watercourse or 500 m of a wetland/pan	Interfering with ecological processes and biodiversity pattern	**Impact:** Decrease in species composition, activity and abundance. **Consequence:** Forced redistribution out of home ranges	Quantity	02

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Reg: 2006/023163/23

Layout and Design	Installing panel arrays and associated infrastructure (from racks to field transformers) including within 100 m of a watercourse or 500 m of a wetland/pan	Interfering with ecological processes and biodiversity pattern	**Impact:** Disturbance to roosting sites and commuting routes during construction activities **Consequence:** (1) Forced redistribution out of home ranges. (2) Cumulative deterioration to the landscape and the loss of habitat due to vegetation clearing and roost disturbance/destruction may cause a shift in the species composition and abundance within the bat community to a bias towards more hardy species such as the Egyptian free-tailed bat, T. aegyptiaca.	Quantity	02
Layout and Design	Installing panel arrays and associated infrastructure (from racks to field transformers) including within 100 m of a watercourse or 500 m of a wetland/pan	Interfering with ecological processes and biodiversity pattern	**Impact:** Removal of vegetation and disruption to the ephemeral watercourse **Consequence:** (1) Habitat degradation leads to disturbance/alteration of important areas of bat activity such as roosting sites, commuting, foraging and socialising areas. (2) Habitat degradation leads to changes in bat community and abundance of bat species. (3) Cumulative deterioration to the landscape and the loss of habitat due to vegetation clearing and roost disturbance/destruction may cause a shift in the species composition and abundance within the bat community to a bias towards more hardy species such as the Egyptian free-tailed bat, T. aegyptiaca.	Quantity	02
Layout and Design	Installing panel arrays and associated infrastructure (from racks to field transformers) including within 100 m of a watercourse or 500 m of a wetland/pan	Physical structures	**Impact:** The attraction of some novel bird species due to the development of a solar farm with associated infrastructure such as lake effect perches, nest and shade opportunities. **Consequence:** Damage to the infrastructure through acidic defecation by certain species and draws birds closer to infrastructure and cause significant direct mortality risks.	Quantity	02

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Reg: 2006/023163/23

Layout and Design	Distribution Line	Obstruction	**Impact:** Power lines are a major cause of avian mortality among power line sensitive species, especially Red Data species incl. Blue Crane, Ludwig's Bustard, Kori Bustard, Secretary bird, etc. (Transmission Bird Collision Prevention Guideline (Revision 1) effective date June 2010) **Consequences:** - Preliminary results of ongoing research indicate that the unnatural mortality caused by bird collisions with transmission lines could be unsustainable for regional populations of species such as Blue Cranes in the central Karoo. - Consistent high adult mortality over an extensive period could have a serious effect on a population's ability to sustain itself in the long or even medium term, e.g. when a reduced population becomes functionally extinct.	Quantity	02
Layout and Design	Installing Perimeter Fence and Access Control	Terrestrial barrier	**Impact:** Bird mortalities during the operational phase due to vehicle collisions, collisions with infrastructure and/or combustion. **Consequence:** Decrease in avifauna population.	Quantity	02
Layout and Design	Roads		**Impact:** Collision of traffic with fauna crossing roads etc. **Consequence:** Death/loss of fauna species.	Quantity	02
Layout and Design	Buffers	Specialist Assessment Reports	**Impact:** The destruction or disturbance of bird roosts/nests during the construction phase. **Consequences:** Decrease in avifauna population due to loss of offspring/breeding pairs for generation	Quantity	02

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 02 (Animal species)

- Changes in landscape and habitat conversion can affect bat populations and assemblages on a local and regional scale.
- Bats are known to use a variety of roost types from rock cavities, exfoliating rock, tree foliage, under tree bark, tree cavities, aardvark burrows, natural and man-made caves and numerous man-made structures. However, during the active search for roosts in the rocky outcrop along the eastern boundary, no roosting sites were located.

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Reg: 2006/023163/23

- Linear structures in the landscape such as vegetation edges and rocky outcrops/ridges, are known to be used by some bats as landmarks to navigate across the landscape.
- Seasonal water bodies (for example ephemeral pans) are important as surface water is a scarce resource in arid and semi-arid regions that is important for the survival of many animals. These pans are key drinking and foraging resources for bats and must be protected. Open water in arid and semi-arid environments (such as in the Nama-Karoo) may be an important resource influencing survival, resource use, distribution and activity of insectivorous bats.
- The DFFE Screening Tool identified the Soventix Phase 3 site as having a low sensitivity. The site verification confirmed the low sensitivity and it is unlikely that any red-listed fauna are present within the site.
- Sedentary animals pose a higher risk of harm than active animals.

Impact 02 (PV "heat island" (PVHI) effects)

- The lateral and vertical extent of the PVHI effect cannot be known. However, it is unlikely that Solar PV modules will have a direct negative impact on wild animals considering domestic animals such as sheep are successfully used in Agrivoltaic systems and actively seek shade beneath the modules.

Impact 02 (Lighting)

- Although the facility will not be lit up during the nighttime period, selected infrastructure will have to be illuminated. These comparatively small, illuminated areas can still impact the surrounding ecological functioning (including biological systems) of the adjacent landscape through spill over lighting and sky glow.
- Artificial lighting is well known to disrupt the flow of information to organisms, provides misleading clues and can cause interspecific competition for food resources by extending diurnal species foraging activity into the night-time period. As such, the spill-over of artificial lighting beyond the proposed solar PV facility into dark, natural spaces must be prevented.
- Over fine and large scales, bats can be impacted by all types of conventional lighting.
- Known impacts of artificial lighting on bats are; delayed emergence and reduced number of individuals from roosts, changes in navigation and commuting behaviour, foraging behaviour alterations, the creation of "barriers" limiting the connectivity of habitats in the landscape and the effective dispersal of species (isolating habitat patches and populations from immigration), and decreased growth rates of young bats if adult bats incur higher energetic losses and experience decreased foraging time if they have to forage further afield from maternity roosts.
- Artificial lighting appears to benefit some bat species (light-tolerant) through increasing their foraging efficiency by identifying and exploiting insects swarming around lights. Typical bat species that make use of the foraging opportunities under lights are often open-air and clutter-edge forager bat species with echolocation calls adapted for open and semi-open habitats created around artificial lighting, thus there is an expectation that L. capensis and T. aegyptiaca may benefit from artificial lighting. Laephotis capensis has been shown to forage around lights.

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Reg: 2006/023163/23

- Light intolerant bat species are often slow flying and highly manoeuvrable, adapted for foraging in cluttered environments such as Rhinolophids and Nycterids. One reason for these species avoiding lit areas is that their echolocation call structure is not well suited for foraging in the open habitat associated with artificial lighting. A second reason for certain bat species to avoid artificially lit areas is the sensitivity of bat eyes to light. As light intensity increases, bat's visual sensitivity decreases.
- Lighting, particularly in arid regions can have significant impacts on arid bat communities where bats may reduce drinking activity due to artificial lighting.
- A combination of mitigation strategies could effectively reduce the impact of ecological light pollution.

Impact 02 (Important Bird Area)

- 84 bird species were observed within and around the Combined Project Area out of an expected total of 104 species, based on previous surveys, the SABAP Pentad analysis and habitat suitability, based Probability of Occurrences.
- The observed avian species richness and abundance is considered low to moderate for an area of this size in the South African context although the proportion of observations related to SCC was considered high, as was the overall SCC diversity. Many of the birds observed are generally considered to be common, widespread and adaptable species which were observed within their expected habitats.
- Multiple nests of multiple raptor species were located within the project footprint with two SCC nests located within the combined project are. The Combined Project Area was confirmed to support resident and / or breeding populations of SCC.
- Generally, small passerine flight activity was surprisingly low and flight paths mainly low, short and local with very few higher-flying commuting individuals observed. However, observations of medium to larger species, including large flocks of commuting waterfowl and cranes were observed, as were ground congregations of species such as Blue Cranes and Northern Black Korhaan. Abundances of powerline collision-prone species such as Ludwig's Bustard and Kori Bustard were moderate.
- Notable Priority Species recorded during walked transects included Blue Cranes, Verreaux's Eagle, Ludwig's Bustards that were often flushed from foraging positions as well as numerous Northern Black Korhaans and Karoo Korhaans. Raptors and korhaans were the most frequently recorded priority species during drive transects.
- Due to its abundance and conservation status, the Blue Crane and Ludwig's Bustard is a priority species of concern since it may be prone impacts at certain times (e.g., when commuting between roosting and feeding sites, following rainfall events, invertebrate outbreaks (locusts) or commuting after farming activities which increase food availability).
- Blue Cranes were observed throughout the study area but especially in association with drainage lines and artificial water points.
- Ludwig's Bustards were in frequent in their observations and were mostly observed close to koppies, drainage lines, adjacent to roadsides and in adjacent livestock fields. Larger raptors persisted throughout the survey area but were often congregated near perching habitat (pylons).
- Due to the high diversity and density of the above mentioned Red-Listed species recorded during the survey, (including regionally and globally listed Endangered and Vulnerable birds), the region as a whole is considered to be an area of very high avifaunal importance and activities should be managed in a holistic manner at a policy level, prioritising mitigation and monitoring of avifaunal species of conservation concern.

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Reg: 2006/023163/23

- Bird nesting sites and roosts varied from artificial structures such as pylons and windmills to some trees within the project footprint and infrastructure development will be associated with the destruction or disturbance of such roosts.
- Impacts due to bird mortalities during the operational phase are practically unavoidable for any large facility, but with the appropriate mitigation measures these impacts can be minimised. It is likely that most of the avifaunal populations will be largely displaced from the majority of the project infrastructure, although significant risks are associated with the likelihood of project vehicles flushing birds into fencing infrastructure as well as collisions of large bodied species with powerlines. Although the current overall bird activity qualifies the proposed solar development boundary as a high-density area, there are certain times of the year (and day) when it appears that large flocks of birds (such as cranes bustards and large birds of prey) are far more prevalent.
- Essentially, all habitat attractants should be eliminated so that avifaunal populations will not embedded themselves within the infrastructure over time.
- Lake Effect can attract aquatic birds and insects (food) as panels mimic reflective surfaces of waterbodies.

Conservation Issues/Threats

- Renewable energy developments are a new threat. Thirteen wind and solar developments have been approved for development within this IBA. All the large trigger species are highly susceptible to collisions with wind turbines, as are large flocks of Lesser Kestrels and Amur Falcons. All the trigger species are predicted to be moderately susceptible to the various impacts of solar-energy facilities.
- Numerous existing and new power lines are significant threats to trigger species. Power lines kill substantial numbers of all large terrestrial bird species in the Karoo, including threatened species (Jenkins et al. 2011, Shaw 2013). The planned Eskom central corridor for future power-line developments includes the northern half of this IBA. There is currently no completely effective mitigation method to prevent collisions.
- Climate change scenarios for the region predict slightly higher summer rainfall by 2050, and increased rainfall variability. Droughts are expected to become more severe. The Blue Crane's diet depends largely on the timing and amount of rainfall, and climate change is predicted to have both positive and negative consequences for its populations. Increased summer rainfall could improve survival, and conversely drought years can lower long-term average survival. Large, mainly resident species dependent on rainfall are also more vulnerable to climate change. This would include the slow-breeding Verreauxs' Eagle, Tawny Eagle and Martial Eagle, which also exhibit extended parental care. Severe hailstorms kill hundreds of roosting Lesser Kestrels and Amur Falcons and could become more frequent.
- Habitat loss (including foraging and breeding) and fragmentation due to displacement (avoidance of disturbance). Habitat loss has the tendency to not only destroy existing habitat but also displace bird species from large areas of natural habitat. This specifically has a greater impact on bird species restricted to a specific habitat and its requirements.
- Collision and electrocution with above-ground power transmission lines. In some cases, collision can be associated with polarised light pollution and waterbird species mistaking large PV panels areas as wetlands or other waterbodies, a case known as the "lake effect"

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Reg: 2006/023163/23

(as per Jenkins et al. 2017). The mitigation of these impacts will be addressed in the final EIA report with operational phase monitoring to be designed in the EMPr.

- Disturbance due to noise such as, machinery movements and maintenance operations during the construction and operational phase of the proposed PV solar farm.
- The attraction of some novel bird species due to the development of a solar farm with associated infrastructure such as perches, nest and shade opportunities
- Chemical pollution: Chemicals being used to keep the PV panels clean from dust (suppressants) etc.

Conservation actions

- The major threat of power-line collisions was initially investigated by the Eskom/EWT partnership and MD Anderson, including the impact of power lines on populations of large terrestrial bird species and evaluated the effectiveness of earth-wire marking devices (Eskom's Transmission Bird Collision Prevention Guideline - Revision 1 and Eskom's Utilization of Bird Flight Diverters on Eskom Overhead Lines (Revision 1) authorised date July 2015).
- Ludwig's Bustard is classified as Endangered as the population is projected to have undergone a very rapid population decline due to collisions with power lines, a trend which is set to continue into the future as the power grid in southern Africa expands and successful mitigation measures are yet to be implemented (BirdLife International (2022) Species factsheet: *Neotis ludwigii*. Downloaded from http://www.birdlife.org on 30/03/2022; http://datazone.birdlife.org/species/factsheet/ludwigs-bustard-neotis-ludwigii).
- Ludwig's Bustard was listed as globally Endangered on the IUCN Red List in 2010 as a result of potentially unsustainable collision mortality, but there is no evidence for a population decrease over the past 20 years despite extremely high annual power line mortality rates (41% of the Ludwig's Bustard population) (Shaw, J. 2013. Power line collisions in the Karoo conserving Ludwig's bustard. University of Cape Town).- **this finding contradicts BirdLife's statement that the rapid population decline in the Ludwig's Bustard is due to collisions with power lines (above)**.
- Anti-collision devices have success rates of up to 60% reduction in mortality and even more have been documented (Ferrer and Janns, 1999 - in Eskom's Transmission Bird Collision Prevention Guideline).
- Anti-collision devices are an effective mitigation measure in reducing mortality for Blue Cranes (*Anthropoides paradiseus*) (Shaw J.M., 2013).

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**

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Reg: 2006/023163/23

H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
02	M	M	M	-I	M	H	1	H	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- Timing construction to May, June, July and August in order to avoid breeding periods of species within the sensitive drainage lines, wetlands and the general region.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Chiropteran Specialist Report for Phase 3 of the Proposed Soventix-Solar Africa Solar PV Facility, Hanover, Northern Cape Prepared by: Dawn Cory Toussaint dated July 2022.
- Terrestrial Animal Species Compliance Statement – Soventix Phase 3 Pv Project (Second Draft) prepared by Simon Todd of 3 Foxes Biodiversity Solutions dated September 2022.
- Terrestrial Biodiversity Specialist Assessment – Soventix Phase 3 Pv Project prepared by Simon Todd of 3 Foxes Biodiversity Solutions dated September 2022.
- Avifauna Specialist Assessment (Final) prepared by Enviro-Insight CC (Sam Laurence and A.E. van Wyk) dated October 2022).
- Eskom's Transmission Bird Collision Prevention Guideline (Revision 1) effective date June 2010
- Eskom's Utilization of Bird Flight Diverters on Eskom Overhead Lines (Revision 1) authorised date July 2015.
- Shaw, J. 2013. Power line collisions in the Karoo conserving Ludwig's bustard. University of Cape Town
- Barron-Gafford G.A., et al (2016) "The Photovoltaic Heat Island Effect: Larger solar power plants increase local temperatures" www.nature.com/scientificreports

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Reg: 2006/023163/23

- (BirdLife International (2022) Species factsheet: Neotis ludwigii. Downloaded from http://www.birdlife.org on 30/03/2022; http://datazone.birdlife.org/species/factsheet/ludwigs-bustard-neotis-ludwigii).

Mitigations:

Impact Management Outcome(s):

- Ensure least impact on animal behaviour.
- The conservation of the natural vegetation, seasonal resources (such as the aquatic system), rocky outcrops and ecosystem functionality to enhance the conservation of all bat species that occur in the area.
- Ensure the protection of Aves.
- Minimize the loss/injury to fauna caused by roads.

Targets:

- No impacts on bat species due to lighting.
- Important bat areas are protected.
- No impacts on bat roosting sites due to disturbance
- Avoid or reduce possible PVHI effect on neighbouring game farm (Farm No. 149) – 250 m 'visual sensitivity' buffer along north-eastern property boundary.
- Reduce Risk of avian mortality below unsustainable thresholds that threaten regional populations of powerline sensitive and priority avian species – relatively few mortalities observed and recorded beneath the 66-132 kV powerline relative to Eskom's 132 kV powerline, bird diverting devices observed across the entire length from pylon to pylon, and a Mace Bird Lite is mounted on the overhead ground wire.
- Bird diverting devices around/across PV panels
- Curved mirrors
- Animal friendly road design.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
02	Heat Island Effect	Possible PVHI effect on wild game.	Ensure least impact on animal behaviour.	Avoid or reduce possible PVHI effect on neighbouring game farm	A risk averse approach to the unknown lateral and vertical extent of the PVHI effect on wild game is to establish a 250 m corridor along the	Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
				(Farm No. 149) – 250 m 'visual sensitivity' buffer along north-eastern property boundary.	concerned neighbours' game farm boundary.			
02		Decrease in species composition, activity and abundance.	The conservation of the natural vegetation, seasonal resources (such as the aquatic system), rocky outcrops and ecosystem functionality to enhance the conservation of all bat species that occur in the area.	Important bat areas are protected.	Areas of significance for bats such as foraging and socialising areas, landscape features used for commuting/navigation and roosting sites must be considered during the planning, layout and design of the solar arrays.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
02	Layout and Design	Disturbance to roosting sites and commuting routes during construction activities	Ensure least impact on animal behaviour.	No impacts on bat roosting sites due to disturbance	Avoid development of the ridge near the eastern border of the farm and extend a 100m buffer zone from the crest of the rocky outcrop to limit any potential impact on possible roosting sites and commuting routes.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
02	Layout and Design	Removal of vegetation and disruption to the	The conservation of the natural vegetation,	Important bat areas are protected.	The ephemeral drainage line running centrally through the proposed footprint must not be	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

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		ephemeral watercourse	seasonal resources (such as the aquatic system), rocky outcrops and ecosystem functionality to enhance the conservation of all bat species that occur in the area.		altered/developed as this feature would be an important seasonal resource for bats.			
02	Layout and Design	Light Pollution can negatively affect bat species	Ensure least impact on animal behaviour.	No impacts on bat species due to lighting.	(1) The number and position of lights required must be limited and installed in areas where it is absolutely necessary. (2) A light shield/lamp shade should be used to focus the beam downwards onto the ground to prevent sky glow as well as to prevent light from trespassing beyond the development area into the surrounding naturally dark areas. (3) The intensity of the lighting is lowered (dim the lights). Alternatively, in conjunction with substantially dimming the lights, motion sensors could be installed. (4) The spectrum of light chosen has longer	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

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					wavelengths to reduce the attractiveness of light to insects. (5) If possible, the duration of the lighting period should be limited, and lights switched on shortly after the peak night-time emergence of clutter-edge forager bats ~60min after sunset.			
02	Layout and Design	Bird mortalities during the operational phase due to vehicle collisions, collisions with infrastructure and/or combustion.	Ensure the protection of Aves	Reduce Risk of avian mortality below unsustainable thresholds that threaten regional populations of sensitive and priority avian species	In all areas where service road intersect with semi natural or natural habitat, all fences must be set back at least (strictly) 75 metres from the edge of every service road in order to allow for vulnerable species such as cranes and korhaans to obtain adequate height after being flushed by vehicle traffic. Alternative to and where a 75 metre buffer is not possible, new fences must be set back no more than 2 metres (directly adjacent) from the edge of service roads. Through the essential elimination of habitat, this will limit any chance of vulnerable species foraging on verge side vegetation and	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					causing subsequent fence collisions.			
02	Layout and Design	The destruction or disturbance of bird roosts/nests during the construction phase.	Ensure the protection of Aves	Reduce Risk of avian mortality below unsustainable thresholds that threaten regional populations of sensitive and priority avian species	Timing construction to May, June, July and August in order to avoid breeding periods of species within the sensitive drainage lines, wetlands and the general region.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
02	Layout and Design	The destruction or disturbance of bird roosts/nests during the construction phase.	Ensure the protection of Aves	Reduce Risk of avian mortality below unsustainable thresholds that threaten regional populations of sensitive and priority avian species	All Verreaux's and Tawny Eagle nests must be buffered by at least a 1 km exclusion zone of ALL project activities with a preferable "non-disturbance" exclusion of 1.5 km during breeding season.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
02	Layout and Design	The destruction or disturbance of bird roosts/nests during the construction phase.	Ensure the protection of Aves	Reduce Risk of avian mortality below unsustainable thresholds that threaten regional populations of sensitive and priority avian species	No construction vehicles or personnel may approach the Verreaux's/ Tawny Eagle nests within 1.5 km during the construction phase.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
02	Layout and Design	Collisions of avifauna with fencing	Ensure the protection of Aves	Reduce Risk of avian mortality below unsustainable thresholds that threaten regional populations of sensitive and priority avian species	Utilize systematic fence marking to reduce avian collisions with fences. Markings should be at an appropriate height to be visible to birds flying at or above the height of the solar panels.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
02	Layout and Design	Power lines are a major cause of avian mortality among power line sensitive species.	Ensure the protection of Aves	Reduce Risk of avian mortality below unsustainable thresholds that threaten regional populations of powerline sensitive and priority avian species – relatively few mortalities observed and recorded beneath the 66-132 kV powerline relative to Eskom's 132 kV powerline.	Fit swan/spiral flight diverters, dynamic devices (usually called bird flappers) and/or reflective devices (such as the Inotec BFD88) to the earth wire at 5m intervals as per Eskom's Transmission Bird Collision Prevention Guideline (Revision 1) effective date June 2010, and Eskom's Utilization of Bird Flight Diverters on Eskom Overhead Lines (Revision 1) authorised date July 2015.	Holder, Engineer	Planning and Design Phase	Bi-weekly monitoring beneath the 66-132 kV distribution line (and a comparable transect beneath Eskom's 132 kV powerline) to be undertaken by SEO. Compliance to be verified by ECO and IEA.
02	Layout and Design	The attraction of some novel bird species due to the	Ensure the protection of Aves	Bird diverting devices around/across PV panels	Bird diverters, perch deterrents and the application of Non-polarising white tape can	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		development of a solar farm with associated infrastructure such as lake effect perches, nest and shade opportunities.			be used around and/or across panels to minimise reflection.			
02	Layout and Design	The attraction of some novel bird species due to the development of a solar farm with associated infrastructure such as lake effect perches, nest and shade opportunities.	Ensure the protection of Aves	Curved mirrors	Use of parabolic (curved) mirrors instead of flat heliostats to reduce the likelihood of skyward reflection to minimise potential bird collisions.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
02	Layout and Design	Power lines are a major cause of avian mortality among power line sensitive species.	Ensure the protection of Aves	Bird diverting devices observed across the entire length from pylon to pylon.	Although Eskom's Transmission Bird Collision Prevention Guideline requires that only the middle 60% of each span needs to be marked, powerlines shall be marked with bird diverting devices from pylon to pylon along their entire length (Shaw J.M., 2013).	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
02	Layout and Design	Power lines are a major cause of avian mortality among power line	Ensure the protection of Aves	A Mace Bird Lite is mounted on the overhead ground wire.	A Mace Bird Lite, which is a Perspex tube with a fluorescent tube inside, shall be mounted on the overhead ground wire to	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		sensitive species.			protect birds that fly at night, such as Flamingos.			
02	Layout and Design	Collision of traffic with fauna crossing roads etc.	Minimize the loss/injury to fauna caused by roads.	Animal friendly road design	Appropriate design of roads and other infrastructure to minimise faunal impacts and allow fauna to pass over, through or underneath these features as appropriate.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
02	L	L	M	-I	M	M	1	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
02	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

- Sedentary or burrowing fauna, as well as ground nesting birds, may occupy the development site after their observed absence during the environmental impacts assessment process.
- Residual risk of avian mortality after installation of anti-collision devices will depend on the effectiveness of these mitigatory measures in reducing mortality below unsustainable thresholds that threaten regional populations of powerline sensitive and priority avian species. The residual risk on the Ludwig’s Bustard is assumed “Low” because of the reported success rates of anti-collision devices (up to 60% reduction in mortality and even more have been documented according to Ferrer and Janns, 1999 - in Eskom's Transmission Bird Collision Prevention Guideline) combined with the species’ resilience to extremely high annual power line mortality rates in the absence of mitigation measures (41% of the

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Reg: 2006/023163/23

Ludwig's Bustard population according to Shaw, J. 2013. Power line collisions in the Karoo conserving Ludwig's bustard. University of Cape Town).

- Overall, the residual risk of loss of threatened terrestrial fauna (**02**) after mitigation is assumed to be Low.

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Reg: 2006/023163/23

Receiving Environment: Terrestrial flora

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Change in Land Use	Uncertainty (SIA)	Fire	**Impact:** Risk of veld fires caused by workers during the construction of the facility decreases grazing capacity. **Consequence:** - Runaway fires on neighbouring properties will result in a loss of grazing for livestock and/or wild game, increasing the running costs to provide supplementary feed.	Quantity	03

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 03 (Fire)

- The De Aar area falls within the Nama Karoo biome. Runaway fires could result in a decrease in grazing capacity.

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
03	L	M	L	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- National Veld and Forest Fire Act, 1998 (Act No. 101 of 1998)

Mitigations:

Impact Management Outcome(s):

- Fire management plan.

Targets:

- No run-away (uncontrolled) fires.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
03	Change in Land Use	Risk of veld fires caused by workers during the construction of the facility decreases grazing capacity	Fire management plan	No run-away (uncontrolled) fires - no open fires	Undertake a risk analysis to determine inter alia the probability and frequency of a wildfire during construction and operation and prepare a fire management plan accordingly.	Holder	Planning and Design	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
03	L	M	L	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
03	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- The residual risk of loss of grazing material due to uncontrolled fires (**03**) after mitigation is assumed to be Low.

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Reg: 2006/023163/23

Receiving Environment: Soil and Rock

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Layout and Design	Installing panel arrays and associated infrastructure (from racks to field transformers) including within 100 m of a watercourse or 500 m of a wetland/pan	Surface water hydrology (run-off)	**Impact:** Run-off from solar PV arrays in dispersive soils can cause erosion. **Consequence:** Storm water and runoff from hard surfaces such as solar PV panels, need to be managed to prevent initiation of erosion. Any degradation of the soil-terrain complex that undermines its capacity to function - from storing water and recycling nutrients to resisting erosion - will lead to a decline in primary production and diminish energy flow to higher trophic levels. Primary production is an ecosystem supporting service that maintains other ecosystem services, so its harm can lead to ecosystem collapse.	Quantity	04
Layout and Design	Services (pipes and cables)	Dispersive Soils	**Impact:** Supplying services via trenches in dispersive soils can cause tunnel erosion. **Consequence:** Trenches may be used to supply services such as water and electricity, however in dispersive soils, the increased porosity of repacked spoil within the trench can lead to tunnel erosion and damage to pipes and cables. Any degradation of the soil-terrain complex that undermines its capacity to function - from storing water and recycling nutrients to resisting erosion - will lead to a decline in primary production and diminish energy flow to higher trophic levels. Primary production is an ecosystem supporting service that maintains other ecosystem services, so its harm can lead to ecosystem collapse.	Quantity	04

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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Layout and Design	Roads	N/A	**Impact:** Constructing roads and culverts in dispersive soils can cause erosion. **Consequence:** Construction of roads on dispersive soils is difficult due to their low bearing capacity when wet. Concentrating water in roadside culverts and drains which have been excavated into dispersive soils often leads to erosion and collapse of the road batter adjacent embankments. Any degradation of the soil-terrain complex that undermines its capacity to function - from storing water and recycling nutrients to resisting erosion - will lead to a decline in primary production and diminish energy flow to higher trophic levels. Primary production is an ecosystem supporting service that maintains other ecosystem services, so its harm can lead to ecosystem collapse.	Quantity	04
Layout and Design	Roads	N/A	**Impact:** The clayey soils and most noticeably the Swartland and Valsrivier soils may restrict vehicle movement during the wet season. **Consequence:** Economic, delays in construction. Soil erosion cause by vehicles stuck in access roads	Quantity	04
Layout and Design	Installing panel arrays and associated infrastructure (from racks to field transformers) including within 100 m of a watercourse or 500 m of a wetland/pan	Interfering with ecological processes and biodiversity pattern	**Impact:** Spills from damaged and leaking oil-filled field transformers will contaminate the topsoil (Risk). **Consequences:** Sterile habitat for fauna and flora (direct).	Quality	05

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Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

- During the rainy season terrain mobility on high clay soils in low lying areas with drainage lines will be difficult and might increase soil erosion when drainage lines are disturbed.

Impact 04 (Soils)

- The entire site has very thin soils and either bedrock sub-outcrop at less than 0,5 metres depth below ground surface or bedrock outcrop/dispersed outcrop. The thickest soils of 1,0 to 1,2 metres thickness over minor parts occur in areas of either gully wash material, alluvial deposits or pediplain positions (at low landscape localities). These soils are generally of a silty sand to clayey sand nature.
- Most of the soils are very shallow with an average depth of less than 30cm. Clay content ranges from sandy loam to very clayey. Calcareous soils are covering relatively small areas. Soils are unsuitable for most types of agriculture.
- No severe donga erosion has been observed in the study areas. Minor to moderate plate erosion is present. Severe donga and sheet erosion have been observed on flood plains outside the study areas.
- It is not envisaged that the proposed development will result in major soil erosion or any other degradation of the soils of the focus areas if there is proper runoff management from roads and other bare areas.

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
04	H	L	H	-I	H	M	1	M	L	0
Reversibility	L	**Irreplaceability**	M	**Mitigatory Potential**	H					

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
05	H	L	M	-I	H	M	1	H	M	1
Reversibility	M	**Irreplaceability**	M	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- Proper runoff management from roads and other bare areas is to be implemented.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Hardie M. (2009), "Dispersive Soils and their Management, Technical Reference Manual." Department of Primary Industries and Water, State of Tasmania, Australia (ISBN 978-0-7246-6774-1).
- Hydrological Assessment (Version – Final 3) 01 September 2022 GCS Project Number: 22-0076 by Hendrik Botha.
- Soil Mapping Report prepared by Hennie van den Burg of Iris International and Francois Botha of Eco Soil dated June 2022.
- Geotechnical Assessment Study prepared by FDJ Stapelberg of the Council for Geoscience dated 11 May 2022 (CO2017-5806 (Phase 80)).

Mitigations:

Impact Management Outcome(s):

- Minimise the risk of erosion on dispersive soils.
- Minimise the risk of tunnel erosion in dispersive soils.
- Conserve topsoil/prevent contamination.

Targets:

- No signs of soil erosion.
- No signs of oil spills from field transformers.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
04	Layout and Design	Run-off from solar PV arrays in dispersive soils can cause erosion.	Minimise the risk of erosion on dispersive soils.	No signs of soil erosion	Sheep will help control the height of the underlying vegetation. However, given that they are highly selective grazers and the unlikelihood of all karoo 'bossies' immediately to the east and west of each solar module being browsed below 300 mm, indigenous vegetation may where required be cropped/cut by staff to a height of 100 mm below the solar module at maximum tilt, but not cleared.	Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
04	Layout and Design	Run-off from solar PV arrays in dispersive soils can cause erosion.	Minimise the risk of erosion on dispersive soils.	No signs of soil erosion	Cut vegetation shall be left on the ground beneath and around the trimmed plants to protect the soil and provide shelter for seedlings.	Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
04	Layout and Design	Run-off from solar PV arrays in dispersive soils can cause erosion.	Minimise the risk of erosion on dispersive soils.	No signs of soil erosion	If solar arrays are to be installed on potentially dispersive soils (e.g., bare patches) then implement the 'Solar Arrays on Dispersive Soils Protocol' (Appendix B3).	Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
04	Layout and Design	Impact: Supplying services via trenches in dispersive soils can cause tunnel erosion.	Minimise the risk of tunnel erosion in dispersive soils.	No signs of tunnel erosion.	If trenching is to be undertaken in potentially dispersive soils (e.g., bare patches) then implement the 'Trenching in Dispersive Soils Protocol' (Appendix B1)	Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
04	Layout and Design	Constructing roads and culverts in dispersive soils can cause erosion.	Minimise the risk of erosion on dispersive soils.	No signs of soil erosion.	If roads and culverts are to be constructed in potentially dispersive soils (e.g., bare patches) then implement the 'Roads & Culverts in Dispersive Soils Protocol' (Appendix B2)	Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
04	Layout and Design	The clayey soils and most noticeably the Swartland and Valsrivier soils may restrict vehicle movement during the wet season.	Minimise the risk of erosion on dispersive soils.	No signs of soil erosion.	Access roads to the project area, especially those crossing large flood plains, should be well planned.	Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
04	Layout and Design	The clayey soils and most noticeably the Swartland and Valsrivier soils may restrict vehicle	Minimise the risk of erosion on dispersive soils.	No signs of soil erosion.	The design of access roads must include the adequate management of surface water run-off	Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		movement during the wet season.						
05	Layout and Design	Spills from damaged and leaking oil-filled field transformers will contaminate the topsoil (Risk).	Conserve topsoil/prevent contamination.	No signs of oil spills from field transformers.	Field transformers shall be located in/on a transformer contaminant bund designed with an oil/water separation system, such as but not limited to a valve with an oil/water capture filter that allows water to pass through but trap oil.	Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
04	L	L	L	-I	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
05	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

- The residual risk of soil erosion (**04**) after mitigation is assumed to be Low.

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Reg: 2006/023163/23

- Whilst effective against a damaged transformer leaking oil, the transformer containment bund (**05**) will not prevent spillage in the case of an explosion resulting from a direct lightning strike. The residual risk of topsoil contamination resulting from direct lightning strikes is assumed to be “Low”.

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Reg: 2006/023163/23

Receiving Environment: Ground and Surface Water

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Climate Change	Solar PV Facility	N/A	**Impact:** Water availability for irrigation and drinking in an arid District dependent on ground water (with a high salt content). **Consequences:** - A lack of sufficient locally available water for construction and operation could be a fatal flaw of the proposed development.	Quantity	06
Climate Change	Solar PV Facility	N/A	**Impact:** Decreased quality of drinking water in an arid District dependent on ground water (with a high salt content). **Consequences:** - High salt content in drinking water can be harmful to humans and livestock.	Quality	07
Change in Land Use	Uncertainty (SIA)	Fires	**Impact:** Water demand for fighting wildfires may temporarily jeopradise available water reserves for development or operational requirements. **Consequence:** - Lower performance due to insufficient water to meet water demands during development or operation.	Quantity	06
Planning	Dust suppression	Water Usage	**Impact:** Uncontrolled abstraction of groundwater from an underground aquifer could deplete the ecological reserve and affect other water users' rights to domestic use and livestock watering. **Consequences:** -- Less water in an underground aquifer means less water for other water users, including for reasonable domestic use and livestock watering (direct).	Quantity	06

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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Layout and Design	Distribution Lines	Obstruction	**Impacts:** Installation of pylons for transmission lines may cause temporary sedimentation after storm events. **Consequence:** Sedimentation of watercourse.	Quality	07
Layout and Design	Effluent Infrastructure (Sanitation)	Effluent disposal	**Impact:** Groundwater is vulnerable to pollution from on-site effluent disposal facilities **Consequences:** - Abstraction of polluted groundwater is harmful to human health.	Quality	07
Layout and Design	Effluent Infrastructure (Sanitation)	Effluent disposal	**Impact:** Leaking /overflowing chemical toilets can contaminate soil and surface water causing soil and water pollution. **Consequence:** Contaminated soil and water can contribute to terrestrial and aquatic ecosystem degradation, respectively.	Quality	07
Layout and Design	Water infrastructure (Supply)	Groundwater abstraction, purification and storage	**Impact:** Increased demand for groundwater during operation to water livestock as well as clean solar panels, control dust and provide staff with potable/drinking water, may stress groundwater reserves (exceed the rate at which reserves are naturally replenished). **Consequences:** - Loss of agricultural productivity (livestock production) due to lower availability of water. - Reduced operational efficiency due to insufficient water to clean solar panels and provide potable/drinking water to the operational area.	Quantity	06
Layout and Design	Water infrastructure (Supply)	Groundwater abstraction, purification and storage	**Impact:** The yield from a new borehole may not be viable. **Consequences:** Wasted resources	Quantity	06
Layout and Design	Water infrastructure (Supply)	Groundwater abstraction, purification and storage	**Impact:** Impact on the aquifer reserve and borehole pump lifespan. **Consequence:** Less water in an underground aquifer means less water for other water users, including for reasonable domestic use and livestock watering (direct).	Quantity	06

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Layout and Design	Water infrastructure (Supply)	Groundwater abstraction, purification and storage	**Impact:** Groundwater is vulnerable to pollution **Consequences:** Abstraction of polluted groundwater is harmful to human health.	Quality	07
Layout and Design	Water infrastructure (Supply)	Groundwater abstraction, purification and storage	**Impact:** Rainwater harvesting is vulnerable to pollution. **Consequence:** Polluted rainwater is harmful to the receiving environment.	Quality	07
Layout and Design	Culverts/Stormwater outlets	N/A	**Impacts:** Installation of road culverts may cause temporary sedimentation after storm events. Alteration of natural drainage lines may lead to ponding or increased runoff. Installation of road culverts or pylons for transmission lines may cause temporary sedimentation after storm events. **Consequence:** Ponding may cause stagnant water levels and increased run-off may cause erosion.	Quality	08
Layout and Design	Culverts/Stormwater outlets		**Impact:** The construction of culverts or stormwater outlets tend to concentrate and increase the velocity of surface water flow, changing the surface water hydrology or flow patterns. **Consequence:** Altered flow patterns can slow down the stream flow, causing deposition of sediment or increase the velocity and turbulence of the water, causing erosion (direct).	Behaviour	08

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Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 06 (Water Quantity/Use)

- A Geohydrological Assessment was commissioned to determine if there is enough groundwater to support demand during construction and operation under normal conditions and under drought years/climate change scenarios, as well as investigate the feasibility of drilling an additional borehole should it be required.
- A geophysical investigation aimed to identify likely dolerite contact zones, as these are known preferential flow paths for groundwater movement, revealed two high-feasibility drilling positions which can be considered for future water supply: T1 and T2 located in the southwestern corner of Phase 3.
- If the combined sustainable abstraction yield for both boreholes (336.67 m^3/day for 8 hours of pumping) is used as the Proposed Use in the water balance calculation for the HRU2 sub-catchment (Phase 3), there will be a surplus amount of 54 824.94 m3/yr (or 150.21 m3/day) available after the allocation of existing uses, basic human needs, base flow (to surface water streams) and PU (refer to Table 5-4 of the Geohydrological Assessment Report).
- However, if the PU is substituted for the estimated demand during construction (including the period when construction and operation overlap), that is 216 m3/day, there will be a greater surplus of 98 869,79 m3/yr (or 270,87 m3/day)
- It is therefore estimated that there is enough groundwater available on a sub-catchment level to sustain the proposed 8-hour abstraction from the designated boreholes and the sub- catchments they fall in. Provided the surplus estimates are not exceeded, the impact on the groundwater reserve will likely be minimum.
- The base case water balance will be different under the forecasted climate change scenario for 2050. If the combined sustainable abstraction yield for both boreholes (336.67 m^3/day for 8 hours of pumping) is used as the Proposed Use (PU) in the water balance calculation under the climate change scenario (lower rainfall and effective recharge to the aquifer), there will be a deficit amount of -29 954.96 m3/yr (or -82.07 m3/day) available after the allocation of existing uses, basic human needs, base flow (to surface water streams) and PU (refer to Table 5-4 of the Geohydrological Assessment Report). Based on the climate change predictions, HRU2 will therefore not be able to meet the demand for water uses by 2050. Water abstraction rates, or specifically the PU, would need to be considerably decreased nearing the 2050 mark. The potential deficit must be avoided by reducing water usage during operation and substituting the PU with the estimated demand during operation, that is 150 m3/day, in which case there will be a surplus of 38 180 m3/yr (or 140,60 m3/day).
- Although forecasted production rates (to support the development and operation of the Solar PV facility) under current and future climate change scenarios, are/can be sustainable, groundwater is a very important resource for locals in the area, so care should be taken not to overproduce from boreholes chosen for this project, and to ensure that there is a limited impact on existing livestock/domestic watering already implemented.
- Almost a third of the households in Ward 6 get their water from a borehole, a much higher proportion than on local, district or provincial level, while just over 60% get their water from a regional or local water scheme (much lower than on local, district or provincial level).

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

- The project area overlies a moderate to high yielding aquifer (median yields of 0,5 to 2 L/sec), on average 6,9 m below ground level, and generally in bedding planes in shale or interbedded sandstone of the Beaufort Group and jointed and fractured contact zones between sedimentary rocks and dolerite dykes. (Hydrology Assessment)
- However, the landowner, Willem Retief has indicated that each windmill pump yields approximately 1 200l/hr from both (two) boreholes in the project area for Phase 3. This is equivalent to 0,33 L/s, which falls at the bottom of the range (0.5 to 2 L/s – Class D3 Intergranular & Fractured Aquifer System) that is considered the median aquifer yield of the project area (Meyer, P.S., Chetty, & T., Jonk, F., 2002). Furthermore, Willem observed the water table dropped by at least 3 ms over the last few years during the drought.
- The electrical conductivity (EC) for the underlying aquifers generally ranges from 70 to 300 mS/m and the pH ranges from 6 to 8. Consequently, groundwater can generally be used for domestic and recreational use. (Hydrology Assessment)
- Water scarcity in the arid Pixley Ka Seme District Municipality is expected to be exacerbated by climate change, specifically drought. Most of the province receives minimal summer rainfall ranging from 50 mm to 400 mm depending on the location. Under a low climate change mitigation scenario (Climate Change Adaptation Response Strategy for the Northern Cape, 2016), model simulations indicated an average temperature increase by 2.3 °C, an increase of 16.1 in the total number of heat waves experienced and a decrease in rainfall to 17 mm - 74.3 mm annually.
- It is advised that all groundwater boreholes (4 identified within proximity of the solar farm) be monitored for the decline in water levels/yields, as well as water quality. It is known that the boreholes are used as the main water supply for livestock / domestic use. (Hydrology Assessment)
- Geohydrological Assessment Report (Final Rev 3) prepared by GCS Water and Environmental Consultants dated 10th August 2022 (GCS Project Number: 22-0401).
- It is advised that water be pumped to dedicated storage tanks from the boreholes to build up a reserve, whereafter the boreholes are only used to top up the storage tanks. Allowing boreholes to rest and recover between pumping cycles will help to decrease the impact on the aquifer reserve.
- He (Willem Retief, Landowner) also mentioned that the water table dropped by at least 3 metres over the last few years, due to the drought. So the question is how effective are the windmills, for if the water table drops below the intake pump the mill will spin, but no water will be abstracted?" (pers. comm. Henri Botha, Hydrologist).
- Dust Suppression - Assuming four litres of water on every square meter, the access road from the N10 to the main entrance of the facility (a road roughly 18,5 km long and 6 m wide) would require the use of roughly 444 m3 of water for dust suppression or control.
- Total permissible abstraction for the project area, that is both properties combined is 109 +107 = 216 m^3 per day.

Impact 07 (Water Quality)

- The natural hardness of water is influenced by the geology of the catchment and the presence of soluble calcium and magnesium minerals. Water hardness depends on whether it is caused by bicarbonate salts or non-bicarbonate salts, such as chloride, sulphate and nitrate. Bicarbonate salts of calcium and magnesium precipitate on heating and cause scaling in hot water systems and appliances, whereas the non-

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Reg: 2006/023163/23

bicarbonate salts do not precipitate on heating. Excessive hardness in water forms scale on heat exchange surfaces such as cooking utensils, hot water pipes, kettles and geysers, and results in an increase in soap required to produce a lather when bathing and in household cleaning. The resulting scums are unesthetic, leading in the long term to the marking of enamel surfaces of baths and handbasins. Total hardness for domestic use should be limited to between 50 - 100 mg/• as $CaCO_3$, where possible. (DWAF Water Quality Guidelines)

- On heating water containing calcium bicarbonate, carbon dioxide is lost and calcium carbonate precipitates; this causes scaling in hot water systems (DWAF Water Quality Guidelines).
- Considering the District Municipality's Climate Change Response Plan highlighted the risk of reduced deterioration in (surface) water quality due to increased salt concentrations in dams, wetlands and soil/plant systems from enhanced evaporation rates, and the farmer has 'always' supplied his livestock with groundwater via boreholes, it is assumed that no further treatment is required for livestock production.
- Groundwater is vulnerable to pollution (DHS Redbook, Section J)
- Groundwater boreholes are generally situated within and downstream of the development areas, hence are potential receptors to pollution.
- The Sewerage flow contribution as a % of Average Annual Daily Demand (AADD) for business, commercial, industrial land use categories is 80% (DHS Redbook, Section K, Table K.4).
- Rainwater harvesting is the direct capture of stormwater run-off, typically from rooftops, for supplementing water which is used on the site. Rainwater is naturally slightly acidic but can be made very acidic by industrial pollution. Consequently, filtered rainwater is suitable for all non-potable use, e.g., toilet flushing, dust suppression (DHS Redbook, Section J, Water Supply).
- To calculate the yield of a rainwater harvesting system, multiply the roof area with the mean annual rainfall and adjust by an efficiency factor (runoff coefficient; dependant on roof surface – for roofs an efficiency of 0,8 is usual) to calculate the average quantity of water available from a roof area. Average rainwater (litres) = catchment area (m2) x mean rainfall (mm) x efficiency, where 'efficiency' has a value between 0 and 1. Note that the 'catchment area' refers to the horizontal exposure of the roof's footprint to the sky, not the total roof surface (DHS Redbook, Section J, Water Supply).

Impact 08 (Surface Water Hydrology)

- The project area is located within a Strategic Water Source Area (Screening Report). Strategic Water Source Areas (SWSAs) are defined as areas of land that (a) supply a disproportionate (e.g., relatively large) quantity of mean annual surface water runoff in relation to their size and so are considered nationally important; and/or (b) have high groundwater recharge and where the groundwater forms a nationally important resource. **The protection and restoration of strategic water source areas is of direct benefit to all downstream users.** This dependence needs to be considered in decisions relating to these primary headwater catchments. **The protection of both water quantity (flows) and quality must be addressed. Any failure to address impacts on water quality or quantity will have impacts on the water security of all those depending on that water downstream.** Groundwater is the main or only source of water for numerous towns and settlements across

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

the country so protecting the capture zone, specifically for municipal supply well-fields, the recharge area, and the integrity of the aquifers is important as well.

- The project area falls within quaternary catchment D62D and the Orange Water Management Area. (Hydrology Assessment)
- The ephemeral drainage line running through the project area is an unnamed tributary to the D62D – 05610 tributary with its confluence just downstream of the Project Area. (Plan of Study prepared by Dr Andrew Deacon)
- The project area contains 3 Hydrological Response Units (HRU). Ninety-six percent (96%) of the project area falls within HRU2. The average slope of HRU2 (21,738 km^2) is 0,56%. Sixteen percent (16,51%) of HRU2 has a 3-10% slope, which is mostly restricted to the western and eastern corners of the project area. Consequently, the topography of the study area is generally flat with elevations on the site typically ranging from 1 335 to 1 370 m above mean sea level. (Hydrology Assessment)
- Drainage is generally towards the north-west via multiple non-perennial drainage lines towards the ephemeral Brak River, approximately 6,6 km further downstream. However, the drainage channels or flow paths are not clearly defined. Sheet flow occurs from micro sub-catchments towards lower topographical areas or isolated depressions forming temporarily flooded areas. Irregular occurrences of ponded water were visible across the project area, even in areas with no defined drainage lines or stream channels. (Hydrology Assessment)
- In the absence of clearly defined drainage channels or streams the area is prone to exhibit ponded flood occurrence zones. Micro sub-catchment sheet flow towards lower-lying areas within the non-perennial river flood plains is likely to dominate flood propagation, and isolated flooded areas are predicted to occur. (Hydrology Assessment)
- The project area falls within a spring to summer rainfall area (October to April), ranging from 112,4 to 738,9 mm/yr but averaging 320 mm/yr. The Mean Annual Evaporation (2 000 – 2 150 mm/yr) exceeds the Mean Annual Precipitation (MAP) by about 85%, so non-perennial streams and rivers will only have water when there are flooding events. (Hydrology Assessment)
- Considering run-off is directly related to rainfall intensity, and longer precipitation events, both monthly rainfall and run-off, peak from January to April. The run-off during these peak months, ranges from 0,3 to 1,1 mm/yr over the surface area of quaternary catchment D62D. The annual run-off from natural (unmodified) catchments in D62D is approximately 0,9% of the MAP. (Hydrology Assessment)
- Accounting for changes in soil type, slope angle and rainfall intensity, ground cover beneath solar arrays was found to have the most significant impact on run-off rates. So, if vegetation cover beneath the solar arrays is maintained, no significant increase in surface water run-off (run-off volumes, peak rates, or time to peak rates) is anticipated compared to greenfield run-off rates. (Hydrology Assessment)

Assessment without mitigation:

Legend		
Criteria	**Reversibility, Irreplaceability, & Mitigatory Potential**	**Significance (Impact Magnitude & Impact Importance**

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Abbreviation	Description	Abbreviation	Description	Abbreviation	Description
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
06	H	M	M	-I	H	M	1	H	M	1
Reversibility	H		**Irreplaceability**	H		**Mitigatory Potential**	H			

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
07	H	M	M	-I	H	M	1	H	M	1
Reversibility	H		**Irreplaceability**	H		**Mitigatory Potential**	H			

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
08	M	L	M	-I	M	M	1	M	M	1
Reversibility	M		**Irreplaceability**	M		**Mitigatory Potential**	H			

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

None.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Pixley ka Seme District Municipality Climate Change Vulnerability Assessment and Response Plan (Draft Version 3) December 2016
- Climate Change Adaptation Response Strategy for the Northern Cape, 2016
- Social Impact Assessment Report prepared by Ilse Aucamp of Equispectives Research & Consulting Services dated August 2022.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

- Hydrological Assessment (Version – Final 2) 11 April 2022 GCS Project Number: 22-0076 by Hendrik Botha
- Geohydrological Assessment Report (Final Rev 3) prepared by GCS Water and Environmental Consultants dated 10th August 2022 (GCS Project Number: 22-0401).
- General Authorisation for S21(a) and (b) published in GN 538 of GG 40243 on 02nd September 2016
- Department of Water Affairs and Forestry, 1996. South African Water Quality Guidelines (second edition). Volume 1: Domestic Use.
- DHS Redbook, Section J, Water Supply, The Neighbourhood Planning and Design Guide, Part II, Planning and design guidelines, developed by Department of Human Settlements, published by the South African Government ISBN: 978-0-6399283-2-6, version 1.1, printed July 2019.
- DHS Redbook, Section K, Sanitation, The Neighbourhood Planning and Design Guide, Part II, Planning and design guidelines, developed by Department of Human Settlements, published by the South African Government ISBN: 978-0-6399283-2-6, version 1.1, printed January 2019.

Mitigations:

Impact Management Outcome(s):

- Safe water for non-potable usage.
- Reduce Impact on aquifer reserve.
- Preserve ecological functioning of watercourse.
- Maintain the quantity of groundwater available for construction and operation without compromising the ecological reserve and other water users of the same aquifer, particularly in light of the challenges posed by climate change such as increased droughts.
- Reduce deterioration in water quality due to increased salt concentrations in dams, wetlands and soil/plant systems from enhanced evaporation.
- Protection and restoration of a Strategic Water Source Area (abstract groundwater for construction and operation without compromising the ecological reserve and other water users of the same aquifer, particularly considering the challenges posed by climate change such as increased droughts).
- Avoid adverse economic implications of excessive hardness on solar panel efficiency, as well as plumbing and household heating appliances.

Targets:

- Preserve the underground aquifer, that is abstracting without depleting.
- Save water through wise water use initiatives and monitoring.
- A functional deionization plant at each borehole.
    - Total hardness for domestic use should be limited to between 50 - 100 mg/• as $CaCO_3$, where possible.
- Avoidance of groundwater pollution.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

- Avoidance of surface water pollution.
- Alternative firefighting technologies in place.
- Preserve landscape hydrological pattern, including river channel and stormwater run-off hydrological pattern.
    - Avoid and remediate any erosion of the riverbed, banks, and bars.
    - Aquatic and terrestrial landscapes are shaped to natural forms.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
06	Climate Change	Water availability for irrigation and drinking in an arid District dependent on ground water (with a high salt content).	Reduce Impact on aquifer reserve.	Preserve the underground aquifer, that is abstracting without depleting.	Do not overproduce from boreholes used as part of the project. 8 hours of pumping per day is recommended.	Holder, Engineer	All phases	Compliance to be verified by ECO and IEA.
06	Climate Change	Water availability for irrigation and drinking in an arid District dependent on ground water (with a high salt content).	Reduce Impact on aquifer reserve.	Preserve the underground aquifer, that is abstracting without depleting.	The abstraction of groundwater from both properties combined (but limited to sub-catchment HRU2 of Quaternary Catchment D62D), including all boreholes contained thereon, shall not exceed 216 m3/ day (or 78 840,43 m3/ yr) during the construction period (including when it overlaps with operation), and 150 m3/day (or 54 750,3 m3/ yr) during operation.	Holder, Engineer	All phases	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
06	Climate Change	Water availability for irrigation and drinking in an arid District dependent on ground water (with a high salt content).	Reduce Impact on aquifer reserve.	Preserve the underground aquifer, that is abstracting without depleting.	Abstraction may not exceed the sustainable abstraction yield at the recommended pumping rate of 8 hrs per day for each borehole, that is 6,58 l/s @ 8hrs (or 189,5 m3/8hr day) for BH4 and 5,11 l/s @ 8 hrs (or 147,17 m3/8hr day) for BH5.	Holder, Engineer	All phases	Compliance to be verified by ECO and IEA.
06	Climate Change	Water availability for irrigation and drinking in an arid District dependent on ground water (with a high salt content).	Reduce Impact on aquifer reserve.	Preserve the underground aquifer, that is abstracting without depleting.	Undertake water level monitoring of boreholes within a 1.5 km radius of the pumping borehole. If a decline in water levels is noted in all boreholes, because of pumping, the abstraction rate should be lowered to prevent aquifer depletion. (and operation, particularly relating to, but not limited to, washing solar panels.	Holder, Engineer	All phases	Compliance to be verified by ECO and IEA.
06	Climate Change	Water availability for irrigation and drinking in an arid District dependent on ground water	Reduce Impact on aquifer reserve.	Preserve the underground aquifer, that is abstracting without depleting.	All new boreholes drilled in the project area (such as T1 or T2) must be pump tested, and interference (if any)	Holder, Engineer	All phases	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		(with a high salt content).			with other existing boreholes (closer than 500 m) be evaluated by long-duration pump tests.			
06	Climate Change	Water availability for irrigation and drinking in an arid District dependent on ground water (with a high salt content).	Reduce Impact on aquifer reserve.	Preserve the underground aquifer, that is abstracting without depleting.	Conduct multi borehole water level logging, to ensure that no cumulative dewatering impacts are taking place for boreholes which may be in the same contact zones.	Holder, Engineer	All phases	Compliance to be verified by ECO and IEA.
06	Climate Change	Water availability for irrigation and drinking in an arid District dependent on ground water (with a high salt content).	Reduce Impact on aquifer reserve.	Preserve the underground aquifer, that is abstracting without depleting.	Implement the Surface and Groundwater Monitoring Protocol during construction and operation (Appendix D).	Holder, Engineer	All phases	Compliance to be verified by ECO and IEA.
06	Climate Change	Water availability for irrigation and drinking in an arid District dependent on ground water (with a high salt content).	Reduce Impact on aquifer reserve.	Preserve the underground aquifer, that is abstracting without depleting.	Continually investigate (or research) and implement (or adopt) water-saving strategies and technologies or alternatives, including designs throughout construction and operation, particularly relating to, but not limited to, washing solar panels.	Holder, Engineer	All phases	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
06	Change in Land use	Water demand for fighting wildfires may temporarily jeopradise available water reserves for development or operational requirements.	Reduce Impact on aquifer reserve.	Alternative firefighting technologies in place.	Consider alternative firefighting technologies such as CAFS (Compressed Air Foam Systems), which can multiply water use efficiency by as much as 11 times (pers. comm. Stefan Schlimmer 072 474 3155).	Holder, Engineer	Planning and Design	Compliance to be verified by ECO and IEA.
06	Planning	Uncontrolled abstraction of groundwater from an underground aquifer could deplete the ecological reserve and affect other water users' rights to domestic use and livestock watering.	Protection and restoration of a Strategic Water Source Area.	Preserve the underground aquifer, that is abstracting without depleting: Save water through wise water use – evidence of water saving behaviour, methods, and technologies.	Reduce the need for dust suppression/control, particularly along the access road from the N10 to the main entrance of the construction camp (and operational area) during construction (and operation) by providing construction staff (and employees) with a prearranged bus charter service.	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.
06	Planning	Uncontrolled abstraction of groundwater from an underground aquifer could deplete the ecological reserve and affect other water users' rights to domestic use and	Protection and restoration of a Strategic Water Source Area.	Preserve the underground aquifer, that is abstracting without depleting: Save water through wise water use – evidence of water saving behaviour,	Remove dust from the solar panels using compressed air to reduce the frequency of watering the panels from 4 times (every 3 months) to 2 times each year (every 6 months).	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		livestock watering.		methods, and technologies.				
07	Climate Change	Decrease in the quality of water	Reduce deterioration in water quality due to increased salt concentrations in dams, wetlands and soil/plant systems from enhanced evaporation.	A functional deionization plant at each borehole. Total hardness for domestic use should be limited to between 50 - 100 mg/• as CaCO3, where possible.	Establish water treatment, e.g., deionization plants at water sources used for washing solar modules and domestic use (potable water).	Holder, Engineer	Planning and Design	Compliance to be verified by ECO and IEA.
07	Layout and Design	Installation of pylons for transmission lines may cause temporary sedimentation after storm events.	Preserve ecological functioning of watercourse	Watercourses show no signs of sedimentation.	All development footprint areas to remain as small as possible.	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.
07	Layout and Design	Groundwater is vulnerable to pollution.	Safe drinking water.	Avoidance of groundwater pollution: Correct positioning of boreholes relative to on-site disposal facilities.	Boreholes for domestic use should be positioned at least 30 m to 50 m away from potential pollution sources, such as on-site toilets, and site-specific conditions should be considered to determine the appropriate distance. The direction of the aquifer flow is also an	Holder	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					important consideration.			
07	Layout and Design	Groundwater is vulnerable to pollution.	Safe drinking water.	Avoidance of groundwater pollution: Employee appointed and trained	An employee should be trained to maintain the borehole and borehole pump and to alert management when major breakdowns occur.	Contractor	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
07	Layout and Design	Groundwater is vulnerable to pollution.	Safe drinking water.	Avoidance of groundwater pollution: A sanitary seal is present on each borehole.	To prevent aquifer pollution, the installation of a sanitary seal on the borehole is required.	Holder, Engineer	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
07	Layout and Design	Groundwater is vulnerable to pollution.	Safe drinking water.	Avoidance of groundwater pollution: Design includes points of reuse and subsurface discharge.	Ensure the design and development of the NewGen100 treatment plant includes *inter alia* a discharge pump and piping from the chlorine contact tank to a storage tank(s) and a sub-surface soakaway at the points of reuse (e.g., dust control) and discharge, respectively.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
07	Layout and Design	Groundwater is vulnerable to pollution.	Safe drinking water.	Avoidance of groundwater pollution: Biogas is converted into energy.	Ensure the design and development of the NewGen100 treatment plant allows for the safe capture and reuse of biogas	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					as a source of energy for cooking, boiling water in a hot water urn and/or to provide hot water to the basins in the containerised toilet blocks via a gas geyser.			
07	Layout and Design	Groundwater is vulnerable to pollution.	Safe drinking water.	Avoidance of groundwater pollution: Design includes a subsurface discharge point.	Ensure the design and development of the Multirock 60 treatment plant includes *inter alia* discharge piping from the storage tanks at the point of reuse (e.g., dust control) to a sub-surface soakaway at the point of discharge.	Holder, Engineer	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
07	Layout and Design	Groundwater is vulnerable to pollution.	Safe drinking water.	Avoidance of groundwater pollution: A floating chlorine basket is visible in the tanks or germicidal UV-light radiation.	Disinfect the treated effluent from the Multirock 60 plant in storage tanks by means of chlorine dosing or germicidal UV-light radiation. Consider diluting the treated effluent with rainwater (when available). The same storage tanks can be used for rainwater harvesting.	Holder, Engineer	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
07	Layout and Design	Groundwater is vulnerable to pollution from effluent disposal	Safe drinking water.	Avoidance of groundwater pollution: Show compliance with Annexure A of SANS 10252-2.	Comply with the National Standards on septic tank systems provided in SANS 10252-2 Water Supply and Drainage for Buildings: Part 2 Drainage installations for buildings (relevant information is included in Annexure A of SANS 10252-2.	Holder, Engineer	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
07	Layout and Design	Groundwater is vulnerable to pollution from effluent disposal	Safe drinking water.	Avoidance of groundwater pollution: Show compliance with Guidelines for the Utilisation and Disposal of Wastewater Sludge.	Sludge from septic tanks should be disposed of in accordance with the "Guidelines for the Utilisation and Disposal of Wastewater Sludge: Volume 3: Requirements for the on-site and off-site disposal of sludge."	Holder	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
07	Layout and Design	Groundwater is vulnerable to pollution from effluent disposal	Safe drinking water.	Avoidance of groundwater pollution: Show compliance with National Building Regulations SANS 10400	The design of a soakaway must comply with the guidelines given in the National Building Regulations SANS 10400.	Holder, Engineer	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
07	Layout and Design	Groundwater is vulnerable to pollution from effluent disposal	Safe drinking water.	Avoidance of groundwater pollution: Sampling records	Treated effluent must be sampled and monitored at the points of ingress to the effluent plants and	Holder	Continuous	Compliance to be monitored by SEO and verified by

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					at the points of reuse or discharge.			ECO and IEA.
07	Layout and Design	Groundwater is vulnerable to pollution from effluent disposal	Safe drinking water.	Avoidance of groundwater pollution: A suitably qualified operator.	The success of the NewGen100 and/or Multirock 60 treatment plants is dependent on correct operation and maintenance. Therefore, a suitably qualified operator should be appointed prior to commissioning.	Holder	Continuous	Compliance to be monitored by SEO and verified by ECO and IEA.
07	Layout and Design	Groundwater is vulnerable to pollution from effluent disposal	Safe drinking water.	Avoidance of groundwater pollution: Grease traps are present in kitchens. FOG's no more than 10 mg/L	Fats, oils and greases (FOG's) should be treated at the source with grease/fat traps in the kitchens (during construction and operation) and shall be no more than 10 mg/L before entering the effluent plant.	Holder, Engineer	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
06	Layout and Design	Increased demand for groundwater during operation to water livestock as well as clean solar panels, control dust and provide staff with potable/drinking water, may stress groundwater reserves (exceed the rate at which	Protection and restoration of a Strategic Water Source Area.	Preserve the underground aquifer, that is abstracting without depleting: Save water through wise water use – evidence of water saving behaviour, methods, and technologies.	Supplement non-potable water at the operational area by harvesting rainwater runoff from the roof of the main building at the operational area, unless non-potable usage doesn't warrant it.	Holder	Continuous	Compliance to be monitored by SEO and verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		reserves are naturally replenished).						
06	Layout and Design	Increased demand for groundwater during operation to water livestock as well as clean solar panels, control dust and provide staff with potable/drinking water, may stress groundwater reserves (exceed the rate at which reserves are naturally replenished).	Protection and restoration of a Strategic Water Source Area.	Preserve the underground aquifer, that is abstracting without depleting: Save water through wise water use – evidence of water saving behaviour, methods, and technologies.	Reuse treated wastewater generated by a waterwork (e.g., a wastewater treatment package plant) for non-potable usage, e,g., dust suppression, during operation.	Holder	Continuous	Compliance to be monitored by SEO and verified by ECO and IEA.
06	Layout and Design	Increased demand for groundwater during operation to water livestock as well as clean solar panels, control dust and provide staff with potable/drinking water, may stress groundwater reserves (exceed the rate at which reserves are naturally replenished).	Protection and restoration of a Strategic Water Source Area.	Preserve the underground aquifer, that is abstracting without depleting: Save water through wise water use – evidence of water saving behaviour, methods, and technologies.	Remove dust from the solar panels using compressed air to reduce the frequency of watering the panels from 4 times (every 3 months) to 2 times each year (every 6 months).	Holder	Continuous	Compliance to be monitored by SEO and verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
06	Layout and Design	Increased demand for groundwater during operation to water livestock as well as clean solar panels, control dust and provide staff with potable/drinking water, may stress groundwater reserves (exceed the rate at which reserves are naturally replenished).	Protection and restoration of a Strategic Water Source Area.	Preserve the underground aquifer, that is abstracting without depleting: Save water through wise water use – evidence of water saving behaviour, methods, and technologies.	Reduce the quantity of groundwater and frequency of applications required for dust suppression on gravel access roads by adding environmentally friendly soil binding agents. This would require the necessary storage tanks complete with Programmable Logic Controller (PLC) and pump systems required for dosage purposes.	Holder	Continuous	Compliance to be monitored by SEO and verified by ECO and IEA.
06	Layout and Design	Increased demand for groundwater during operation to water livestock as well as clean solar panels, control dust and provide staff with potable/drinking water, may stress groundwater reserves (exceed the rate at which reserves are naturally replenished).	Protection and restoration of a Strategic Water Source Area.	Preserve the underground aquifer, that is abstracting without depleting: Save water through wise water use – evidence of water saving behaviour, methods, and technologies.	Install suitable water meters to ensure that the abstracted volumes are measured on a daily basis (DEA Generic EMPr).	Holder	Continuous	Compliance to be monitored by SEO and verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
06	Planning and Design	The yield from a new borehole may not be viable.	Protection and restoration of a Strategic Water Source Area.	Preserve the underground aquifer, that is abstracting without depleting: Save water through wise water use – evidence of water saving behaviour, methods, and technologies.	Tests should be conducted to estimate the likely yield before drilling a borehole to ensure viability.	Holder	Planning and Design	Compliance to be monitored by SEO and verified by ECO and IEA.
06	Planning and Design	The yield from a new borehole may not be viable.	Protection and restoration of a Strategic Water Source Area.	Preserve the underground aquifer, that is abstracting without depleting: Save water through wise water use – evidence of water saving behaviour, methods, and technologies.	The drilling should be executed in accordance with the South African National Standard, development, maintenance and management of groundwater resources - Part 4 Test Pumping of water boreholes.	Holder	Planning and Design	Compliance to be monitored by SEO and verified by ECO and IEA.
06	Planning and Design	The yield from a new borehole may not be viable.	Protection and restoration of a Strategic Water Source Area.	Preserve the underground aquifer, that is abstracting without depleting: Save water through wise water use –	A reputable driller registered with the Borehole Water Association of South Africa (BWASA) should be used to drill the borehole.	Holder	Planning and Design	Compliance to be monitored by SEO and verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
				evidence of water saving behaviour, methods, and technologies.				
06	Planning and Design	The yield from a new borehole may not be viable.	Protection and restoration of a Strategic Water Source Area.	Preserve the underground aquifer, that is abstracting without depleting: Save water through wise water use – evidence of water saving behaviour, methods, and technologies.	Install flow metres at all abstraction points (boreholes). Water meters should not only be used to measure water consumption of end users but also measure water losses (through leakage), improve maintenance of infrastructure, and manage the water levels of storage facilities.	Holder	Planning and Design	Compliance to be monitored by SEO and verified by ECO and IEA.
06	Planning and Design	The yield from a new borehole may not be viable.	Protection and restoration of a Strategic Water Source Area.	Preserve the underground aquifer, that is abstracting without depleting: Save water through wise water use – evidence of water saving behaviour, methods, and technologies.	An employee should be trained to maintain the borehole and borehole pump and to alert management when major breakdowns occur.	Holder	Planning and Design	Compliance to be monitored by SEO and verified by ECO and IEA.
06	Planning and Design	The yield from a new borehole may not be viable.	Protection and restoration of a	Preserve the underground aquifer, that is	Borehole water level measurements should be taken regularly and recorded to ensure	Holder	Planning and Design	Compliance to be monitored by SEO and

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
			Strategic Water Source Area.	abstracting without depleting: Save water through wise water use – evidence of water saving behaviour, methods, and technologies.	the pump is submerged at all times and to provide early warning of source depletion. Management outcome: Saving water through its wise use.			verified by ECO and IEA.
06	Planning and Design	Impact on the aquifer reserve and borehole pump lifespan.	Protection and restoration of a Strategic Water Source Area.	Preserve the underground aquifer, that is abstracting without depleting: Save water through wise water use – evidence of water saving behaviour, methods, and technologies.	Groundwater should be pumped from the boreholes to dedicated water storage tanks to build up a reserve, whereafter the boreholes are only used to top up the storage tanks	Holder, Engineer	Planning and Design	Compliance to be monitored by SEO and verified by ECO and IEA.
07	Layout and Design	Harvested rainwater is susceptible to pollution.	Safe water for non-potable usage.	Avoidance of surface water pollution: Design of rainwater harvesting system includes a first-flush diverter or similar mechanism.	If rainwater harvesting is a feasible option to supplement non-potable usage during operation, then some mechanism (e.g., a first-flush diverter) should be installed to discard the first flush of rainwater from a roof.	Holder, Engineer	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
07	Layout and Design	Harvested rainwater is susceptible to pollution.	Safe water for non-potable usage.	Avoidance of surface water pollution: Design of rainwater harvesting system includes a gauze screen at the inlet.	If rainwater harvesting is a feasible option to supplement non-potable usage during operation, then the inlet to the storage tank should be protected by a gauze screen to keep out debris, as well as insects and rodents.	Holder, Engineer	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
07	Layout and Design	Leaking chemical toilets can contaminate soil and surface water.	Safe drinking water.	Avoidance of surface water pollution: no leaks. The holdings tanks are contained.	Portable chemical toilets shall be in good working order and the holding tank shall be contained within a drip tray or other impermeable containment structure.	Holder, Engineer	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
07	Layout and Design	Overflowing chemical toilets can contaminate soil and surface water.	Safe drinking water.	Avoidance of surface water pollution: The holding tanks are not overfilled. Municipal disposal bills.	The sewerage shall be removed regularly (dependant on usage) from the holding tank of portable chemical toilets and conveyed to a municipal treatment or disposal facility.	Contractor, SEO	Continuous	Compliance to be monitored by the SEO and verified by ECO and IEA.
08	Layout and Design	Culverts or stormwater outlets tend to concentrate and increase the velocity of surface water flow, changing the surface water	Protection and restoration of a Strategic Water Source Area	Preserve river channel hydrological pattern: Observed box culverts.	Road crossing designs, such as box culverts or concrete drifts with rock fill, which spread the surface water into a broadly distributed sheet whilst	Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		hydrology or flow patterns.			maintaining unrestricted subterranean flow should be sized to accommodate at least 1:100 yr flood events			
08	Layout and Design	Culverts or stormwater outlets tend to concentrate and increase the velocity of surface water flow, changing the surface water hydrology or flow patterns.	Protection and restoration of a Strategic Water Source Area	Preserve river channel hydrological pattern: Box culverts span the width of the active channel.	Road crossing designs, such as box culverts or concrete drifts with rock fill, shall spread the surface water into a broadly distributed sheet whilst maintaining unrestricted subterranean flow, across the width of the active channel(s).	Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
08	Layout and Design	Altered stormwater run-off patterns, e.g., from sheet flow to channelled flow, can cause erosion.	Protection and restoration of a Strategic Water Source Area	Preserve stormwater run-off hydrological pattern: Minimal erosion of disturbed areas during construction.	The levelling of disturbed areas must be done concurrent with construction activities.	Contractor, SEO	Continuous	Compliance to be monitored by SEO and verified by ECO and IEA.
08	Layout and Design	Altered stormwater run-off patterns, e.g., from sheet flow to channelled	Protection and restoration of a Strategic Water Source Area	Preserve stormwater run-off hydrological pattern: No linear depressions or mounds of earth.	The levelling of disturbed areas should not significantly alter the flow characteristics of	Contractor.	Continuous	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		flow, can cause erosion.			stormwater run-off, e.g., shaped to natural pre-existing forms that retain sheet flow.			
08	Layout and Design	Altered stormwater run-off patterns, e.g., from sheet flow to channelled flow, can cause erosion.	Protection and restoration of a Strategic Water Source Area	Preserve stormwater run-off hydrological pattern: Shaped to natural forms.	Ensure the re-instatement of original terrestrial landscape levels.	Engineer, Contractor.	Upon completion of a construction activity	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
06	L	L	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
06	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
07	L	L	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

07	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
08	L	L	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
08	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- The residual risk of abstracting groundwater on the underground aquifer (**06**) after effective water saving measures can only be calculated once the Geohydrological Assessment is completed.
- The residual risk of surface and groundwater pollution (**07**) after mitigation is assumed to be Low.
- The residual risk of erosion caused by changed surface water flow patterns (**08**) after mitigation is assumed to be Low.

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Receiving Environment: Atmosphere

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Heat Island Effect	Solar PV Facility	Atmospheric warming	**Impact:** The PV "heat island" (PVHI) effect would be the result of a detectable increase in sensible heat flux (atmospheric warming). This may be compounded by the forecasted increase in temperatures linked to climate change. Transitions to PV plants alters the energy flux dynamics of an area, specifically the way that incoming energy is reflected back to the atmosphere or absorbed, stored and reradiated because PV plants change the albedo, vegetation and structure of the terrain. (Barron-Gafford G.A., et al 2016) **Consequences:** - Warming surrounding areas could potentially influence wildlife habitat, ecosystem function and human health. (indirect)	Quality	09
Layout and Design	Roads		**Impact:** Air pollution or reduced air quality from gravel roads. **Consequence:** - Airborne dust from gravel roads (a type of PM10) can cause eyes, nose and throat irritations (direct). - Dust settling on and smothering plants will reduce photosynthetic capacity and plant vigour, making them less resistant to diseases and pest infestations (indirect). - Dust settling on and smothering solar panels will reduce their efficiency, causing a decline in electrical power output, lost income for the operator and increase the payback period.	Quality	10
Layout and Design	Roads		**Impact:** Air pollution or reduced air quality from gravel roads. **Consequence:** - Airborne dust from gravel roads (a type of PM10) can cause eyes, nose and throat irritations (direct). - Dust settling on and smothering plants will reduce photosynthetic capacity and plant vigour, making them less resistant to diseases and pest infestations (indirect). - Dust settling on and smothering solar panels will reduce their efficiency, causing a decline in electrical power output, lost income for the operator and increase the payback period	Quality	10

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Reg: 2006/023163/23

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 09 (Heat Island Effect)

- The study area is not within an Air Quality Priority Area.
- Incoming solar energy is typically either reflected to the atmosphere or absorbed, stored and later reradiated in the form of latent or sensible heat. (Barron-Gafford G.A., et al 2016)
- Within natural ecosystems, vegetation reduces heat gain (or capture) and storage in soils by creating surface shading. Energy absorbed by vegetation and surface soils can be released as latent heat in the transition of liquid water to water vapour to the atmosphere through evapotranspiration (the combined water loss from soils and vegetation). (Barron-Gafford G.A., et al 2016)
- In PV farms, the reduced albedo (reflectance) of the dark panels combined with the greater amount of exposed ground surfaces compared to natural systems absorbs a larger proportion of high energy, shortwave solar radiation during the day. Combined with minimal rates of heat-dissipating transpiration from vegetation, a proportionately higher amount of stored energy is reradiated as longwave radiation during the night in the form of sensible heat. (Barron-Gafford G.A., et al 2016)
- The PHVI effect occurs across all seasons with the greatest influence on ambient temperature at night (by as much as 3 to 4 degrees Celcius), possibly due to heat trapping of reradiated sensible heat flux under PV arrays at night and delayed cooling. (Barron-Gafford G.A., et al 2016)
- The maintenance of vegetation and ecosystem regulating services will reduce, but not avoid the potential PV "heat island" effect.
- A wind blows year-round and should alleviate heat trapping at night. Heat trapping can be further alleviated through adequate spacing between solar arrays.
- The decreased albedo due to a PV power plant and their associated warming from the PVHI is at least offset by the carbon dioxide emission reductions associated with PV power plant and more so when ecosystem regulating services, such as carbon sequestration, are maintained through sound ecological management.
- A risk averse approach to counter increased climatic uncertainty is through climate change mitigation, specifically the need to halt and reverse existing degradation primarily from extensive livestock production and adopt the most effective management practices.
- The lateral and vertical extent of the PHVI effect cannot be known.

Impact 10 (Dust Generation)

- For the PV scope (excluding the MTS and DX works) we have projected the following number of delivery trucks per 100MW sub-phase of the project: Panels - 273 trucks, Mounting Structure - 300 trucks, Inverters - 13 trucks, Field Transformers - 12 trucks, Cable & BOS - 120 trucks *(pers. comm Bruce Conné, General Manager, Soventix).*

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Reg: 2006/023163/23

- Although still to be finalised it is projected that staff will be transported in mini-bus taxis or small busses daily. Assuming mini-bus taxis one could work on 15 people per taxi which would result in an estimated average of 20 taxis per day X 2 for morning and afternoon trips. Using busses will reduce the number of vehicle-trips *(pers. comm Bruce Conné, General Manager, Soventix).*

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
09	M	M	M	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
10	M	M	M	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None

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Reg: 2006/023163/23

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Barron-Gafford G.A., et al (2016) "The Photovoltaic Heat Island Effect: Larger solar power plants increase local temperatures" www.nature.com/scientificreports

Mitigations:

Impact Management Outcome(s):

- Increased ecosystem resilience to atmospheric warming.
- Minimise dust generation.

Targets:

- Reduced potential PV "heat island" (PVHI) effect.
- Dust generation is controlled.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
09	Heat Island Effect	The PV "heat island" (PVHI) effect.	Increased ecosystem resilience to atmospheric warming.	Reduce the potential PVHI: Restored bare patches.	Minimise vegetation clearance.	Holder	Continuous	Compliance to be verified by ECO and IEA.
09	Heat Island Effect	The PV "heat island" (PVHI) effect.	Increased ecosystem resilience to atmospheric warming.	Reduce the potential PVHI: Restored bare patches.	Halt and reverse existing degradation primarily from extensive livestock production to counter increased climatic uncertainty - restore all bare patches of soil with vegetation using the Bare Patch Restoration Protocol (Appendix C).	Holder, Landowner	Continuous	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
09	Heat Island Effect	The PV "heat island" (PVHI) effect.	Increased ecosystem resilience to atmospheric warming.	Reduce the potential PVHI: No signs of overgrazing.	Ensure responsible natural resource management that maintains the integrity of ecosystems and the continued provision of ecosystem services to current and future generations.	Holder, Landowner	Continuous	Compliance to be verified by ECO and IEA.
09	Heat Island Effect	The PV "heat island" (PVHI) effect.	Increased ecosystem resilience to atmospheric warming.	Reduce the potential PVHI: Natural vegetation retained underneath solar PV modules.	Once construction has been completed in an area, immediately reinstate and maintain the vegetation underneath the solar PV modules to retain its cooling effect through transpiration.	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.
09	Heat Island Effect	The PV "heat island" (PVHI) effect.	Increased ecosystem resilience to atmospheric warming.	Reduce the potential PVHI: A fragmented development.	Fragment the expansive covering of the solar PV development into two or more clusters segregated by ecological or other buffers.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
09	Heat Island Effect	The PV "heat island" (PVHI) effect.	Increased ecosystem resilience to atmospheric warming.	Reduce the potential PVHI: Adequate spacing between solar arrays.	Solar panel arrays shall be spaced approximately 9.5 m apart (from pile to pile). If each module is 2.2 m long, this will allow a 5 m gap between the modules of parallel arrays.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
10	Layout and Design	Air pollution or reduced air	Minimise dust generation	Dust generation is controlled.	Reduce speed to 30km/hr	Holder, Contractor	Continuous	Compliance to be verified

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		quality from gravel roads						by ECO and IEA.
10	Layout and Design	Air pollution or reduced air quality from gravel roads	Minimise dust generation	Dust generation is controlled.	Restrict the width of new or upgraded gravel roads to preferably 5 m, but not wider than 6 m except for passing lanes (which should be less than 8m wide).	Holder, Engineer	Continuous	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
09	L	M	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
09	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
10	L	M	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
10	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

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Reg: 2006/023163/23

- The residual risk of the solar PV facility on increased atmospheric warming (**09**) after (a) the maintenance and sound ecological management of ecosystem regulating services, such as carbon sequestration, (b) fragmentation of the facility, and (c) spacing of the arrays is assumed to be "Low", particularly when considered in combination with the carbon dioxide emission reductions associated with a PV power plant.
- The residual risk of the solar PV facility on increased dust generation (**10**) with mitigation measures is considered to be "Low".

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Reg: 2006/023163/23

Receiving Environment: Terrestrial and Avian Ecosystem

Description of potential impacts:

Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Climate Change	Solar PV Facility	NA	**Impacts:** According to the District Municipality's Climate Change Response Plan there are increased risks to *inter alia* Biodiversity and environment, including increased impacts due to land-use change associated with continuing development of the renewable energy corridor (**negative**). However,… Diversification by changing the current land-use (Agriculture) to an Agrivoltaic system is potentially a powerful climate resilient land-use, involving both climate change mitigation and adaption measures, that simultaneously supports the agricultural and energy industries. **Consequences:** - Maintenance of ecosystem integrity increases resilience to climate change.	transformation	11
Change in Land Use	Rezoning Land use application for a "special zone" or a "consent use" (temporary) submitted through the Emthanjeni LM for a decision by the District Municipal Planning Tribunal	SPLUMA and the ELM Land Use Scheme 2022	**Impact:** The development footprint of solar PV facilities will result in a loss of local terrestrial habitat. **Consequence:** - reduced habitat for terrestrial fauna and Aves (direct). - reduced productivity and carrying capacity (direct).	quantity	11
Change in Land Use	Rezoning Land use application for a "special zone" or a "consent use" (temporary)	SPLUMA and the ELM Land Use Scheme 2022	**Impact:** Overgrazing by sheep will denude the area, increasing surface water run-off and causing erosion. **Consequence:** - Erosion can result in a degraded or dysfunctional ecosystem (direct) and loss of ecosystem services (indirect)	transformation	12

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Reg: 2006/023163/23

Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
	submitted through the Emthanjeni LM for a decision by the District Municipal Planning Tribunal				
Planning	Commencement	NA	**Impact:** The largest risk is potential run-off and stormwater discharge from the site into the surrounding causing soil erosion. (Hydrology Assessment) **Consequences:** - Erosion can result in a degraded or dysfunctional ecosystem (direct) and loss of ecosystem services (indirect)	transformation	12
Planning	Space	Magnitude of physical disturbance	**Impact:** The construction equipment and materials needed to develop a 400 MW Solar PV Facility on 600 ha will require a substantial area for parking and storing resulting in a loss of habitat (direct). **Consequences:** - Loss of ecosystem (direct). - Loss of biodiversity and climate change resilience (direct).	quantity	11
Planning	Access Roads	NA	**Impact:** Roads, including the two-track service roads between the solar panel arrays, will increase surface water run-off, causing erosion and sedimentation of watercourses. Erosion and sediment transport may be exacerbated by the concentrated rainfall volumes off the solar PV panels. Efforts should be made in managing run-off from the PV panels and arrays onto the soils, and then managing the distribution of the accumulated water back to the environment. (Hydrology Assessment Report) **Consequences:** - Erosion can result in a degraded or dysfunctional terrestrial ecosystem (direct) and loss of ecosystem services (indirect) - Sedimentation can increase turbidity and Total Suspended Solids (TSS) (direct).	transformation	12

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Reg: 2006/023163/23

Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Layout and Design	Lighting	NA	**Impact:** Artificial lighting threatens biodiversity by disrupting the night behaviour of organisms affecting survivorship and or reproduction, e.g., by attracting insects and their predators from frogs to bats. **Consequences:** - Altered ecological processes (e.g., predation, reproduction, etc.) could cause insect population declines, a change in biodiversity pattern, and reduced ecosystem regulating services such as pollination (indirect).	transformation	13
Layout and Design	Installing Perimeter Fence and Access Control	Terrestrial Barrier	**Impact:** Fencing causes fragmentation of the landscape. **Consequences:** -Fragmentation reduces connectivity, interrupts ecological process pathways such as local migration patterns of aquatic species effectively isolating fragmented patches (or ""islands""). This can result in species extinction and biodiversity loss due to decreased colonization and population size.	Fragmentation	11
Layout and Design	Installing panel arrays and associated infrastructure (from racks to field transformers) including within 100 m of a watercourse or 500 m of a wetland/pan	Physical Structures	**Impact:** Birds may be attracted to the area for nesting/landing. **Consequence:** injury/death of avifauna	Quantity	11
Layout and Design	Installing panel arrays and associated infrastructure (from racks to	Physical Structures	**Impact:** Habitat loss and fragmentation due to displacement as a result of infrastructure installation (panels, powerlines, roads, fences and sub surface cables). **Consequences:**	Quantity	11

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Reg: 2006/023163/23

Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
	field transformers) including within 100 m of a watercourse or 500 m of a wetland/pan		Destroy existing habitat but also displace bird species from large areas of natural habitat. This specifically has a greater impact on bird species restricted to a specific habitat and its requirements.		
Layout and Design	Installing panel arrays and associated infrastructure (from racks to field transformers) including within 100 m of a watercourse or 500 m of a wetland/pan	Surface water hydrology (run-off)	**Impact:** Erosion and sediment transport may be exacerbated by the concentrated rainfall volumes off the solar PV panels. Efforts should be made in managing run-off from the PV panels and arrays onto the soils, and then managing the distribution of the accumulated water back to the environment. (Hydrology Assessment Report) **Consequences:** - Erosion can result in a degraded or dysfunctional terrestrial ecosystem (direct) and loss of ecosystem services (indirect)	Transformation	12
Layout and Design	Installing panel arrays and associated infrastructure (from racks to field transformers) including within 100 m of a watercourse or 500 m of a wetland/pan	Interfering with ecological processes and biodiversity pattern	**Impact:** Bare areas created by vegetation removal will increase surface water run-off, causing erosion and sedimentation of watercourses. **Consequences:** - Erosion can result in a degraded or dysfunctional terrestrial ecosystem (direct) and loss of ecosystem services (indirect) - Sedimentation can increase turbidity and Total Suspended Solids (TSS). Turbid waters reduce light penetration, decreasing photosynthesis and primary production, reducing food availability for aquatic organisms higher up the food chain. Suspended solids may interfere with the feeding mechanisms of filter-feeding organisms such as certain macroinvertebrates, and the gill functioning, foraging efficiency (due to visual disturbances) and growth of fish, leading to changes in invertebrate and fish assemblages. Suspended	Transformation	12

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Reg: 2006/023163/23

Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
			solids that settle out may cover spawning grounds (places to lay eggs), smother or abrade benthic plants and animals, resulting in changes to the nature of the substratum where invertebrates live, causing either change in the structure of the biotic community by the replacement of these organisms with organisms that burrow in soft sediments, or massive declines in fish populations. Sensitive species may be permanently eliminated if the source of the suspended solids is not removed. The recovery of a stream from sediment deposition is dependent on the elimination of the sediment source and the potential for the deposited material to be flushed out by stream flow (indirect).		
Layout and Design	Installing panel arrays and associated infrastructure (from racks to field transformers) including within 100 m of a watercourse or 500 m of a wetland/pan	Interfering with ecological processes and biodiversity pattern	**Impact:** Erosion and sediment transport will likely take place from the concentrated rainfall volumes off the solar PV panels. Efforts should be made in managing run-off from the PV panels and arrays onto the soils, and then managing the distribution of the accumulated water back to the environment. (Hydrology Assessment Report) **Consequences:** - Same as above.	Transformation	12
Layout and Design	Installing panel arrays and associated infrastructure (from racks to field transformers) including within 100 m of a watercourse or	Interfering with ecological processes and biodiversity pattern	**Impact:** A 600 ha solar PV facility has the potential of fragmenting the local landscape, particularly if considered together with the adjacent Phase 2 development. **Consequences:** -Fragmentation reduces connectivity, interrupts ecological process pathways such as local migration patterns of aquatic species effectively isolating fragmented patches (or "islands"). This can result in species extinction and biodiversity loss due to decreased colonization and population size.	Fragmentation	11

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Reg: 2006/023163/23

Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
	500 m of a wetland/pan				
Layout and Design	Roads	N/A	**Impact:** Habitat loss and fragmentation of watercourse areas due to displacement as a result of infrastructure installation (panels, powerlines, roads, fences and sub surface cables). **Consequences:** Destroy existing habitat but also displace bird species from large areas of natural habitat. This specifically has a greater impact on bird species restricted to a specific habitat and its requirements.	Fragmentation	11
Layout and Design	New Quarry	N/A	**Impact:** A new quarry will transform the local habitat. **Consequence:** Transformation may lead to degradation and a loss or alteration of ecosystem function.	Transformation	11
Layout and Design	New Quarry	N/A	**Impact:** A new quarry will transform the local habitat. **Consequence:** Transformation may lead to degradation and a loss or alteration of ecosystem function.	Transformation	11

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

- A surface area of approximately 2 ha will be required for the borrow pit and 4 ha for the construction camp.

Impact 11 (Terrestrial Biodiversity)

- Although there are no CBAs within the affected area, the whole of the Soventix Phase 3 site falls within an extensive ESA. According to the reasons layer that accompanies the CBA map, the ESA is based on the selection of the area as Northern Upper Karoo, the Platberg - Karoo Conservancy Important Bird Area, the presence of natural wetlands, rivers, and wetland FEPAs. However, the aquatic features listed above have been excluded from the development footprint, with the result that the impact of the development on these features would be minimal.
- There are no impacts associated with the development of the Soventix Phase 3 site on terrestrial biodiversity that cannot be mitigated to an acceptable level.

Impact 11 (Ecosystem/Vegetation Type)

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Reg: 2006/023163/23

Northern Upper Karoo is one of the most extensive vegetation types in the country and occupies over 40 000km2 of the interior Karoo. The vegetation consists of shrubland dominated by dwarf Karoo shrubs, grasses and Acacia mellifera subsp. detinens, and other low trees particularly on the sandy soils. Four plant species are known to be endemic to the vegetation type, Lithops hookeriana, Stomatium pluridens, Galenia exigua and Manulea deserticola. Northern Upper Karoo has not been significantly affected by transformation and is still approximately 96% intact and is classified as Least Threatened.

Impact 11 (Important Bird Area)

- The study area is within an Important Bird Area (IBA) called Platberg-Karoo Conservancy (unprotected). IBAs are sites of global significance for bird conservation, identified nationally through multi-stakeholder processes using globally standardised, quantitative, and scientifically agreed criteria. Essentially, these are the most important sites for conserving. IBAs are sites for conservation action and obtaining formal protection. Activities in IBA should be aligned to conservation outcomes of the protected area and should include developments such as low-impact eco-tourism.
- The impact of the development on the IBA would also be minimal as the PV footprint represents a very small (>>1%) of the IBA and would not represent significant habitat loss within the IBA. However, most importantly, the primary purpose of ESAs is to ensure the broad-scale maintenance of ecological processes and within the site, the primary ecological features and associated processes would be around the drainage features of the site and the corridors associated with the drainage systems linking the wetlands and artificial dams of the site. As these would be outside of the PV footprint, the processes associated with these features would not be compromised by the development of the PV facility.
- Migratory pathways of birds cannot be changed and the resulting impacts are unavoidable. However, severity of the impacts can be reduced with appropriate mitigation measures. Some significant discernible migratory flight pathways were able to be established which could be explained by large areas of generic habitats punctuated by some distinguishing geographic features in the landscape, such as large ridges. large impoundments, wetlands and drainage lines.

Impact 11 (Bats)

- A watercourse was observed via Google Earth Pro to be present centrally in the proposed Phase 3 footprint and indicated on maps provided by the EAP. The watercourse and the extent of any wetland associated with the watercourse, could be an important resource for bats for both drinking and foraging particularly in dry landscapes (Blakey et al. 2018).
- The potential roosting site identified during the desktop study were investigated on foot on 03 April 2022 for signs of bat occupancy. No roosts were located, however, the ridge should be preserved and buffered with a zone of at least 100m from the parameter of the solar array.
- Three bat species out of a potential eight species were recorded over the proposed Phase 3 footprint namely: Tadarida aegyptiaca (Egyptian Free-tailed bat), Laephotis capensis (Cape Serotine), and Miniopterus natalensis (Natal Long-fingered bat). All three species are widespread

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Reg: 2006/023163/23

and abundant and are classified as “Least Concern” on the IUCN Red Data List (IUCN 2021) and the Red List of Mammals of Southern Africa, Lesotho and Swaziland (refer to Table 2. Species identified according to echolocation calls, conservation status, distribution, habitat preference, foraging ecology, roost type and profile of specialist study)

Impact 12 (Surface Water Hydrology)

- The project area is located within a Strategic Water Source Area (Screening Report). Strategic Water Source Areas (SWSAs) are defined as areas of land that (a) supply a disproportionate (e.g., relatively large) quantity of mean annual surface water runoff in relation to their size and so are considered nationally important; and/or (b) have high groundwater recharge and where the groundwater forms a nationally important resource. **The protection and restoration of strategic water source areas is of direct benefit to all downstream users.** This dependence needs to be considered in decisions relating to these primary headwater catchments. The protection of both water quantity (flows) and quality must be addressed. Any failure to address impacts on water quality or quantity will have impacts on the water security of all those depending on that water downstream. Groundwater is the main or only source of water for numerous towns and settlements across the country **so protecting the capture zone, specifically for municipal supply well-fields, the recharge area, and the integrity of the aquifers is important as well**.
- The largest risk is potential run-off and stormwater discharge from the site into the surrounding causing soil erosion and should be managed according to the CSWMP and Monitoring Plan (for the Storm Water Management System and ground and surface water resources. (Hydrology Assessment)
- Considering run-off is directly related to rainfall intensity, and longer precipitation events, both monthly rainfall and run-off, peak from January to April. The run-off during these peak months ranges from 0,3 to 1,1 mm/yr over the surface area of quaternary catchment D62D. The annual run-off from natural (unmodified) catchments in D62D is approximately 0,9% of the MAP. (Hydrology Assessment)
- The solar panels are going to have an impact on rainfall runoff, especially along the dripline of the panels, and that will probably be an area of ongoing management, as well as channelling from the “two-spoor” roads in-between the panel arrays and along the perimeter fence, necessary for inspection and cleaning. As the panels need to be largely north facing (although they will be single-axis tracking units), at face value, the orientation of the panels and associated service roads will lie largely on the contour, which will be important for minimising runoff down the slope.
- Accounting for changes in soil type, slope angle and rainfall intensity, ground cover beneath solar arrays was found to have the most significant impact on run-off rates. It is therefore anticipated, that maintaining natural vegetation cover will assist in preventing increases in peak flow to the non-perennial streams/rivers. Hence, a marginal impact in terms of post-development peak flows on a sub-catchment scale is anticipated. It is predicted that there may only be an impact on the sub-catchment flood peak flows, if severe erosion and vegetation clearing activities take place, with inadequate stormwater management. So, if vegetation cover beneath the solar arrays is maintained, no significant increase in surface water run-off (run-off volumes, peak rates or time to peak rates) is anticipated compared to greenfield run-off rates.

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Reg: 2006/023163/23

Impact 13 (Lighting)

- Although the facility will not be lit up during the nighttime period, selected infrastructure will have to be illuminated. These comparatively small, illuminated areas can still impact the surrounding ecological functioning (including biological systems) of the adjacent landscape through spill over lighting and sky glow.
- Artificial lighting is well known to disrupt the flow of information to organisms, provides misleading clues and can cause interspecific competition for food resources by extending diurnal species foraging activity into the night-time period. As such, the spill-over of artificial lighting beyond the proposed solar PV facility into dark, natural spaces must be prevented.
- Known impacts of artificial lighting on bats are; delayed emergence and reduced number of individuals from roosts, changes in navigation and commuting behaviour, foraging behaviour alterations, the creation of "barriers" limiting the connectivity of habitats in the landscape and the effective dispersal of species (isolating habitat patches and populations from immigration), and decreased growth rates of young bats if adult bats incur higher energetic losses and experience decreased foraging time if they have to forage further afield from maternity roosts.
- Artificial lighting appears to benefit some bat species (light-tolerant) through increasing their foraging efficiency by identifying and exploiting insects swarming around lights.
- Light intolerant bat species are often slow flying and highly manoeuvrable, adapted for foraging in cluttered environments such as Rhinolophids and Nycterids. One reason for these species avoiding lit areas is that their echolocation call structure is not well suited for foraging in the open habitat associated with artificial lighting. A second reason for certain bat species to avoid artificially lit areas is the sensitivity of bat eyes to light. As light intensity increases, bat's visual sensitivity decreases.
- Lighting, particularly in arid regions can have significant impacts on arid bat communities where bats may reduce drinking activity due to artificial lighting.

Impact 14 (Change in Land use)

- None.

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		

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Reg: 2006/023163/23

-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
11	M	L	M	-I	M	H	1	M	H	1
Reversibility	M		**Irreplaceability**	H		**Mitigatory Potential**	H			

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
12	H	L	M	-I	H	H	1	H	H	1
Reversibility	M		**Irreplaceability**	H		**Mitigatory Potential**	H			

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
13	H	L	M	-I	H	M	1	H	M	1
Reversibility	M		**Irreplaceability**	H		**Mitigatory Potential**	H			

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
14	H	L	M	-I	H	H	1	H	H	1
Reversibility	M		**Irreplaceability**	H		**Mitigatory Potential**	H			

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- Commencement with construction, specifically civil works may only take place after the peak monthly rainfall and run-off period (from January to April), and preferably during the winter months (e.g., June to September) when there is a decreased probability of storm events. Civils works should as far as is practical be completed before the next rainfall season.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

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Reg: 2006/023163/23

- BirdLife website (https://www.birdlife.org.za/iba-directory/platberg-karoo-conservancy - page last updated Friday 13th February 2015)
- Chiropteran Specialist Report for Phase 3 of the Proposed Soventix-Solar Africa Solar PV Facility, Hanover, Northern Cape Prepared by: Dawn Cory Toussaint dated July 2022
- Hydrological Assessment (Version – Final 3) 01 September 2022 GCS Project Number: 22-0076 by Hendrik Botha.
- National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds, Commonwealth of Australia 2020
- Soil Mapping Report prepared by Hennie van den Burg of Iris International and Francois Botha of Eco Soil dated June 2022.
- Grazing Potential Assessment prepared by Francois de Wet of Enviro Pulse and Shobie Arnoldi of Topveld dated June 2022.
- Terrestrial Biodiversity Specialist Assessment – Soventix Phase 3 Pv Project (Final) prepared by Simon Todd of 3 Foxes Biodiversity Solutions dated September 2022.
- Avifauna Specialist Assessment (Final) prepared by Enviro-Insight CC (Sam Laurence and A.E. van Wyk) dated October 2022.

Mitigations:

Impact Management Outcome(s):

- The solar PV facility remains vegetated.
- Avoid extensive terrestrial habitat loss in localised areas.
- Ensure protection of undisturbed or sensitive vegetation units.
- Maintain connectivity, particularly terrestrial and aquatic ecological process pathways within the local landscape, through spatially explicit corridors and buffers, especially for aquatic systems.
- Protection and restoration of a Strategic Water Source Area.
- Maintenance of near natural landscapes with minimal loss in ecosystem integrity and functioning.
- Maintenance of ecological processes (e.g., predation, reproduction, etc.) and biodiversity pattern.

Targets:

- Natural vegetation is retained.
    - Loss of natural vegetation is limited to the physical footprint of associated structures and infrastructure (except for borrow pit and construction camp).
- Sensitive vegetation units remain intact.
- Maintain ecosystem integrity and resilience to climate change
- Limit Fragmentation

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Reg: 2006/023163/23

- Pipeline corridors are no wider than 10m through ephemeral drainage line.
- Aerial or overhead equipment used where possible.
- No unnecessary ephemeral drainage line crossings.
- Best possible crossing sites utilized.
- Roads do not impede surface or subsurface flows
- Sensitive avifauna habitats are protected and maintained.
- Minimise the risk of erosion on dispersive soils.
- Minimise areas that attract birds
- Minimise the effects of artificial light on wildlife (and humans).
- The facility is built in sequential phases.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
14	Climate Change	Diversification by changing the current land-use (Agriculture) to an Agrivoltaic system is potentially a powerful climate resilient land-use	Maintenance of near natural landscapes with minimal loss in ecosystem integrity and functioning.	Maintain ecosystem integrity and resilience to climate change: An Agrivoltaic system	The solar PV facility shall adopt a symbiotic Agrivoltaic system that combines agriculture, specifically good ecological management (grazing) practices, with green energy generation.	Holder, Engineer, Landowner	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
14	Change in land Use	Diversification by changing the current land-use (Agriculture) to an Agrivoltaic system is potentially a powerful climate	Maintenance of near natural landscapes with minimal loss in ecosystem integrity and functioning.	Maintain of ecosystem integrity and resilience to climate change: soil maps and veld condition assessments	Undertake detailed soil mapping and veld condition assessments to determine the grazing capacity of the project area so that the landowner	Holder, Landowner	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		resilient land-use			does not exceed recommended stocking densities and ensure adequate vegetation cover necessary for the maintenance of ecosystem services.			
14	Change in Land Use	Diversification by changing the current land-use (Agriculture) to an Agrivoltaic system is potentially a powerful climate resilient land-use	Maintenance of near natural landscapes with minimal loss in ecosystem integrity and functioning/Protection and restoration of a Strategic Water Source Area	Maintain ecosystem integrity and resilience to climate change: Revegetated bare patches.	Halt and reverse existing degradation from extensive livestock production or other drivers to counter increased climatic uncertainty - restore all bare patches of soil with vegetation.	Holder, Landowner	Continuous	Compliance to be verified by ECO and IEA.
14	Change in Land Use	Diversification by changing the current land-use (Agriculture) to an Agrivoltaic system is potentially a powerful climate resilient land-use	Maintenance of near natural landscapes with minimal loss in ecosystem integrity and functioning	Maintain ecosystem integrity and resilience to climate change: No signs of overgrazing.	Ensure responsible natural resource management that maintains the integrity of ecosystems and the continued provision of ecosystem services to current and future generations.	Holder, Landowner	Continuous	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
11	Layout and Design	Habitat loss and fragmentation of watercourse areas due to displacement as a result of infrastructure installation (panels, powerlines, roads, fences and sub surface cables).	Minimize habitat loss.	Roads do not impede surface or subsurface flows	All roads and crossings must be engineered not to impede surface or subsurface flow in any way.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
11	Layout and Design	The physical footprint of the quarry will result in a loss of local terrestrial	Minimize habitat loss.	Natural vegetation is retained.	The quarry shall not exceed 2 ha in size.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
11	Layout and Design	The physical footprint of the quarry will result in a loss of local terrestrial	Minimize habitat loss.	Natural vegetation is retained.	The borrow pit may only be used to source suitable material for improvements to the property that it is located on.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
11	Layout and Design	The physical footprint of the quarry will result in a loss of local terrestrial	Minimize habitat loss.	Natural vegetation is retained.	As far as is practical, feasible and permissible within the law, mine material for concrete aggregate and/or road layers from existing quarries before resorting to establishing a new	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					quarry in the project area (on the Remainder or Portion 3 of Farm Goede Hoop 26C). None of the following existing quarries utilize good quality sandstone or dolerite rock but can be recommended as construction material source: • 30,821773° S; 24,403240° E • 30,87254° S; 24,36635° E • 30,84143° S; 24,31322° E • 30,8333° S; 24,30296° E • 30,85369° S; 24,26418° E • 30,87197° S; 24,32169° E Better quality material (sandstone) which appears to be intermittently used in road layers occurs at a large dormant quarry			

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					near the N10 national road: • 30,87990° S; 24,23715° E			
11	Layout and Design	Fragmenting the local landscape.	Maintenance of connectivity, particularly terrestrial and aquatic ecological process pathways within the local landscape/Protection and restoration of a Strategic Water Source Area	Limit fragmentation: A perimeter fence does not intersect the ephemeral drainage line running through the project area (an unnamed tributary to the D62D – 05610 tributary).	Fragmentation of the terrestrial ecosystem will be reduced by fencing each PV Block separately.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
11	Layout and Design	Fragmenting the local landscape.	Maintenance of connectivity, particularly terrestrial and aquatic ecological process pathways within the local landscape.	Limit fragmentation: A perimeter fence does not intersect an ecological buffer.	Fencing shall remain outside the delineated edge of ecological buffers inclusive of the riparian or other 'High' sensitive habitats.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
11	Layout and Design	Fragmenting the local landscape.	Maintenance of connectivity, particularly terrestrial and aquatic ecological process pathways within the local landscape.	Limit fragmentation: A perimeter fence does not intersect a 'High' sensitive habitat.	Fragmentation must be limited by the exclusion of 'High' sensitive habitats from fenced in areas and the preservation of ecological corridors	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					connecting these 'High' sensitive habitats.			
11	Layout and Design	Habitat loss and fragmentation due to displacement as a result of infrastructure installation (panels, powerlines, roads, fences and sub surface cables).	Maintenance of ecological processes (e.g., predation, reproduction, etc.) and biodiversity pattern.	Sensitive avifauna habitats are protected and maintained.	Avoid avifaunal specific highly sensitive areas and their associated buffers, such as the local drainage lines, impoundments, smaller watercourses, pans and rocky koppies.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
11	Layout and Design	Habitat loss and fragmentation due to displacement as a result of infrastructure installation (panels, powerlines, roads, fences and sub surface cables).	Maintenance of ecological processes (e.g., predation, reproduction, etc.) and biodiversity pattern.	Sensitive avifauna habitats are protected and maintained.	The linear Drainage line habitats must be buffered by a minimum of 50 metres from the edge of the demarcated wetland.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
11	Layout and Design	Habitat loss and fragmentation due to displacement as a result of infrastructure installation (panels, powerlines,	Maintenance of ecological processes (e.g., predation, reproduction, etc.) and biodiversity pattern.	Sensitive avifauna habitats are protected and maintained.	A green buffer should be maintained around all habitats with a SEI designated as High or above. This includes a 50 m no-go buffer proposed around	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		roads, fences and sub surface cables).			small artificial water points (borehole pans and livestock watering troughs).			
11	Layout and Design	Habitat loss and fragmentation due to displacement as a result of infrastructure installation (panels, powerlines, roads, fences and sub surface cables).	Maintenance of ecological processes (e.g., predation, reproduction, etc.) and biodiversity pattern.	Sensitive avifauna habitats are protected and maintained.	All large impoundments (dams) require a 1000 metre buffer from any infrastructure activity although this may be reduced to 800 metres if no new powerline infrastructure impacts the 1000 metre threshold. The 1000 metre buffer will not apply to roads and fences.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
11	Layout and Design	Birds may be attracted to the area for nesting/landing	Maintenance of ecological processes (e.g., predation, reproduction, etc.) and biodiversity pattern.	Minimise areas that attract birds	Numerous devices have been developed to deter birds from an area. Deterrents could include habitat management, control of prey populations, anti-perching devices, nest-proofing, netting or other enclosures,	Engineer, Landowner	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					scaring or chasing (e.g. with trained dogs or raptors), bio-acoustic or visual deterrence.			
12	Layout and Design	Erosion and sediment transport may be exacerbated by the concentrated rainfall volumes off the solar PV panels.	Maintenance of near natural landscapes with minimal loss in ecosystem integrity and functioning	Minimise erosion	Sheep will help control the height of the underlying vegetation. However, given that they are highly selective grazers and the unlikelihood of all karoo 'bossies' immediately to the east and west of each solar module being browsed below 300 mm, indigenous vegetation may where required be cropped/cut by staff to a height of 100 mm below the solar module at maximum tilt, but not cleared.	Holder, Engineer, Contractor	Planning and Design Phase Pre-construction	Compliance to be verified by ECO and IEA.
12	Layout and Design	Erosion and sediment transport may be exacerbated by the concentrated rainfall volumes	Maintenance of near natural landscapes with minimal loss in ecosystem integrity and functioning	Minimise erosion.	Cut vegetation shall be left on the ground beneath and around the trimmed plants to protect the soil and	Holder, Engineer, Contractor	Planning and Design Phase Pre-construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		off the solar PV panels.			provide shelter for seedlings.			
12	Layout and Design	Erosion and sediment transport may be exacerbated by the concentrated rainfall volumes off the solar PV panels.	Maintenance of near natural landscapes with minimal loss in ecosystem integrity and functioning	Minimise erosion	If solar arrays are to be installed on potentially dispersive soils (e.g., bare patches) then implement the 'Solar Arrays on Dispersive Soils Protocol' (Appendix B3).	Holder, Engineer, Contractor	Planning and Design Phase Pre-construction	Compliance to be verified by ECO and IEA.
14	Change in Land Use	The physical footprint of solar PV facility will result in a loss of local terrestrial habitat.	Minimize habitat loss.	Natural vegetation is retained.	The development footprint of the Solar PV facility and associated infrastructure shall not be cleared in its entirety. The clearance of indigenous vegetation shall be restricted to the physical footprint of the facility and associated infrastructure (with the exception of temporary clearance and/or disturbance associated with 'normal'	Engineer, Landowner	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					construction-related activities).			
14	Change in Land Use	The physical footprint of solar PV facility will result in a loss of local terrestrial habitat.	Minimize habitat loss.	Natural vegetation is retained.	Limit the number of equipment staging areas and spoil storage areas.	Engineer, Landowner	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
14	Change in Land Use	The physical footprint of solar PV facility will result in a loss of local terrestrial habitat.	Minimize habitat loss.	Natural vegetation is retained.	A rehabilitation plan must be commissioned before construction commences.	Engineer, Landowner	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
11	Layout and Design	Habitat loss and fragmentation of watercourse areas due to displacement as a result of infrastructure installation (panels, powerlines, roads, fences and sub surface cables).	Minimize habitat loss.	Pipeline corridors are no wider than 10m through ephemeral drainage line	All Pipelines corridors (affected areas) should be implemented to a maximum 10 metres wide through wetlands during construction.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
11	Layout and Design	Habitat loss and fragmentation of watercourse areas due to displacement as a result of	Minimize habitat loss.	Aerial or overhead equipment used where possible	Avoid the construction of a crossing or staging area by either choosing an alternative route or	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		infrastructure installation (panels, powerlines, roads, fences and sub surface cables).			by using aerial or overhead equipment.			
11	Layout and Design	Habitat loss and fragmentation of watercourse areas due to displacement as a result of infrastructure installation (panels, powerlines, roads, fences and sub surface cables).	Minimize habitat loss.	No unnecessary ephemeral drainage line crossings	Limit the number of crossings.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
11	Layout and Design	Habitat loss and fragmentation of watercourse areas due to displacement as a result of infrastructure installation (panels, powerlines, roads, fences and sub surface cables).	Minimize habitat loss.	Best possible crossing sites utilized	Consider criteria when locating crossing sites to minimize disturbance, such as shortest crossing point, avoiding unstable or steep banks, avoiding highly erodible soils, avoid unstable portions of stream channels.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
14	Change in Land Use	The physical footprint of solar PV facility will result in a loss of local terrestrial habitat.	Minimize habitat loss.	Natural vegetation is retained.	The clearance or disturbance of indigenous vegetation resulting from 'normal' construction-related activities shall be rehabilitated immediately upon the completion of those activities on a site, in accordance with a rehabilitation plan and/or the Bare Patch Restoration Protocol (Appendix C).	Engineer, Landowner	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
11	Planning	Loss of terrestrial habitat cleared for the development footprint and construction camp.	Ensure the protection of undisturbed or sensitive vegetation units.	The facility is built in sequential phases.	Reduce the area needed for parking, storage, etc. by building the facility in sequential phases of 100 MW blocks as opposed to trying to build the 400 MW facility in one go.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
12	Layout and Design	Bare areas created by vegetation removal will increase surface	Maintenance of near natural landscapes with minimal loss in ecosystem integrity and functioning	Minimise erosion	Maintain vegetation cover beneath the solar arrays.	Holder, Landowner	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		water run-off, causing erosion and sedimentation of watercourses .						
12	Layout and Design	Erosion and sediment transport will likely take place from the concentrated rainfall volumes off the solar PV panels. Efforts should be made in managing run-off from the PV panels and arrays onto the soils, and then managing the distribution of the accumulated water back to the environment.	Maintenance of near natural landscapes with minimal loss in ecosystem integrity and functioning	Minimise erosion	Maintain vegetation cover beneath the solar arrays.	Holder, Landowner	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
12	Planning	Potential run-off and stormwater discharge from the site can cause erosion.	Maintenance of near natural landscapes with minimal loss in ecosystem integrity and functioning	Minimise erosion	The civil construction phase should take place during the winter months (e.g., June to September) with a decreased probability of storm events.	Holder, Engineer, Contractor	Planning and Design Phase Pre-construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
12	Layout and Design	Access roads, including the two-track service roads between the solar panel arrays, will increase surface water run-off, causing erosion and sedimentation of watercourses.	Maintenance of near natural landscapes with minimal loss in ecosystem integrity and functioning	Minimise erosion	The Engineers responsible for designing the roads shall include berms & mitre drains at strategic points along the two-track service roads between the solar panel arrays (and other roads) as a mechanism to dissipate runoff.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
13	Layout and Design	Artificial lighting threatens biodiversity.	Maintenance of ecological processes (e.g., predation, reproduction, etc.) and biodiversity pattern.	Minimise the effects of artificial light on wildlife (and humans): LEDs and smart control technologies.	Adopt LEDs and smart control technologies (such as motion sensors and timers) to control and manage the effects of artificial light on wildlife and 'sense of place'.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
13	Layout and Design	Artificial lighting threatens biodiversity.	Maintenance of ecological processes (e.g., predation, reproduction, etc.) and biodiversity pattern.	Minimise the effects of artificial light on wildlife (and humans): best practice lighting design principles have been incorporated into the design of lighting.	Incorporate the following best practice lighting design principles into the design of lighting: (a) Start with natural darkness and only add light for specific purposes, (b) Use adaptive light controls to manage light	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					timing, intensity and colour, (c) Light only the object or area intended – keep lights close to the ground/mounting fixtures as low as possible, directed and shielded to avoid light spill, (d) Use the lowest intensity lighting appropriate for the task, (e) Use non-reflective, dark-coloured surfaces, and (f) Use lights with reduced or filtered blue, violet and ultra-violet wavelengths/Use lights with longer wavelengths, e.g., a white 2 700 K LED light (as opposed to a 5 000 K LED light) (National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds,			

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					Commonwealth of Australia 2020)			

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
11	L	L	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
11	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
12	L	L	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
12	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
13	L	L	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
13	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
14	L	L	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
14	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

- The residual risk of losing terrestrial ecosystems, including through fragmentation (**11**) after mitigation is assumed to be Low.
- The residual risk of lost biodiversity from erosion (**12**) after mitigation is assumed to be Low.
- The residual risk of disrupted life cycles from artificial lighting (**13**) after mitigation is assumed to be Low.
- The residual risk of lost biodiversity from a change of land use (**14**) after mitigation is assumed to be Low.

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Reg: 2006/023163/23

Receiving Environment: Aquatic Ecosystem

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Climate Change	Solar PV Facility		**Impact:** According to the District Municipality's Climate Change Response Plan there are increased risks to inter alia Biodiversity and environment, including increased impacts due to loss of priority wetlands and river ecosystems. (negative) **Consequences:** - Lost wetlands would remove ecosystem regulating services and increase the risk of flood events and ecosystem degradation(erosion) further downstream.	Transformation	15
Planning	Commencement and Dust Suppression		**Impact:** The generation of excessive wind-blown dust could 'choke' the ecologically sensitive ephemeral drainage line system. **Consequence:** Turbid waters reduce light penetration, decreasing photosynthesis and primary production, reducing food availability for aquatic organisms higher up the food chain. Suspended solids may interfere with the feeding mechanisms of filter-feeding organisms such as certain macroinvertebrates, and the gill functioning, foraging efficiency (due to visual disturbances) and growth of fish, leading to changes in invertebrate and fish assemblages. Suspended solids that settle out may cover spawning grounds (places to lay eggs), smother or abrade benthic plants and animals, resulting in changes to the nature of the substratum where invertebrates live, causing either change in the structure of the biotic community by the replacement of these organisms with organisms that burrow in soft sediments, or massive declines in fish populations. Sensitive species may be permanently	Transformation	15

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Reg: 2006/023163/23

			eliminated if the source of the suspended solids is not removed. Alter feeding and breeding behaviour (lowering vigour and reproductivity), species composition and aquatic ecosystem functioning (indirect).		
Layout and Design	Lighting		**Impact:** Artificial lighting threatens biodiversity by disrupting the night behaviour of organisms affecting survivorship and or reproduction, e.g., by attracting insects and their predators from frogs to bats. **Consequences:** - Altered ecological processes could cause insect population declines, a change in biodiversity pattern, and reduced ecosystem regulating services such as pollination (indirect)	Transformation	16
Layout and Design	Installing Perimeter Fence and Access Control	Terrestrial barrier	**Impact:** Fencing causes fragmentation of the landscape. **Consequences:** -Fragmentation reduces connectivity, interrupts ecological process pathways such as local migration patterns of aquatic species effectively isolating fragmented patches (or "islands"). This can result in species extinction and biodiversity loss due to decreased colonization and population size.	Fragmentation	15
Layout and Design	Installing panel arrays and associated infrastructure (from racks to field transformers) including within 100 m of a watercourse or 500 m of a wetland/pan	Interfering with ecological processes and biodiversity pattern	**Impact:** A 600 ha solar PV facility has the potential of fragmenting the local landscape, particularly if considered together with the adjacent Phase 2 development. **Consequences:** -Fragmentation reduces connectivity, interrupts ecological process pathways such as local migration patterns of aquatic species effectively isolating fragmented patches (or "islands"). This can result in species extinction and biodiversity loss due to decreased colonization and	Fragmentation	15

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Reg: 2006/023163/23

			population size.		
Layout and Design	Distribution Lines	Obstruction	**Impact:** distribution line can transform wetland areas altering hydrology and ecosystem **Consequence:** disturbance	Transformation	15
Layout and Design	Water infrastructure (Supply)	Groundwater abstraction, purification and storage	**Impact:** Water storage tanks can topple over, leak or overflow. **Consequences:** - Overflowing water storage tanks may cause erosion or degradation of the receiving environment.	Transformation	15
Layout and Design	Quarry (new)		**Impact:** Quarries in or near to fragile terrestrial and/or aquatic ecosystems could transform those systems. **Consequences:** - Aquatic ecosystem degradation	Transformation	15
Layout and Design	Roads		**Impact:** Existing two track access road crossings through the watercourse become waterlogged during the wet season. Pipe culvert crossings channel and increase the velocity of surface water flows. **Consequences:** - Aquatic ecosystem degradation	Transformation	15
Layout and Design	Roads		**Impact:** Access roads crossing a drainage channel will be subject to submerged conditions from time to time (Geotechnical Assessment) **Consequence:** Vehicles may get stuck and damage the sensitive bed and banks of a watercourse.	Transformation	15

<u>Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts</u>

Impact 15 (Aquatic Biodiversity)

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Reg: 2006/023163/23

- An Aquatic Biodiversity Impact Assessment was commissioned to inter alia Identify, describe, delineate, and demarcate ecological buffers around watercourses, including wetlands.
- The drainage systems are predominantly classified as ephemeral, which means that the stream flows briefly in direct response to precipitation in the immediate vicinity, and the channel is at all times above the ground-water reservoir. These ephemeral tributaries of the Brak River and considered to be in a largely natural ecological state. These systems have a far less predictable flow regime compared to perennial or seasonal rivers, and are frequently dry for long periods in arid regions. The ephemeral drainage system consists of one major ephemeral drainage channel which are fed by upstream catchment areas beyond the project area fence line. Three smaller tributaries are feeding into the main drainage line in the project area. The ecological importance and sensitivity category (EISC) of the ephemeral drainage system and associated alluvial floodplains is classified as “High” and therefore considered as a "no-go area" for all infrastructure apart from access roads, pipelines, cables and pylons. The no-go area includes the ecological buffer.
- The delineated ephemeral drainage system is of conservation importance as it is considered a Freshwater Ecosystem Protected Area (FEPA) category. The entire sub-quaternary catchment indicates that the surrounding land and smaller stream network need to be managed in a way that maintains the good condition (A or B ecological category) of the river reach.
- A buffer of 20 m wide on both sides of the drainage line delineation is required during the construction and operational phases to protect the Phase 3 PV facility in its current condition from any degradation. This buffer width is obtained whenever the following mitigation measures are applied to the model: (a) the management of surface water runoff, (b) erosion monitoring, and (c) constraints regarding the clearing of vegetation within these areas.
- The generation of excessive wind-blown dust could 'choke' the ecologically sensitive ephemeral drainage line system (pers. comm. Sam Laurence). The recovery of a stream from sediment deposition is dependent on the elimination of the sediment source and the potential for the deposited material to be flushed out by stream flow.

Impact 15 (Surface Water Hydrology)

- The project area is located within a Strategic Water Source Area (Screening Report). Strategic Water Source Areas (SWSAs) are defined as areas of land that (a) supply a disproportionate (e.g., relatively large) quantity of mean annual surface water runoff in relation to their size and so are considered nationally important; and/or (b) have high groundwater recharge and where the groundwater forms a nationally important resource. **The protection and restoration of strategic water source areas is of direct benefit to all downstream users.** This dependence needs to be considered in decisions relating to these primary headwater catchments. The protection of both water quantity (flows) and quality must be addressed. Any failure to address impacts on water quality or quantity will have impacts on the water security of all those depending on that water downstream. Groundwater is the main or only source of water for numerous towns and settlements across the country **so protecting the capture zone, specifically for municipal supply well-fields, the recharge area, and the integrity of the aquifers is important as well**.
- The project area falls within quaternary catchment D62D and the Orange Water Management Area. (Hydrology Assessment)

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Reg: 2006/023163/23

- The ephemeral drainage line running through the project area is an unnamed tributary to the D62D – 05610 tributary with its confluence just downstream of the Project Area. (Plan of Study prepared by Dr Andrew Deacon)
- The project area contains 3 Hydrological Response Units (HRU). Ninety-six percent (96%) of the project area falls within HRU2. The average slope of HRU2 (21,738 km2) is 0,56%. Sixteen percent (16,51%) of HRU2 has a 3-10% slope, which is mostly restricted to the western and eastern corners of the project area. Consequently, the topography of the study area is generally flat with elevations on the site typically ranging from 1 335 to 1 370 m above mean sea level. (Hydrology Assessment)
- Drainage is generally towards the north-west via multiple non-perennial drainage lines towards the ephemeral Brak River, approximately 6,6 km further downstream. (At least) Three small capacity in-stream dams occur within the development area. (Hydrology Assessment)
- The rivers are ephemeral and only have water shortly after storm events. (Hydrology Assessment) – **Construction of watercourse crossings during the dry winter months will minimise the risk of sedimentation and increased TSS or turbidity.**
- It is anticipated that soils downstream of the proposed development, and the non-perennial streams (feeding into temporary livestock watering dams) are the receivers of any sediment runoff or poor-quality runoff from the site. (Hydrology Assessment)
- It is proposed that four (4) bi-annual water monitoring points be established in the non-perennial stream and temporary dams constructed by the landowner. These are the only areas where there will likely be sufficient water to sample and monitor the impact of the development on pH, Electrical Conductivity (EC)/Total Dissolved Solids (TDS), and Temperature. It is proposed that monitoring take place up to 2 years after the completion of the development (Hydrology Assessment) – **Baseline measurements will need to be obtained prior to the commencement of construction**.

Impact 15 (Wetlands)

- The clayey soils and most noticeably the Swartland and Valsrivier soils may restrict vehicle movement during the wet season. During the rainy season terrain mobility on high clay soils in low lying areas with drainage lines will be difficult and might increase soil erosion when drainage lines are disturbed.
- The study area is not within an area identified in terms of an international convention, such as a RAMSAR site.
- The drainage systems are predominantly classified as ephemeral drainage lines and not wetlands.

Impact 16 (Lighting)

- Animals perceive light differently from humans. Most animals are sensitive to ultra-violet (UV)/violet/blue light. Understanding the sensitivity of wildlife to different light wavelengths is critical to assessing the potential effects of artificial light on wildlife. (National Light Pollution Guidelines for Wildlife)
- Under low light conditions (dark adapted vision), light is detected by cells in the eye called rods. Rods only perceive light in shades of grey (no colour). This is known as scotopic vision, and it is more sensitive to shorter wavelengths of light (blue/violet) than photopic vision. (National Light

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Reg: 2006/023163/23

Pollution Guidelines for Wildlife). Consequently, keeping the light LONG wavelength (ambers and reds) actually makes the light that is visible seem dimmer to nocturnal animals that primarily use rod vision (https://myfwc.com/conservation/you-conserve/lighting/pollution/).

- White LEDs generally contain short wavelength blue light. Short wavelength light scatters more readily than long wavelength light, contributing more to sky glow. Also, most wildlife is sensitive to blue light. However, LEDs can be smart controlled, are highly adaptable in terms of wavelength and intensity, and can be instantly turned on and off. (National Light Pollution Guidelines for Wildlife)
- Lamps that have a warm yellowish colour have low colour temperatures between 1000K and 3000K while lamps characterised by a cool bluish colour have a colour temperature, or CCT, over 5000K. Correlated colour temperature does not provide information about the blue content of a lamp. However, all LEDs contain blue light, and the blue content generally increases with increased CCT. (National Light Pollution Guidelines for Wildlife)

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
15	M	L	M	-I	M	M	1	H	M	1
Reversibility	M	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE

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Reg: 2006/023163/23

16	M	L	M	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- Commencement with construction, specifically civil works may only take place after the peak monthly rainfall and run-off period (from January to April), and preferably during the winter months (e.g., June to September) when there is a decreased probability of storm events. Civils works should as far as is practical be completed before the next rainfall season.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Hydrological Assessment (Version – Final 3) 01 September 2022 GCS Project Number: 22-0076 by Hendrik Botha
- Aquatic Biodiversity Impact Assessment, Section 21(c) and (i) Risk Assessment and Wetland Delineation Verification by Dr Andrew Deacon August 2022.
- Soil Mapping Report prepared by Hennie van den Burg of Iris International and Francois Botha of Eco Soil dated June 2022.
- National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds, Commonwealth of Australia 2020
- The National Water Act, 1998 (Act No. 36 of 1998) requirements with regards to *inter alia* classification of water resources and Resource Quality Objectives (RQO's) must be adhered to.
- The White Paper on a National Water Policy for South Africa (1997), states that effective resource protection requires two separate sets of measures. The first are resource-directed measures, which set clear objectives for the desired level of protection for each resource. The second are source-directed controls which aim to control what is done to the water resource by way of registration of sources of impact, standards for waste discharges, best management practices, permits, Water Use Authorisations, impact assessments and environmental management plans - so that the resource protection objectives are achieved.

Mitigations:

Impact Management Outcome(s):

- Protection and Restoration of a Strategic Water Source Area
- Preservation of aquatic ecosystem composition, structure, and function as well as riparian habitat.
- Persistence of Wetland FEPAs in good ecological condition, particularly ecological processes (e.g., predation, reproduction, etc.) and biodiversity pattern to increase their resilience to changes in rainfall patterns and temperature (climate change).

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Reg: 2006/023163/23

- Maintenance of connectivity, particularly terrestrial and aquatic ecological process pathways within the local landscape, through spatially explicit corridors and buffers, especially for aquatic systems.
- Minimise dust generation.

Targets:

- Avoid extensive aquatic habitat loss in localised areas.
- Avoid erosion from water storage tanks.
- Limit transformation of Wetland FEPAs.
- Maintain ecological, massing, and visual sensitivity buffers.
- Limit Fragmentation
- Construction of Linear infrastructure during dry months
- Mining from quarry during wet summer season.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
15	Climate Change and Layout and Design	Fragmenting the local landscape.	Maintenance of connectivity, particularly terrestrial and aquatic ecological process pathways within the local landscape.	Limit fragmentation: A perimeter fence does not intersect the ephemeral drainage line running through the project area (an unnamed tributary to the D62D – 05610 tributary).	Fragmentation of the aquatic ecosystem will be avoided by fencing each PV Block separately.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
15	Climate Change and Layout and Design	Fragmenting the local landscape.	Maintenance of connectivity, particularly terrestrial and aquatic ecological	Limit fragmentation: A perimeter fence does not intersect an ecological buffer.	Fencing shall remain outside the delineated edge of ecological buffers inclusive of the riparian or other 'High' sensitive habitats.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
			process pathways within the local landscape.					
15	Climate Change	Increased risks to inter alia Biodiversity and environment, including increased impacts due to loss of priority wetlands and river ecosystems	Preserve wetlands and the ecosystem services they provide to increase their resilience to changes in rainfall patterns and temperature.	Limit transformation of aquatic ecosystem	Road crossing designs, such as box culverts or concrete drifts with rock fill, shall ensure year-round access to all parts of the veld (for livestock management) and facility (for operational management) and avoid vehicles getting stuck and damaging the watercourse.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
15	Climate Change	Increased risks to inter alia Biodiversity and environment, including increased impacts due to loss of priority wetlands and river ecosystems	Preserve wetlands and the ecosystem services they provide to increase their resilience to changes in rainfall patterns and temperature.	Limit transformation of aquatic ecosystem	Access roads to the project area, especially those crossing large flood plains, should be well planned.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
15	Climate Change	Increased risks to inter alia Biodiversity and environment, including increased impacts due to loss of priority	Preserve wetlands and the ecosystem services they provide to increase their resilience to changes in	Limit transformation of aquatic ecosystem	The design of access roads must include the adequate management of surface water run-off.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		wetlands and river ecosystems	rainfall patterns and temperature.					
15	Climate Change	Increased risks to inter alia Biodiversity and environment, including increased impacts due to loss of priority wetlands and river ecosystems	Preserve wetlands and the ecosystem services they provide to increase their resilience to changes in rainfall patterns and temperature.	Limit transformation of aquatic ecosystem	Laydown areas must be located in uplands a minimum of 35 metres from the wetland edge.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
15	Climate Change	Increased risks to inter alia Biodiversity and environment, including increased impacts due to loss of priority wetlands and river ecosystems	Preserve wetlands and the ecosystem services they provide to increase their resilience to changes in rainfall patterns and temperature.	Limit transformation of aquatic ecosystem	Avoid discharges of untreated wastewater into natural wetlands.	Holder, Engineer, Contractor	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
15	Climate Change	Increased risks to inter alia Biodiversity and environment, including increased impacts due to loss of priority wetlands and river ecosystems	Preserve wetlands and the ecosystem services they provide to increase their resilience to changes in rainfall patterns and temperature.	Limit transformation of aquatic ecosystem	Avoid or restrict point source discharges of storm water into natural wetlands by relying on free drainage.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
15	Planning	The generation of excessive wind-blown dust could 'choke' the ecologically sensitive ephemeral drainage line system.	Minimise dust generation	Construction of Linear infrastructure during dry months	The construction of linear infrastructure across parts of the ephemeral drainage system, should be restricted to the dry winter months (e.g., May to September), that is commence with such activities as clearing or grading, excavating and importing material at the end of the wet season/beginning of the dry season whilst the soil is still moist and as far as is practical, be completed in, the dry winter months.	Holder, Contractor	Planning and Design Phase	Compliance to be verified by ECO and IEA.
15	Planning	The generation of excessive wind-blown dust could 'choke' the ecologically sensitive ephemeral drainage line system.	Minimise dust generation	Construction during dry months	The civil construction phase should be restricted to the dry winter months (e.g., April/May to September), that is commence with such activities as clearing or grading, excavating and importing material at the end of the wet season/beginning of the dry season whilst the soil is still moist to reduce dust and as far as is practical, be	Holder, Contractor	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					completed in, the dry winter months with a decreased probability of storm events.			
15	Planning	The generation of excessive wind-blown dust could 'choke' the ecologically sensitive ephemeral drainage line system.	Minimise dust generation	Mining from quarry during wet summer season.	Mining of suitable material from a quarry for road construction and associated rock crushing should as far as is practical take place during the wet summer season prior to the commencement of the civil construction phase.	Holder, Contractor	Planning and Design Phase	Compliance to be verified by ECO and IEA.
15	Layout and Design	Distribution line can transform wetland areas altering hydrology and ecosystem	Persistence of aquatic ecosystems in good ecological condition.	Limit transformation of aquatic ecosystem	Wetlands must be avoided or, where wetland crossing is unavoidable, the power line should be routed over the narrowest part of the wetland.	Holder, Engineer, Contractor	Planning and Design Phase	Compliance to be verified by ECO and IEA.
15	Layout and Design	Overflow from water storage tanks can cause erosion of receiving environment.	Protection and Restoration of a Strategic Water Source Area/ Preservation of aquatic ecosystem, composition, structure, and function.	Avoid erosion from water storage tanks: no muds, Water storage tanks are on a solid foundation, platform or stand.	Place water tanks on solid foundations, platforms or stands to ensure that they are level, will not fall over and are above the ground in order to build up the necessary water pressure for the outlet.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
15	Layout and Design	Overflow from water storage tanks can cause erosion	Protection and Restoration of a Strategic Water Source Area/	Avoid erosion from water storage tanks: Water storage	The platform or stand for water storage tanks must be level and must have hooks onto	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		of receiving environment.	Preservation of aquatic ecosystem, composition, structure, and function.	tanks are fastened to the platform or stand.	which the tank can be anchored or fastened.			
15	Layout and Design	Overflow from water storage tanks can cause erosion of receiving environment.	Protection and Restoration of a Strategic Water Source Area/ Preservation of aquatic ecosystem, composition, structure, and function.	Avoid erosion from water storage tanks: Water pipes are visibly secured.	The pipes leading to and from the water storage tanks should also be anchored to prevent them from breaking, cracking and leaking.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
15	Layout and Design	Overflow from water storage tanks can cause erosion of receiving environment.	Protection and Restoration of a Strategic Water Source Area/ Preservation of aquatic ecosystem, composition, structure, and function.	Avoid erosion from water storage tanks: no muds, Design includes an overflow pipe to a soakaway.	Each water storage tank or series of water storage tanks should have an overflow pipe to prevent water being forced out of the inlet when the tank is full. The overflow pipe should be diverted to a soakaway.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
15	Layout and Design	Overflow from water storage tanks can cause erosion of receiving environment.	Protection and Restoration of a Strategic Water Source Area/ Preservation of aquatic ecosystem, composition, structure, and function.	Avoid erosion from water storage tanks: no muds, puddles or signs of erosion around water storage tanks.	If water storage tanks are placed on a raised platform or stand, then a layer of gravel should be placed around and/or under the platform or stand to ensure good drainage and to prevent forming mud and puddles.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
15	Layout and Design	Quarries in or near to fragile terrestrial and/or aquatic ecosystems could transform those systems.	Persistence of aquatic ecosystems in good ecological condition.	Limit transformation of aquatic ecosystem	Any new quarry site shall be located outside any and all ecological buffers	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
15	Layout and Design	Pipe culvert crossings channel and increase the velocity of surface water flows.	Persistence of Wetland FEPAs in good ecological condition.	Limit transformation of Wetland FEPAs	Road crossing designs, such as box culverts or concrete drifts with rock fill, which spread the surface water into a broadly distributed sheet whilst maintaining unrestricted subterranean flow should be sized to accommodate at least 1:100 yr flood events	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
15	Layout and Design	Pipe culvert crossings channel and increase the velocity of surface water flows.	Persistence of Wetland FEPAs in good ecological condition.	Limit transformation of Wetland FEPAs	Ensure that any dedicated stream crossings use road crossing designs, such as box culverts or concrete drifts with rock fill, which spread the surface water into a broadly distributed sheet whilst maintaining unrestricted subterranean flow	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
15	Layout and Design	Pipe culvert crossings channel and	Persistence of Wetland FEPAs in good	Limit transformation of Wetland FEPAs:	It is preferable to eliminate fill roads and utilise raised bridges	Holder, Engineer	Planning and Design Phase	Compliance to be verified

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		increase the velocity of surface water flows.	ecological condition.	Raised bridges and culverts	and culverts with adequate sizing and spacing of water crossing structures, proper choice of the type of crossing structure, and installation of drainage structures at a depth adequate to pass subsurface flow.			by ECO and IEA.
15	Layout and Design	Pipe culvert crossings channel and increase the velocity of surface water flows.	Persistence of Wetland FEPAs in good ecological condition.	Limit transformation of Wetland FEPAs	Avoid or minimise any restriction to subsurface water flow by constructing road crossings at or above (not below) natural ground level (NGL) and, where applicable, retaining the in-situ topsoil with vegetation root mass (or mat). In the case of building road crossings above NGL, and if the natural vegetation is cleared, then ensure that the grader does not penetrate the abovementioned root mat and maintains a flat surface. Topsoil removed from other infrastructure placement sites can be added below the road surface to protect	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					the vegetative binding below.			
15	Layout and Design	Access roads crossing a drainage channel will be subject to submerged conditions from time to time (Geotechnical Assessment)	Persistence of Wetland FEPAs in good ecological condition.	Limit transformation of Wetland FEPAs	The three existing access road crossings require placement of compacted gravel layers to lift their elevation and increase traction.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
16	Layout and Design	Artificial lighting threatens biodiversity.	Persistence of Wetland FEPAs in good ecological condition.	Limit transformation of Wetland FEPAs: No light spillage into adjacent watercourses.	Watercourses shall not be lit up or affected by light spillage.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
16	Layout and Design	Artificial lighting threatens biodiversity.	Persistence of Wetland FEPAs in good ecological condition.	Limit transformation of Wetland FEPAs: No light spillage into adjacent watercourses.	Incorporate the following best practice lighting design principles into the design of lighting: (a) Start with natural darkness and only add light for specific purposes, (b) Use adaptive light controls to manage light timing, intensity and colour, (c) Light only the object or area intended – keep lights close to the ground/mounting fixtures as low as possible, directed and	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					shielded to avoid light spill, (d) Use the lowest intensity lighting appropriate for the task, (e) Use non-reflective, dark-coloured surfaces, and (f) Use lights with reduced or filtered blue, violet and ultra-violet wavelengths/Use lights with longer wavelengths, e.g., a white 2 700 K LED light (as apposed to a 5 000 K LED light)			
16	Layout and Design	Artificial lighting threatens biodiversity.	Persistence of Wetland FEPAs in good ecological condition.	Limit transformation of Wetland FEPAs: No light spillage into adjacent watercourses.	Adopt LEDs and smart control technologies (such as motion sensors and timers) to control and manage the effects of artificial light on wildlife and 'sense of place'	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
15	L	L	L	neutral	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

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Reg: 2006/023163/23

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
15	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
16	L	L	L	neutral	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
16	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- Despite the mitigations to avoid significant suspended sediment in the river, strong flows or a flash flood during summer would render any river diversion works futile.
- The residual risk of transformation or fragmentation of the aquatic ecosystem (**15**) after mitigation is assumed to be Low to zero.
- The residual risk of disrupted life cycles from artificial lighting (**16**) after mitigation is assumed to be zero.

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Reg: 2006/023163/23

Receiving Environment: Economical

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Climate Change	Solar PV Facility		**Impact:** According to the District Municipality's Climate Change Response Plan there are increased risks to inter alia Agriculture, including livestock and game, relating to drought, less grazing and increased livestock mortality, affecting commercial exports (negative). **Consequences:** - Livestock mortality will reduce commercial exports and revenue for the farmer.	N/A	17
Change in Land Use	Uncertainty (SIA)	Conflict with surrounding land uses.	**Impact:** Periodic hunting or culling of game on neighbouring farms may result in damages to property. **Consequences:** - Increased maintenance costs	N/A	18
Change in Land Use	Uncertainty (SIA)	Property values	**Impact:** The development of solar PV facilities in rural areas may reduce the property value of neighbouring farms. **Consequence:** - A lower return on investment. - Lower generational financial security. - Less financial leverage linked to a lower asset value for securing bank loans.	N/A	19
Change in Land Use	Uncertainty (SIA)	Fires	**Impact:** Risk of veld fires caused by workers during the construction of the facility. **Consequence:** - Runaway fires on neighbouring properties will result in a loss of grazing for livestock and/or wild game, increasing the running costs to provide supplementary feed.	N/A	18

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Reg: 2006/023163/23

Change in Land Use	Increased traffic on District Gravel Road during construction	Development of potholes, corrugations and puddles	**Impacts:** Damage to vehicles. **Consequences**: - Increased maintenance costs	N/A	18
Planning	Haulage Routes		**Impact:** Haulage of imported materials incur a cost relating to distance travelled and time. **Consequence:** Financial feasibility of project.	N/A	21
Planning	Haulage Routes		**Impact:** Transport of abnormal roads could be delayed. **Consequence:** Delays in construction	N/A	21
Layout and Design	Overall		**Impact:** A solar PV facility of this size (400 MW), particularly when considered together with Phases 1 and 2 (1 GW in total), will make a significant contribution to our country's power deficit when supply falls behind demand. **Consequences:** - Rolling schedulled and controlled shutdowns (known as load shedding) as well as unplanned and unpredictable outages or blackouts are crippling economic growth. - For businesses, unreliable electricity results in increased running costs and reduced productivity and profitability. It's estimated that the loss to businesses and industries that battle with scheduled power cuts, stands at about R1-billion per stage, per day (https://www.thesouthafrican.com/news/how-long-load-shedding-monday-9-december-when-eskom-floods/).	N/A	22
Layout and Design	Lighting		**Impact:** Energy wastage. **Consequences:** - Increased running cost.	N/A	17

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Reg: 2006/023163/23

Layout and Design	Installing panel arrays and associated infrastructure (from racks to field transformers) including within 100 m of a watercourse or 500 m of a wetland/pan	Physical Structures	**Impact:** Poor foundation conditions or ineffective support will cause the solar panel structures to overturn. **Consequence:** Overturning solar panel structures (or arrays) will have significant financial costs	N/A	20
Layout and Design	Installing panel arrays and associated infrastructure (from racks to field transformers) including within 100 m of a watercourse or 500 m of a wetland/pan	Physical Structures	**Impact:** The shallow soils may present a challenge for some construction items like poles that need to be planted. The Swartland and Valsrivier soils may also have an influence on any foundations. **Consequence:** economic feasibility	N/A	20
Layout and Design	Distribution Lines	Obstruction	**Impact:** The fitting of the marking devices are typically done from a helicopter, which adds considerably to the cost of any project. **Consequence** - Reduced financial feasibility	N/A	21

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Reg: 2006/023163/23

Layout and Design	Water infrastructure (Supply)	Groundwater abstraction, purification and storage	**Impact:** High Electroconductivity levels of abstracted borehole water reflects a high salt content. Excessive hardness in water forms scale on heat exchange surfaces such as cooking utensils, hot water pipes, kettles and geysers, and results in an increase in soap required to produce a lather when bathing and in household cleaning. Corrosive water may lead to corrosion of the pipelines, fittings and storage tanks. High salt content in washing water can leave watermarks on the surface of the solar modules. **Consequence:** - Scaling in hot water systems and appliances results in less efficient use of electrical power and any other fuel used for heating purposes, and the partial obstruction of pipes with adverse economic implications. - Resulting scums are unaesthetic, leading in the long term to the marking of enamel surfaces of baths and handbasins. - Aggressive attack of pipework will result in costly maintenance. - Watermarks can reduce electrical output with considerable economic implications.	N/A	18
Layout and Design	Quarry (new)		**Impact:** The usage of mudstone from the Karoo Supergroup for use as concrete aggregate or road layers may reduce the quality of concrete and/or roads due to its instability. **Consequence:** The usage of poor-quality aggregate is unsafe and will increase the costs of maintenance.	N/A	18
Layout and Design	Quarry (new)		**Impact:** Commercially available sources of concrete aggregate may prove to be too distant. **Consequence:** Distant sources of material may be too expensive for utilization on site.	N/A	21

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Reg: 2006/023163/23

Layout and Design	Buffers	Specialist Assessment Reports	**Impact:** Decrease in property values **Consequences**: - A lower return on investment. - Lower generational financial security. - Less financial leverage linked to a lower asset value for securing bank loans.	N/A	19

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 17 (Climate Change and Energy waste)

- An Agricultural Agro-ecosystem Specialist Assessment was commissioned to undertake detailed soil mapping and veld condition assessments to determine the grazing capacity of the project area so that the landowner does not exceed recommended stocking densities and ensure adequate vegetation cover necessary for the maintenance of ecosystem services and building climate resiliance. From a grassland ecological perspective, the opinion is that the current planned development (and the cumulative effect of 30km from other PV-projects), will not have a significant impact on the determined potential grazing potential.

Impact 18 (Damage to Property/Vehicles)

- "*Game breeding and management. Two of my camps adjacent to the proposed Phase 3 development site contain wild game. The impact of this solar development upon this game is of concern, as is the risk of damage to the solar panels as a result of period hunting and game management. I cannot be held responsible for any property damages, should they occur as a result.*" (Richard Vimpany)
- Responsibility lies with the person using the firearm (Firearm Control Act, 2000 (Act No. 60 of 2000).

Impact 18 (Water Quality)

- High EC (71,2 mS/m in BH4 and 59,7 mS/m in BH5) indicates a high salt load, which could result in scaling on solar panels if applied and left to evaporate. For cleaning purposes, the water would need to be wiped from the panels before it is allowed to evaporate. Otherwise, water softeners or deionisation plants will be required.
- The high dissolved salt content will likely cause scaling in piping exposed to heat, or in appliances used to boil water.
- The natural hardness of water is influenced by the geology of the catchment and the presence of soluble calcium and magnesium minerals. Water hardness depends on whether it is caused by bicarbonate salts or non-bicarbonate salts, such as chloride, sulphate and nitrate. Bicarbonate salts of calcium and magnesium precipitate on heating and cause scaling in hot water systems and appliances, whereas the non-bicarbonate salts do not precipitate on heating. Excessive hardness in water forms scale on heat exchange surfaces such as cooking utensils,

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Reg: 2006/023163/23

hot water pipes, kettles and geysers, and results in an increase in soap required to produce a lather when bathing and in household cleaning. The resulting scums are unesthetic, leading in the long term to the marking of enamel surfaces of baths and handbasins. Total hardness for domestic use should be limited to between 50 - 100 mg/• as $CaCO_3$, where possible. (DWAF Water Quality Guidelines)

- On heating water containing calcium bicarbonate, carbon dioxide is lost and calcium carbonate precipitates; this causes scaling in hot water systems (DWAF Water Quality Guidelines).
- Determine the alkalinity and hardness of the water sources as these aspects have an effect on the treatability of the water, as well as on infrastructure. Typical concerns relate to pH stability and whether the water will lead to excessive scaling in pipework and plumbing, or possibly aggressive attack of pipework (DHS Redbook, Section J).

Impact 19 (Property Values)

- Neighbouring farmers expressed their concerns about the potential impact of living adjacent to a solar facility on the value of their properties. A number of aspects such as interest rates, economic conditions, climate, terrain, carrying capacity and the availability of water, amongst others, can influence the property price of farms. Impacts on property values cannot be predicted with a high level of confidence, and as such should be treated with caution. Due to the recent droughts in the Karoo, even after receiving some rain, prices remain depressed as it will take some time for the natural grazing to recover and farmers to build their herds (Kriel, 2021). A search of estate agent's databases indicated only one or two farms for sale in the Hanover/De Aar area (Compare Private Property; AgriSell; Property24; SA Farm Traders; ReMax South Africa). No local studies could be found regarding the impact of solar farms on property prices of neighbouring properties. Local studies on the impact of wind farms on property prices indicates that there is no measurable or statistically significant effect on sales prices (Van Zyl & Kinghorn, 2022). American studies found that properties immediately adjacent to a solar farm may see a negative impact, but tactics to hide the solar farm from view could help offset those effects (ASFMRA press, 2021). Rich Kirkland, who has conducted more than 100 property valuation studies across 19 states concluded that: "In rural and suburban areas, I'm not finding any consistent negative impact from solar farms as long as there's at least 100 feet between the [solar] farm and the property, and enough landscaping to hide the panels." (ASFMRA press, 2021). In the Netherlands evidence was found that house prices within 1km of a solar farm decrease by 2-3%, but the researchers did not have a high level of confidence in their findings as there are relatively few solar farms in the Netherlands (Koster & Droes, 2020). It is therefore estimated that the proposed development will not have a significant impact on the property values, although there are many external factors that may influence this potential impact.
- Impacts on property values are dependent on how the site is developed and managed to minimise negative biophysical and social impacts. The measures recommended in other specialist reports to these impacts (primarily the minimisation of visual, heritage, traffic and ecological impacts) and in this study would thus also minimise property value impacts.
- There is no evidence to show that Solar PV facilities will affect rural agricultural property values.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

- SPLUMA (Act 16 of 2013) section 7 (a) (vi): A municipal planning tribunal considering an application before it, may not be impeded or restricted in the exercise of its discretion solely on the ground that the value of land or property is affected by the outcome of the application.

Impact 20 General (Agriculture, Soils, Geotechnical)

- The study area is zoned as Agriculture Zone 1 (not open space or conservation).
- Agriculture (mostly 'Karoo' mutton, sheep and wool, with some hunting of small game) forms the backbone of the economy of the Emthanjeni LM and accounts for the largest labour/employment contributor to date. (Social Scoping Report)
- Brink (1983) cautions against the use of mudstone from the Karoo Supergroup for use as construction materials — particularly for use as concrete aggregate and to a limited extent for road layer materials. Preference should be given to the use of dolerite rock as construction material, however, sedimentary rock may be used with caution for the lower road layers — especially the sandstones and also mudstone/shale which have been baked by dolerite intrusions (i.e. in close proximity to dolerite rock).
- The site is largely underlain by soft to medium hard rock sandstone/siltstone or dolerite at depths of less than 0,5 metres (mostly less than 0,3 metres) below ground level.
- For solar panels, the overturning moment will be the main load on the solar panel structure support columns and excavation to 1,0 metres below natural ground level will probably be required to ensure overturning stability. Considering the time-consuming nature of pad footing construction (breaking out and removal of rock and casting of reinforced concrete), and furthermore the difficulty which rock mass at depths shallower than 1,0 m will cause to placement of screwed piles, rammed piles is considered the most effective support option for solar panels. However, since driving to at least 1 metre depth may prove difficult over the major part of the site (where depth to bedrock are < 0,5 metres), as an alternative, ground beam concrete footings (which make use of concrete strip footings at very shallow depth below ground level to act as support and counterweight for solar panels) may possibly have to be utilized. This founding option is expected to be considerably more costly than using of piles.

Impact 21 (Transport)

- The primary access to the proposed 400 MW solar PV facility will be at the junction of the N10 with the existing Burgerville (District) Road. The shoulder sight distance (> 450 m) to the left of the primary site access location will be sufficient (at a design speed of 120 km/hr). Sight distance to the right, however, was measured as approximately 320 m, which is sufficient for Passenger vehicles (P), but not a Single-Unit Truck (SU). It therefore is proposed that appropriate traffic accommodation be placed on the eastern approach of the N10, indicating a construction access ahead with a possible flagman to alert drivers and slow them down.
- There are three alternative routes for the haulage of imported materials to the proposed PV facility, including from (a) the Cape Town harbour, (b) Port of Ngqura, and (c) Port of Saldanah. The preferred route is from the Port of Ngqura as it is the shortest (445 km) and

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Reg: 2006/023163/23

fastest route to the site, following the N2 from the Port before turning north onto the N10 past Hanover and up to the access at Burgerville Road.

Impact 22 (Energy Generation)

- A solar PV facility of this size (400 MW), particularly when considered together with Phases 1 and 2 (1 GW in total), will make a significant contribution to our country's power deficit when supply falls behind demand. Rolling scheduled and controlled shutdowns (known as load shedding) as well as unplanned and unpredictable outages or blackouts are impacting human well-being. **The positive impact of the Solar PV facility on human wellbeing does not require further investigation or mitigation.**

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
17	M	L	M	-I	M	H	1	M	H	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
18	M	L	M	-I	M	H	1	M	H	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

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Reg: 2006/023163/23

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
19	H	M	M	-I	H	H	1	H	H	1
Reversibility	H		**Irreplaceability**	H		**Mitigatory Potential**	M			

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
20	M	L	M	-I	M	H	1	M	H	1
Reversibility	H		**Irreplaceability**	H		**Mitigatory Potential**	H			

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
21	M	L	M	-I	M	H	1	M	H	1
Reversibility	H		**Irreplaceability**	H		**Mitigatory Potential**	H			

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
22	H	H	M	+I	H	H	Significant positive	L	H	Significant positive
Reversibility	NA		**Irreplaceability**	NA		**Mitigatory Potential**	L			

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Soil Mapping Report prepared by Hennie van den Burg of Iris International and Francois Botha of Eco Soil dated June 2022.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

- Grazing Potential Assessment prepared by Francois de Wet of Enviro Pulse and Shobie Arnoldi of Topveld dated June 2022
- Geotechnical Assessment Study prepared by FDJ Stapelberg, Council for Geoscience (Project No. CO2017-5806 (Phase 80)), dated 11th May 2022.
- Traffic Impact Assessment prepared by Annebet Krige of Sturgeon Consulting (Pty) Ltd dated September 2022 (Project No.: STUR0352).
- President Cyril Ramaphosa: 2021 State of the Nation Address, 2021 https://www.gov.za/speeches/president-cyril-ramaphosa-2021-state-nation-address-11-feb-2021-0000
- Richard Vimpany (Neighbouring landowner and Registered Interested and Affected Party)
- Firearm Control Act, 2000 (Act No. 60 of 2000);
    - Section 120(3) "It is an offence to - cause bodily injury to any person or cause damage to property of any person by negligently using a firearm, an antique firearm or an airgun; discharge or otherwise handle a firearm, an antique firearm or an airgun in a manner likely to injure or endanger the safety or property of any person or with reckless disregard for the safety or property of any person; or have control of a loaded firearm, an antique firearm or an airgun in circumstances where it creates a risk to the safety or property of any person and not to take reasonable precautions to avoid the danger."
- Department of Water Affairs and Forestry, 1996. South African Water Quality Guidelines (second edition). Volume 1: Domestic Use.
- DHS Redbook, Section J, Water Supply, The Neighbourhood Planning and Design Guide, Part II, Planning and design guidelines, developed by Department of Human Settlements, published by the South African Government ISBN: 978-0-6399283-2-6, version 1.1, printed July 2019.
- National Veld and Forest Fire Act, 1998 (Act No. 101 of 1998).
- SPLUMA (Act 16 of 2013);
    - Section 7 (a) (vi) "A municipal planning tribunal considering an application before it, may not be impeded or restricted in the exercise of its discretion solely on the ground that the value of land or property is affected by the outcome of the application."
- Social Impact Assessment Report prepared by Ilse Aucamp of Equispectives Research & Consulting Services dated August 2022

Mitigations:

Impact Management Outcome(s):

- Minimise negative health impacts (and mortality) on livestock due to decreases in rainfall and reduction in herbage yields.
- The Solar PV facility is energy efficient and financially feasible
- Limited risk of financial losses to neighbouring farmers
- Limited risk of financial losses due to poor road materials.
- Prolong the lifespan of pipes, appliances, etc.
- Maintain optimum generation capacity of solar modules

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Reg: 2006/023163/23

- Safe (unobstructed) delivery of abnormal loads to site.

Targets:

- Offset productivity losses during drought periods with an additional income stream.
- Good ecological (grazing) management (to minimise negative health impacts (and mortality) on livestock due to decreases in rainfall and reduction in herbage yields).
- Minimise maintenance costs and energy consumption.
- Reduce construction costs.
- Maintain optimum generation capacity of solar modules.
- Minimise risk of reduced property values.
- Minimise risk of and control runaway fires.
- Avoid damage to vehicles.
- Roads are in good condition.
- Proper excavation depth for solar panels.
- Minimise travel distances of materials and abnormal loads are delivered to site timeously.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
17	Climate Change	According to the District Municipality's Climate Change Response Plan there are increased risks to inter alia Agriculture, including livestock and game, relating to drought,	Minimise negative health impacts (and mortality) on livestock due to decreases in rainfall and reduction in herbage yields. Offset productivity losses during drought periods with an	Offset productivity losses during drought periods with an additional income stream: An Agrivoltaic system.	The solar PV facility shall adopt a symbiotic Agrivoltaic system that combines agriculture, specifically good ecological management (grazing) practices, with green energy generation.	Holder, Engineer, Landowner	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		less grazing and increased livestock mortality, affecting commercial exports	additional income stream.					
17	Climate Change	According to the District Municipality's Climate Change Response Plan there are increased risks to inter alia Agriculture, including livestock and game, relating to drought, less grazing and increased livestock mortality, affecting commercial exports	Minimise negative health impacts (and mortality) on livestock due to decreases in rainfall and reduction in herbage yields. Offset productivity losses during drought periods with an additional income stream.	Good ecological (grazing) management: Soil Maps. Recommended stocking densities. Good vegetation cover.	Develop a long-term grazing strategy using the findings (land capability classes/grazing units and carrying capacities) as well as Grazing Management Principles (Appendix F) identified in the Soil Mapping and Grazing Potential Assessments.	Holder, Landowner	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
17	Climate Change	According to the District Municipality's Climate Change Response Plan there are	Minimise negative health impacts (and mortality) on livestock due to decreases in rainfall and	Good ecological (grazing) management	Implement good rangeland management practices defined by an adopted long-term grazing strategy with small	Holder, Landowner	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		increased risks to inter alia Agriculture, including livestock and game, relating to drought, less grazing and increased livestock mortality, affecting commercial exports	reduction in herbage yields. Offset productivity losses during drought periods with an additional income stream.		stock for the areas underneath the solar panels to maintain optimal vegetation cover and to reduce soil erosion and runoff.			
17	Climate Change	According to the District Municipality's Climate Change Response Plan there are increased risks to inter alia Agriculture, including livestock and game, relating to drought, less grazing and increased livestock mortality, affecting	Minimise negative health impacts (and mortality) on livestock due to decreases in rainfall and reduction in herbage yields. Offset productivity losses during drought periods with an additional income stream.	Good ecological (grazing) management: Restoration work on bare patches.	Halt and reverse existing degradation primarily from extensive livestock production to counter increased climatic uncertainty - restore all bare patches of soil by implementing the Bare Patch Restoration Protocol (Appendix C).	Holder, Landowner	Continuous	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		commercial exports						
17	Climate Change	According to the District Municipality's Climate Change Response Plan there are increased risks to inter alia Agriculture, including livestock and game, relating to drought, less grazing and increased livestock mortality, affecting commercial exports	Minimise negative health impacts (and mortality) on livestock due to decreases in rainfall and reduction in herbage yields. Offset productivity losses during drought periods with an additional income stream.	Good ecological (grazing) management: Soil maps. Recommended stocking densities. Good vegetation cover. Restoration work on bare patches.	Ensure responsible natural resource management that maintains the integrity of ecosystems and the continued provision of ecosystem services to current and future generations.	Holder, Landowner	Continuous	Compliance to be verified by ECO and IEA.
17	Layout and Design	Wasted energy from inefficient lighting.	The Solar PV facility is energy efficient and financially feasible.	Minimise maintenance costs and energy consumption: Energy efficient fixtures are used in the buildings.	If colour discrimination is not important, choose energy- efficient fixtures utilising yellowish high-pressure sodium (HPS) bulbs. If "white" light is needed, fixtures using LEDs, compact	Holder, Engineer	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					fluorescent, or metal-halide (MH) bulbs are more energy-efficient than those using incandescent, halogen, or mercury-vapour bulbs.			
17	Layout and Design	Wasted energy from inefficient lighting.	The Solar PV facility is energy efficient and financially feasible.	Minimise maintenance costs and energy consumption: Wattage is lower than traditional candescent bulbs.	When purchasing energy efficient alternatives to traditional energy consumptive lighting, remember that they use less watts to produce the same amount of light (measured in lumens). So, never replace candescent bulbs with alternatives that use the same or more watts.	Holder, Engineer	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
18	Change in Land Use	Periodic hunting or culling of game on neighbouring farms may result in damages to property.	The Solar PV facility is financially feasible and energy efficient.	Minimise maintenance costs and energy consumption: Zero damage to property from hunting on adjacent farms.	Improve the safety of the Solar PV facility including its staff and property during the hunting season, such as identifying no shooting zones, notifying neighbouring properties of	Neighbouring Landowners	Continuous	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					imminent hunts, hunters taking out the appropriate insurances, etc.			
18	Change in Land Use	Damage to vehicles driving on bad gravel roads.	Limited risk of financial losses to neighbouring farmers.	Avoid damage to vehicles: Roads are in good condition.	The holder shall maintain any deterioration to the district gravel roads resulting from increased traffic during construction.	Holder, Contractor	Continuous	Compliance to be monitored by SEO and verified by ECO and IEA.
18	Change in Land Use	Damage to vehicles driving on bad gravel roads.	Limited risk of financial losses to neighbouring farmers.	Avoid damage to vehicles: Roads are in good condition. Minimal corrugations.	Corrugations shall be removed as soon as is reasonably practical (e.g., within 5 working days of being reported).	Holder, Contractor	Continuous	Compliance to be monitored by SEO and verified by ECO and IEA.
18	Change in Land Use	Damage to vehicles driving on bad gravel roads.	Limited risk of financial losses to neighbouring farmers.	Avoid damage to vehicles: Roads are in good condition. Minimal potholes and puddles.	Potholes and puddles will be filled in and compacted as soon as is reasonably practical (e.g., within 5 working days of being reported).	Holder, Contractor	Continuous	Compliance to be monitored by SEO and verified by ECO and IEA.
18	Layout and Design	The usage of mudstone from the Karoo Supergroup for use as concrete aggregate or road layers may reduce	Limited risk of financial losses due to poor road materials.	Roads are in good condition.	When sourcing material from a local quarry, preference should be given to the use of dolerite rock as construction material. Sedimentary rock may be used for the	Engineer, Contractor	Planning and Design Phase Construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		the quality of concrete and/or roads due to its instability. .			lower road layers but with caution — especially the sandstones and mudstone/shale which have been baked by dolerite intrusions (e.g., in close proximity to dolerite rock).			
19	Change in Land Use	Risk of reduced property values.	Limited risk of financial losses to neighbouring farmers.	Minimise risk of reduced property values; Massing and visual sensitivity buffers are indicated on Layout Plan.	Reduce massing effects particularly as seen from neighbouring landowners by implementing appropriate massing and visual sensitivity buffers.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
19	Change in Land Use	Risk of reduced property values.	Limited risk of financial losses to neighbouring farmers.	Minimise risk of reduced property values; Massing and visual sensitivity buffers are indicated on Layout Plan.	Screening the solar facility from the neighbouring properties in a way acceptable to the landowners must be investigated and agreed to.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
19	Change in Land Use	Risk of reduced property values.	Limited risk of financial losses to neighbouring farmers.	Minimise risk of reduced property values; Massing and visual sensitivity buffers are indicated on Layout Plan.	Where the proposed solar field is directly adjacent to a neighbour's fence line there should be a buffer zone between the panels and the fence as agreed in	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					writing between Soventix and the directly affected neighbours during the EIA process, to ensure that it is included in the EIA authorisation. Recommendations made in the Visual Impact Assessment should be considered in the discussion about and development of the buffer zone.			
18	Change in Land Use	Risk of veld fires caused by workers during the construction of the facility.	Limited risk of financial losses to neighbouring farmers.	Minimise risk of and control runaway fires: no evidence of open fires are observed on site.	Undertake a risk analysis to determine inter alia the probability and frequency of a wildfire during construction and operation, and prepare a fire management plan accordingly.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
18	Layout and Design	Poor water quality can adversely affect plumbing and appliances.	The Solar PV facility is energy efficient and financially feasible.	Minimise maintenance costs and energy consumption: Results of water analysis. Results informed the treatment process.	Determine the alkalinity and hardness of the water sources as these aspects have an effect on the treatability of the water, as well as on infrastructure.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					Typical concerns relate to pH stability and whether the water will lead to excessive scaling in or aggressive attack of pipework.			
18	Layout and Design	Poor water quality can adversely affect plumbing and appliances.	Prolong the lifespan of pipes, appliances, etc. Maintain optimum generation capacity of solar modules	Minimise maintenance costs and energy consumption: Results of water analysis. Results informed the treatment process.	Groundwater from BH4 and BH5 should be treated with water softeners or establish deionization plants at these water sources.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
20	Layout and Design	Poor foundation conditions or ineffective support will cause the solar panel structures to overturn.	Maintain project feasibility.	Proper excavation depth for solar panels	Excavation to a depth of 1,0 m below natural ground level will probably be required to ensure overturning stability of solar panel structures.	Engineer, Contractor	Planning and Design Phase	Compliance to be verified by ECO and IEA.
20	Layout and Design	Poor foundation conditions or ineffective support will cause the solar panel structures to overturn.	Maintain project feasibility.	Proper excavation depth for solar panels	Rammed piles are considered the most effective support option for solar panels but if driving to at least 1 m depth proves difficult over most of the site then ground beam concrete	Engineer, Contractor	Planning and Design Phase	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					footings (which make use of concrete strip footings at very shallow depth below ground level to act as support and counterweight for solar panels) may be an alternative option.			
20	Layout and Design	The shallow soils may present a challenge for some construction items like poles that need to be planted. The Swartland and Valsrivier soils may also have an influence on any foundations.	Maintain project feasibility.	Proper design of solar PV facility.	The engineers should be aware of and take into consideration the soil forms and properties as described in the Soil Mapping Report 2022 when planning the design and layout of the solar PV facility including associated infrastructure.	Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
21	Planning	Haulage of imported materials incur a cost relating to distance travelled and time.	Maintain financial feasibility of the project.	Minimise travel distances of materials	The engineers should consider the feasibility of the preferred alternative route for the haulage of imported materials from the Port of Ngqura to the proposed PV	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					facility as recommended in the Traffic Impact Assessment Report.			
21	Planning	Transport of abnormal roads could be delayed.	Safe (unobstructed) delivery of abnormal loads to site.	Abnormal loads are delivered to site timeously.	The appointed engineers should investigate the route to the site to ensure that the abnormal loads are not obstructed at any point by geometric, height and width limitations along the route.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
21	Layout and Design	The fitting of the marking devices via a helicopter adds considerably to the cost of any project.	The Solar PV facility is energy efficient and financially feasible.	Reduce construction costs: anti-collision devices are installed during construction.	Anti-collision devices should be mounted on the distribution line during construction when it is most cost-effective to do so.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
21	Layout and Design	Commercially available sources of concrete aggregate may prove to be too distant.	Maintain financial feasibility of the project.	Minimise travel distances of materials	Dolerite rock or baked sediments from the Phase 3 terrain can be considered for sources of concrete aggregate or road layers but materials will need to be tested for quality	Holder, Engineer, Contractor	Planning and Design Phase	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					purposes (hardness, strength, durability, mineral composition, and degree of weathering).			
21	Layout and Design	Commercially available sources of concrete aggregate may prove to be too distant.	Maintain financial feasibility of the project.	Minimise travel distances of materials	Material intended for use in road surfacing needs to be tested for grading distribution, Atterberg limits, compaction-moisture density values and durability.	Holder, Contractor	Planning and Design Phase	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
17	L	L	L	+I	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
17	H	H	H	-I	H	H	1	H	H	1

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
18	L	L	L	neutral	L	L	0	L	L	0

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
18	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
19	L	L	L	neutral	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
19	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
20	M	M	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
20	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
21	M	M	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
21	L	L	L	neutral	L	L	0	L	L	0

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Reg: 2006/023163/23

Residual Risk (feeds back into "Mitigations"):

- The residual risk of damage to property during the hunting season lies with the adjacent farmers (**18**) and their willingness to take responsibility for their own actions, adopting reasonable precautions and complying with the applicable legislation.
- The residual risk of reducing the financial feasibility of the project (**18**) after mitigation is assumed to be Low to zero.
- The residual risk of financial losses for neighbouring farmers caused by reduced property values, runaway fires, and bad roads (**19**) after mitigation is assumed to be Low.
- Energy generation (**22**) is a **positive impact therefore does not require mitigation.**

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Reg: 2006/023163/23

Receiving Environment: Social

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Layout and Design	Roads		**Impact:** Increased traffic can result in corrugations and potholes on roads. **Consequence:** Decrease in condition of gravel roads, increase in travel times.	N/A	23

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 23 (Traffic)

- The main gravel road, Burgerville Road, in the vicinity of the proposed development is in a fair to poor condition. The main surfaced road, the N10, in the vicinity of the proposed development is in a good condition.
- Road freight, transport, specifically heavy vehicle transport, significantly contributed to the deterioration of the road surfaces and the maintenance of these roads are not always adequate.
- The annual growth rate in Average Daily Traffic (ADT) increased by approximately 6% between 2007 (435) and 2022 (1018). However, a significant increase in ADT and heavy vehicle traffic is evident from 2020 onwards, possibly be attributed to increased mining activities and renewable energy projects. It should however be noted that the capacity of a Class 1 road is in the order of 2000 vehicles per hour and therefore the traffic volumes recorded on this road is still significantly less than the capacity of the road.

General (Social aspect)

- The project area is located in Ward 6 of the Emthanjeni Local Municipality that is located in the Pixley Ka Seme District Municipality in the Northern Cape province. The towns in the area are small and the proposed site is located between the towns of Hanover and De Aar. About 74% of the people in Ward 6 live in urban areas while the remaining 26% (one quarter) live on farms. There are no areas under traditional leadership in the district and the site is surrounded by commercial farms. (Social Impact Report)
- At a local municipal level, the number of households increased (between 2011 and 2016) along with population density (per km^2), but the average household size has decreased (more households but with fewer members) possibly due to children leaving home and starting families of their own. Almost half the population in Ward 6 and the local municipality is 24 years or younger. Such a young population places a lot of

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Reg: 2006/023163/23

pressure on resources and infrastructure of the area, and a great demand for future infrastructure as well as the creation of livelihoods can be expected. (Social Impact Report)

- The intensity of poverty and the poverty headcount is used to calculate the SAMPI score. A higher score indicates a very poor community that is deprived on many indicators. Despite a slight decrease in poverty intensity (average proportion of indicators in which poor households are deprived), the increased poverty headcount (the proportion of households that can be defined as multidimensionally poor) at a local municipal level, has effectively doubled the SAMPI score from 0,01 in 2011 to 0,02 in 2016. This means that more households are deprived on a number of dimensions that mostly relate to access to basic services. Education levels are low (About two fifths (17,8%) of the people in Ward 6 aged 20 years or older have no schooling or only some primary education). In Ward 6, 45,3% of people aged between 15 – 65 years are employed, with about half of those people in the formal sector. Ward 6 has the lowest proportion of people (6,7%) with no annual household income. There are very few employment opportunities. (Social Impact Report)
- The South African Multidimensional Poverty Index (SAMPI) (Statistics South Africa, 2014) assess poverty on the dimensions of health, education, standard of living and economic activity using the indicators child mortality, years of schooling, school attendance, fuel for heating, lighting, and cooking, water access, sanitation, dwelling type, asset ownership and unemployment. (Social Impact Report).

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
23	M	M	L	-I	M	M	1	H	M	1
Reversibility	M	**Irreplaceability**	M	**Mitigatory Potential**	H					

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Reg: 2006/023163/23

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Traffic Impact Assessment prepared by Annebet Krige of Sturgeon Consulting (Pty) Ltd dated September 2022 (Project No.: STUR0352).
- Social Impact Assessment Report prepared by Ilse Aucamp of Equispectives Research & Consulting Services dated August 2022.

Mitigations:

Impact Management Outcome(s):

- Good road conditions.

Targets:

- Internal roads are well maintained.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
23	Layout and Design	Increased traffic can result in corrugations and potholes on roads.	Good road conditions	Internal roads are well maintained	Upgrade the internal farm access road (e.g., internal private roads leading off the Burgerville Road) to suitable standards as specified by the civil engineer.	Holder, Engineer, Contractor	Planning and Design Phase Construction	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
23	L	L	L	neutral	L	L	0	L	L	0

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Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
23	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- The residual risk of damage to roads due to increased traffic (**23**) after mitigation is estimated to be Low.

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Receiving Environment: Property

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Change in Land Use	Uncertainty (SIA)	Fires	**Impact:** Risk of veld fires caused by workers during the construction of the facility. **Consequence:** - damage to property (direct) - runaway fires on neighbouring properties will result in a loss of grazing for livestock and/or wild game, increasing the running costs to provide supplementary feed.	N/A	24
Layout and Design	Installing panel arrays and associated infrastructure (from racks to field transformers) including within 100 m of a watercourse or 500 m of a wetland/pan	Physical Structures	**Impact:** Risk of veld fires caused by lightning strikes to infrastructure within the solar PV facility. **Consequence:** - damage to property (direct) - runaway fires on neighbouring properties will result in a loss of grazing for livestock and/or wild game, increasing the running costs to provide supplementary feed.	N/A	25

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 24

- The risk of runaway fires caused by construction workers and damage to property or loss of grazing has been adequately assessed and mitigated under the "Receiving Environment: Economical" and therefore **does not need to be repeated here.**

Impact 25

- A 10 - 15 m high lightning mast will be installed near the onsite substation.

Assessment without mitigation:

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
25	M	M	M	-R	M	M	1	H	M	1
Reversibility	M	**Irreplaceability**	M	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- None.

Mitigations:

Impact Management Outcome(s):

- Limited risk of financial losses to facility (from lightning strikes) (**25**).

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Reg: 2006/023163/23

Targets:

- Reduce risk of lightning strikes to infrastructure.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
25	Layout and Design	Risk of veld fires caused by lightning strikes to infrastructure within the solar PV facility.	Limited risk of financial losses to facility (from lightning strikes).	Reduce risk of lightning strikes to infrastructure: A lightning mast is included in the substation design.	Install a lightning mast in the vicinity of the on-site substation.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
25	Layout and Design	Risk of veld fires caused by lightning strikes to infrastructure within the solar PV facility.	Limited risk of financial losses to facility (from lightning strikes).	Reduce risk of lightning strikes to infrastructure: A lightning mast is included in the substation design.	Maintain a firebreak around the perimeter of the solar PV facility.	Holder	Continuous	Compliance to be verified by ECO and IEA.
25	Layout and Design	Risk of veld fires caused by lightning strikes to infrastructure within the solar PV facility.	Limited risk of financial losses to facility (from lightning strikes).	Reduce risk of lightning strikes to infrastructure: A lightning mast is included in the substation design.	Adequate firefighting equipment shall be regularly maintained and readily available during construction (and operation).	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.
25	Layout and Design	Risk of veld fires caused by lightning strikes to infrastructure within the solar PV facility.	Limited risk of financial losses to facility (from lightning strikes).	Reduce risk of lightning strikes to infrastructure: A lightning mast is included in the substation design.	A team of designated firefighting personal shall be trained and ready to immediately deal with any runaway veld fires.	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.
25	Layout and Design	Risk of veld fires caused by lightning strikes to infrastructure	Limited risk of financial losses to facility (from lightning strikes).	Reduce risk of lightning strikes to infrastructure: A lightning mast is included in the	Immediately notify neighbouring landowners upon confirming a runaway fire	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		within the solar PV facility.		substation design.				

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
25	M	M	M	-R	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
25	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

- The residual risk of lightning strikes to the remaining Solar PV facility (**25**) is unknown but expected to be Low.

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Reg: 2006/023163/23

Receiving Environment: Land Use

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Change in Land Use	Rezoning Land use application for a "special zone" or a "consent use" (temporary) submitted through the Emthanjeni LM for a decision by the District Municipal Planning Tribunal	SPLUMA and the Scheme Regulations, Spatial Development Framework of the Municipality and Development Principles (Section 7 of Act No. 16 of 2013)	**Impact:** Reduction in or loss of agricultural potential and productivity. **Consequence:** Reduced food security (direct)	N/A	26

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

- None.

Assessment without mitigation:

Legend					
Criteria		Reversibility, Irreplaceability, & Mitigatory Potential		Significance (Impact Magnitude & Impact Importance	
Abbreviation	Description	Abbreviation	Description	Abbreviation	Description
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
26	H	L	H	-I	H	H	1	H	H	1
Reversibility	M	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- The virgin land shall be used for both solar photovoltaic power generation and agriculture (Agrivoltaic).

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Soil Mapping Report prepared by Hennie van den Burg of Iris International and Francois Botha of Eco Soil dated June 2022.
- Grazing Potential Assessment prepared by Francois de Wet of Enviro Pulse and Shobie Arnoldi of Topveld dated June 2022.

Mitigations:

Impact Management Outcome(s):

- Preserve the agricultural potential and maintain or improve the agricultural productivity of the land.

Targets:

- Minimise loss of agricultural potential.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
26	Change in Land Use	Change of land use is a threat to agricultural potential and productivity.	Preserve the agricultural potential and maintain or improve the agricultural productivity of the land.	Minimise loss of agricultural potential: Agrivoltaic system.	The virgin land shall be used for both solar photovoltaic power generation and agriculture (Agrivoltaic). The current land use being sheep farming will continue within the solar PV facility to	Holder, Engineer, Landowner	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					ensure minimal reduction (if any) on agricultural potential of the land as well as a management tool to control vegetation growth.			
26	Change in Land Use	Change of land use is a threat to agricultural potential and productivity.	Preserve the agricultural potential and maintain or improve the agricultural productivity of the land.	Minimise loss of agricultural potential: An Agricultural Agro-Ecosystem Specialist Assessment Report.	Generate sound site-specific grazing management recommendations based on the findings of an Agricultural Agro-Ecosystem Specialist Assessment that models and maps the terrain units, soil patterns and land capability values, as well as determines the veld condition and carrying capacity.	Holder	Planning and Design Phase	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
26	L	L	L	neutral	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
26	L	L	L	neutral	L	L	0	L	L	0

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Residual Risk (feeds back into "Mitigations"):

- The residual risk of change of land use to agricultural potential (**26**) after mitigation is estimated to be Low to zero.

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Receiving Environment: Health and Safety

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Layout and Design	Water infrastructure (Supply)	Groundwater abstraction from boreholes	**Impact:** Groundwater may be unfit for human consumption. **Consequence:** - Poor quality water may be harmful to human health.	N/A	27
Change in Land Use	NA	Conflict with surrounding land uses	**Impact:** Periodic hunting or culling of game on neighbouring farms may result in injury or loss of life. **Consequences:** - Death and burden on families after losing their principal or only means of support, financial or otherwise (Risk).	N/A	28
Change in Land Use	Uncertainty (SIA)	Fires	**Impact:** Risk of veld fires caused by workers during the construction of the facility. **Consequence:** - Injury or loss of life (direct)	N/A	29

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 27 (Groundwater Quality)

- Eight (8) samples were collected from boreholes visited during the field hydrocensus. The sample was submitted to Talbot and Talbot (Pty) Ltd Laboratories. From the data retrieved, the following is noted:
- All samples exhibit neutral pH conditions;
- The Electrical conductivity (EC) for BH4 (71,2 mS/m) exceeds DWAF 1996 Domestic Use TWQR (0 to 70 mS/m), whereas the EC for BH5 (59,7 mS/m) remained within the DWAF threshold. High EC indicates a high salt load, which could result in scaling on solar panels if applied and left to evaporate. For cleaning purposes, the water would need to be wiped from the panels before it is allowed to evaporate. Otherwise, water softeners or deionization plants will be required.
- Ca and Mg are observed to be high for most samples. Dissolved Calcium in BH4 (78 mg Ca/litre) and BH5 (55 mg Ca/litre) exceeds DWAF 1996 Domestic Use TWQR (0 to 32 mg Ca/litre).
- Dissolved metals analysed are generally below the DWAF thresholds for aesthetic effects.
- The high dissolved salt content will likely cause scaling in piping exposed to heat, or in utensils used to boil water.

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Reg: 2006/023163/23

- Potable water must comply with SANS 241-1 (DHS Redbook, Section J).
- Determine the alkalinity and hardness of the water sources as these aspects have an effect on the treatability of the water, as well as on infrastructure. Typical concerns relate to pH stability and whether the water will lead to excessive scaling in pipework and plumbing, or possibly aggressive attack of pipework (DHS Redbook, Section J).

Impact 28

- The risk of injury or loss of life during the hunting season has been assessed and mitigated under the "Receiving Environment: Economical" and therefore **does not need to be repeated here.**

Impact 29

- The risk of injury or loss of life caused by runaway fires started by construction workers has been adequately assessed and mitigated under the "Receiving Environment: Economical" and therefore **does not need to be repeated here.**

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
27	L	M	L	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

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Reg: 2006/023163/23

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
27	M	L	M	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- Commencement with construction, specifically civil works may only take place after the peak monthly rainfall and run-off period (from January to April), and preferably during the winter months (e.g., June to September) when there is a decreased probability of storm events. Civils works should as far as is practical be completed before the next rainfall season.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Geohydrological Assessment Report Version – Final Rev 3 prepared by GCS Water and Environmental Consultants dated 10th August 2022 (GCS Project Number: 22-0401).
- Department of Water Affairs and Forestry, 1996. South African Water Quality Guidelines (second edition). Volume 1: Domestic Use.
- Department of Water Affairs and Forestry, 1996. South African Water Quality Guidelines (second edition). Volume 4: Agricultural Use: Irrigation.
- DHS Redbook, Section J, Water Supply, The Neighbourhood Planning and Design Guide, Part II, Planning and design guidelines, developed by Department of Human Settlements, published by the South African Government ISBN: 978-0-6399283-2-6, version 1.1, printed July 2019.

Mitigations:

Impact Management Outcome(s):

- Safe drinking water (**27**)

Targets:

- Potable water is treated to standard.
    - Total hardness for domestic use should be limited to between 50 - 100 mg/• as $CaCO_3$ if possible.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
27	Layout and Design	Groundwater may be infit for human consumption.	Safe drinking water.	Potable water is treated to standard: Total hardness preferably 50 - 100 mg/• as $CaCO_3$	Test the quality of any water source that is to be used for potable water.	Holder, Engineer	Planning and Design Phase.	Compliance to be verified by ECO and IEA.
27	Layout and Design	Groundwater may be infit for human consumption.	Safe drinking water.	Potable water is treated to standard: Water quality results compare favourably with standard.	Potable water must comply with SANS 241-1 (water used in sanitation systems does not have to), which prescribes health-based water quality requirements.	Holder, Engineer	Planning and Design Phase.	Compliance to be verified by ECO and IEA.
27	Layout and Design	Groundwater may be infit for human consumption.	Safe drinking water.	Potable water is treated to standard: Water quality results compared with standard.	The raw water quality data should be compared against the potable water quality standards to determine the overall treatment requirements.	Holder, Engineer	Planning and Design Phase.	Compliance to be verified by ECO and IEA.
27	Layout and Design	Groundwater may be infit for human consumption.	Safe drinking water.	Potable water is treated to standard: Appropriate treatment technology is adopted.	The treatment technologies selected should focus on those specific parameters in the raw water that do not meet the potable water quality standards (SANS 241-1).	Holder, Engineer	Planning and Design Phase.	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

27	L	L	L	neutral	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
27	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- The residual risk of poor-quality groundwater on human health (**27**) after mitigation is assumed to be Low.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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Receiving Environment: Security

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Planning	Labour	Job Creation	**Impact:** An influx of job seekers and construction workers into the area could increase the potential for criminal activity, including stock theft, game poaching, property theft, emotional and/or physical harm to victims, etc. **Consequences:** - Loss of farming revenue - Injury or loss of life	N/A	28
Layout and Design	Installing Perimeter Fence and Access Control	Security	**Impact:** Increased potential for criminal activity, including theft of and damage to infrastructure, such as solar panels. **Consequences:** - Undermining the economic feasibility of the development. - Unstable electricity supply to South African citizens.	N/A	28

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 28 (Crime towards the community and the PV facility)

- Farm safety is a concern in the rural areas of South Africa. Although there is a low incidence of farm attacks in the Karoo, farmers and farm workers are soft targets due to the isolation on farms and distance from emergency services. More people moving around in the area will make it easier for opportunistic criminals to enter the area without being noticed. Stock theft is a problem in the area, and one farmer reported that during the times that Transnet contractors work in the area they lose up to ten sheep a week. Farmers are concerned that the presence of the construction workers in the area will cause an increase in stock theft, due to people becoming aware of where the stock are kept. There is also a possibility that petty theft or opportunistic crimes can take place. The municipality indicated that general crime levels increased during the construction phases of the renewable developments around the town. The municipality reported that once the construction teams left, they perceive that there is an increase in local petty crimes such as housebreaking which they attribute to loss of income amongst some community members. There will be less people in the area during the operational phase and fewer permanent workers onsite. Theft or vandalism of the PV panels or associated infrastructure may be of some concern during the operation phase.
- *"Crime. This is a reality in SA today and although I don't live on my farm permanently, we have not experienced any criminal incidents in over 40 years. My fear is that industrial development adjacent to my farm will significantly increase the threat of criminal activity, be it stock theft, game poaching, property theft, home invasion or worse."* (Richard Vimpany)

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Reg: 2006/023163/23

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
28	M	M	L	-I	M	M	1	H	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Social Impact Assessment Report prepared by Ilse Aucamp of Equispectives Research & Consulting Services dated August 2022.
- Richard Vimpany (Neighbouring landowner and registered Interested and Affected Party).

Mitigations:

Impact Management Outcome(s):

- A safe local farming community

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Reg: 2006/023163/23

- A secure solar PV facility

Targets:

- Reduce risk of criminal activity.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
28	Planning	An influx of job seekers and construction workers into the area could increase the potential for criminal activity.	A safe local farming community	Reduce risk of criminal activity: Facility is planned to be constructed in blocks/phases.	Limit the number of construction workers required on site at any one time by building the facility in sequential phases of circa 100 MW blocks as opposed to trying to build the 400 MW facility in one go.	Holder, Engineer	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
28	Planning	An influx of job seekers and construction workers into the area could increase the potential for criminal activity.	A safe local farming community	Reduce risk of criminal activity: no accommodation is provided on site.	No accommodation shall be provided for contractors, sub-contractors, and their workers on the construction site.	Holder, Engineer, Contractor	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
28	Layout and Design	Increased potential for criminal activity, including theft of and damage to infrastructure, such as solar panels.	A secure solar PV facility	Reduce risk of criminal activity: A security company is appointed.	Security should be appointed throughout construction and operation to discourage criminal elements.	Holder	Continuous	Compliance to be verified by ECO and IEA.
28	Layout and Design	Increased potential for criminal activity, including theft	A secure solar PV facility	Reduce risk of criminal activity: facility is fenced	The facility should be fenced off and have controlled access using a security gate.	Holder, Engineer	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		of and damage to infrastructure, such as solar panels.		with security access control.	Whilst an eco-friendly alternative is preferred to razor-wire mesh, the final design shall be determined by a due diligence that provides an acceptable balance (best point of intersection) between (a) harm to wildlife or domestic stock, (b) cost, and (c) the IPP's security standards (to ensure protection of the high-valued asset from theft).			
28	Layout and Design	Increased potential for criminal activity, including theft of and damage to infrastructure, such as solar panels.	A secure solar PV facility	Reduce risk of criminal activity: security cameras are present.	The perimeter fence line should be secured using multiple FLIR PTZ security cameras.	Holder, Engineer	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
28	Layout and Design	Increased potential for criminal activity, including theft of and damage to infrastructure, such as solar panels.	A secure solar PV facility	Reduce risk of criminal activity: access	Use existing gates provided to gain access to all parts of the area authorised for development, where possible	Holder, Engineer	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
28	Layout and Design	Increased potential for criminal activity,	A secure solar PV facility	Reduce risk of criminal activity:	Existing and new gates to be recorded	Holder	Planning and Design Phase	Compliance to be verified

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		including theft of and damage to infrastructure, such as solar panels.		access photographs	and documented in photographic record		Continuous	by ECO and IEA.
28	Layout and Design	Increased potential for criminal activity, including theft of and damage to infrastructure, such as solar panels.	A secure solar PV facility	Reduce risk of criminal activity: Locked gates	All gates must be fitted with locks and be kept locked at all times during the development phase, unless otherwise agreed with the landowner	Holder	Continuous	Compliance to be verified by ECO and IEA.
28	Layout and Design	Increased potential for criminal activity, including theft of and damage to infrastructure, such as solar panels.	A secure solar PV facility	Reduce risk of criminal activity: gate design	Care must be taken that the gates must be so erected that there is a gap of no more than 100 mm between the bottom of the gate and the ground	Holder, Engineer	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
28	Layout and Design	Increased potential for criminal activity, including theft of and damage to infrastructure, such as solar panels.	A secure solar PV facility	Reduce risk of criminal activity: Demarcated fences	All demarcation fencing and barriers must be maintained in good working order for the duration of the development activities	Holder	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
28	Layout and Design	Increased potential for criminal activity, including theft	A secure solar PV facility	Reduce risk of criminal activity: fencing	Fencing must be erected around the camp, batching plants, hazardous storage	Holder, Engineer, Contractor	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		of and damage to infrastructure, such as solar panels.			areas, and all designated access restricted areas, where applicable			
28	Layout and Design	Increased potential for criminal activity, including theft of and damage to infrastructure, such as solar panels.	A secure solar PV facility	Reduce risk of criminal activity: fencing	All fencing must be developed of high-quality material bearing the SABS mark	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
28	Layout and Design	Increased potential for criminal activity, including theft of and damage to infrastructure, such as solar panels.	A secure solar PV facility	Reduce risk of criminal activity: locked gates	Fenced areas with gate access must remain locked after hours, during weekends and on holidays if staff is away from site. Site security will be required at all times	Holder, Engineer, Contractor	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
28	L	L	L	-R	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
28	L	L	L	neutral	L	L	0	L	L	0

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Reg: 2006/023163/23

Residual Risk (feeds back into "Mitigations"):

- The residual risk of criminal activity during construction and operation (**28**) after mitigation is estimated to be Low.

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Reg: 2006/023163/23

Receiving Environment: Visual Aesthetics

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Layout and Design	Lighting	NA	**Impacts:** (1) Light directed uselessly above the horizon creates murky skyglow. (2) Light trespass or spillage from poor outdoor lighting shines onto neighbours' properties. (3) Glare from exposed light bulbs can be distracting. **Consequences:** (1) Light pollution washes out our view of the stars, degrading ecosystem services, specifically cultural services (e.g. a remote 'sense of place'). (2) Light spillage is intrusive and gives the area an unattractive, trashy look. (3) Distracting glare (light that beams directly from a bulb into your eye) hampers the vision of pedestrians, cyclists, and drivers.	N/A	29
Layout and Design	Installing Perimeter Fence and Access Control	Terrestrial barrier	**Impact:** Fencing can be visually obtrusive. **Consequences:** - A large, obtrusive perimeter fence creating long lines that wrap over prominent landform would degrade local landscape resources in this rural landscape. - Degraded (ecosystem) cultural services, specifically areas of importance for recreation and aesthetic enjoyment, will negatively impact on human well-being.	N/A	30
Layout and Design	Installing panel arrays and associated infrastructure (from racks to field transformers) including within 100 m of a watercourse or 500 m of a wetland/pan	Physical Structures	**Impact:** **(1)** Proximity to ridgeline features and areas of prominence that add to the medium to high levels of local Scenic Quality. **(2)** Neighbours who are sensitive to landscape change; receptor sensitivity to the landscape changes to the existing rural agricultural landscape character, particularly by neighbouring landowners located to the north- and south-east of the development site. **(3)** Massing effects created by large scale coverage or expanses of solar PV panels in a rural agricultural landscape setting (with medium to high levels of Scenic Quality). **Consequences:** **(1) to (3)** A large-scale project creating long lines of PV that wrap	N/A	31

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Reg: 2006/023163/23

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
			over prominent landform would degrade local landscape resources in this rural landscape. Degraded (ecosystem) cultural services, specifically areas of importance for recreation and aesthetic enjoyment, will negatively impact on human well-being.		
Layout and Design	Quarry		**Impact:** Rock from the irregularly shaped dolerite sill traversing Phase 3 (represented by localities P20, P24, P26, P27, P28, P29, P35, P36, P38) as well as the adjacent baked sediments may be utilized as construction materials. **Consequence:** The usage of poor-quality aggregate is unsafe and will increase the costs of maintenance.	N/A	31
Layout and Design	Quarry		**Impact:** The dolerite dyke running sub-parallel to the southwestern boundary (represented by localities P11, P30, P31 and P34) has a width of between 20 and 50 m and a quarry for utilization of dolerite from this dyke can be located anywhere along the strike of the dyke. **Consequence:** Certain sites are not suitable for a quarry.	N/A	31
Layout and Design	Buffers	Specialist Assessment Reports	**Impact:** Decrease in the "sense of place" as it relates to noise, visual and light pollution. **Consequence**: Lower aesthetic values enjoyed by the community.	N/A	31

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 29 (Lighting)

- Although the facility will not be lit up during the night-time period, selected infrastructure will have to be illuminated.

Impact 30 (Fencing)

- The PV facility will be fenced off with a galvanised diamond razor mesh security fence (*as per comms. Bruce Conne, Soventix*).

Impact 31 (Visual)

- There is a strong sense and spirit of place associated with the Karoo landscape. The surrounding farms are used for sheep farming, game farming and hunting. The current residents and farm owners have a strong sense of place associated with the farms. Many things can impact on a person's perception of sense of place. Farms are generally noisy places if one considers animal-sounds and farming activities. From the

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Reg: 2006/023163/23

receptors' perspective, this kind of noise is acceptable and even attractive, because this is what living on a farm is all about. Noises such as alarms and reverse hooters are not "normal" and disturb the sense of place and the value that people place on the auditory environment. Although lights are used as a security measure on farms, one of the things people values is the absence of bright lights and that they can see the stars. Lights for any other use than lightening up their direct environment is seen as invasive and disturbs the sense of place. Visual aspects are an important consideration in the experience of sense of place. If people are used to unspoiled vistas, or seeing open fields, the establishment of any buildings or infrastructure that they feel do not belong there can alter their sense of place. Sense of place refers to an individual's personal relationship with his/her local environment, both social and natural, which the individual experiences in his/her everyday daily life (Vanclay et al, 2015). It is highly personal, and once it is affected, it cannot be restored. It is also difficult to quantify. Part of the sense of place is the emotional attachment that the farmers have to their properties, and the hopes that they have for it to serve future generations (their children).

- The spirit of place associated with an area is an important factor in tourism and hunting and the marketing of these activities. Spirit of place refers to the unique, distinctive, and cherished aspects of a place. Aspects that will impact on the sense and spirit of place include an increase in noise and activity levels from construction activities, but this will be a temporary impact during the construction phase. The construction phase will see a total transformation from the current setting and landscape of the proposed site. It is inevitable that the visual impact during the construction phase will be affected by dust, increase in vehicle traffic and other construction activities.
- During the operational phase, visual impacts such as glare from the solar panels, buildings, power lines, lack of vegetation and light at night will also impact on the sense and spirit of place and will be an impact as long as the plant is operational. Modern solar modules are designed to absorb the solar radiation and hence are not susceptible to reflection or glinting. Nonetheless, the contrast between the solar arrays and surrounding vegetation will exist, in colour, form, line and texture. The impact of lights in a dark rural area known for its beautiful night sky is a special concern of landowners. Although the preferred site may not influence the sense of and spirit of place of the Karoo as such, it will have a significant impact on the sense and spirit of place of the direct neighbours.
- Although there is visual and biodiversity impact assessment reports that suggest mitigation, it must be acknowledged that the sense of place will be altered permanently and given the personal experience of this impact from some stakeholders, successful mitigation is extremely hard to do. In the eye of the affected parties the only thing that will not alter the sense and spirit of the place in this instance is to avoid any further development.
- The visual recommendations from the scoping phase reporting were all incorporated into the layout design, accommodating a wide buffer on the adjacent properties, as well as accommodating wide ecological corridors between the four PV blocks. While the local sense of place will be modified, the impacted visual resources are localised to some degree and are not highly significant such that a No-go Option would be preferred. Goede Hoop Farmstead could experience partial views of the panels at 4.5 km (the dwelling is at the fringe of the viewshed analysis), with direct views from Skilpadskuil Farmstead screened by local vegetation.
- Part of the potential visual impacts caused by construction activities will include the visual changes brought about by clearance of vegetation for the solar arrays, ancillary buildings, and laydown areas; visual disturbance caused by construction of roads, buildings, energy collectors, power lines, increased traffic (and number of large vehicles), worker presence and activity, and dust emissions. Other visual disturbances may include

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Reg: 2006/023163/23

soil stockpiles (from excavation for building foundations and other structures), soil scars, as well as potential for invasive plant species to develop on disturbed soils and soil stockpiles, which may contrast with existing vegetation.

- Furthermore, a neighbouring landowner has submitted written objections to the proposed activity for *inter alia* the visual impact or massing from 3.3 m solar PV panels located 50m from his farm boundary ('massing' refers when the landscape becomes dominated by a particular theme – in this case, large covering of solar PV panels that result in strong change to the local landscape character).
- *"The negative visual aspect and view of this development when viewed from my property adjacent. My farm has been owned by my family for three generations and the remoteness and unspoiled environment is a key factor of this legacy."* (Richard Vimpany).
- Rock cairns (occurring at locality P31 and P34) may render that area historically sensitive, thus possibly preventing development in that vicinity Although it is possible that these cairns are marking potential drill sites for groundwater, it is unlikely as the recorded cairns are located on top of the dyke, found in pairs opposite each other, with the pairs lining up with other pairs in nearly exact distances from each other. It is therefore seen as more likely being markers for an old road. Although the age, origin and function of this possible old road is not known, it could date to the late 19th/early 20th century, with some cultural material dating to this period found in association (Martini Henry cartridge). This was likely an old wagon road linking farmsteads with each other, as well as these with Hanover and other towns. From this point of view this road and related features (cairns) are relatively significant from a Cultural Heritage point of view and at least should in part be preserved. Stone cairns can be demolished in sections where they cannot be avoided by development actions. (Archaeological & Heritage Impact Assessment, 2022).
- The main drawback of this source in comparison to P34 is that the dyke appears to be thin or even weathered away in parts leaving lesser quality baked sediments as construction material source (Geotechnical Assessment, 2022).
- "P34 not recommended due to more prominence. P24 is my preferred location as it is more visually sheltered and will be cut into the northern facing slopes, screening the cutting from southern receptors" (pers. comm. Steve Stead, Visual Resource Management Africa cc).

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

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Reg: 2006/023163/23

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
29	M	M	M	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
30	H	M	M	-I	H	H	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
31	H	M	M	-I	H	H	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Social Impact Assessment Report prepared by Ilse Aucamp of Equispectives Research & Consulting Services dated August 2022.
- Richard Vimpany (Neighbouring landowner and registered Interested and Affected Party).
- Geotechnical Assessment Study prepared by FDJ Stapelberg of the Council for Geoscience dated 11 May 2022 (CO2017-5806 (Phase 80)).
- Personal communication with Steve Stead, Visual Resource Management Africa cc.
- Visual Impact Assessment Report (Final v_2) dated 19th September 2022, prepared by Stephen Stead of Visual Resource Management Africa cc.
- A Report on a Phase 1 Archaeological & Heritage Impact Assessment prepared by A.J. Pelser dated August 2022 (Report: APAC022/49).

Mitigations:

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Reg: 2006/023163/23

Impact Management Outcome(s):

- Retain the existing rural dark sky night landscape (**29**).
- A less dominant landscape change to local or neighbouring receptors (**30** and **31**).

Targets:

- Effective light management.
- Avoid obtrusive fence lines.
- Height of PV panels not above 4m above ground.
- Internal power line cable is buried.
- Quarry visual screening.
- Site P34 is not used for a quarry.
- Buffer zone and written agreement.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
29	Layout and Design	(1) Light directed uselessly above the horizon creates murky skyglow. (2) Light trespass or spillage from poor outdoor lighting shines onto neighbours' properties. (3) Glare from exposed light bulbs can be distracting.	Retain the existing rural dark sky night landscape.	Effective light management: No murky sky glow. No light spillage onto neighbours' properties. No glare from light bulbs.	Effective light management needs to be incorporated into the design of the lighting to ensure that the visual influence is limited to the solar PV facility, without jeopardising project operational safety and security (See Annexure D of VIA Scoping Report, as well as lighting mitigations by The New England Light Pollution Advisory Group (NELPAG) and	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					Sky Publishing Corp in 14.2).			
29	Layout and Design	(1) Light directed uselessly above the horizon creates murky skyglow. (2) Light trespass or spillage from poor outdoor lighting shines onto neighbours' properties. (3) Glare from exposed light bulbs can be distracting.	Retain the existing rural dark sky night landscape.	Effective light management: No murky sky glow. No light spillage onto neighbours' properties. No glare from light bulbs.	No security lighting should be placed on the perimeter fencing.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
29	Layout and Design	Light directed uselessly above the horizon creates murky skyglow.	Retain the existing rural dark sky night landscape.	Effective light management: No murky sky glow.	No overhead security lighting. Rather locate the light source closer to the operation, use directed technology, and aim fixtures either down or to maximise their impact on the targeted area whilst minimizing their impact elsewhere.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
29	Layout and Design	Light trespass or spillage from poor outdoor lighting shines onto	Retain the existing rural dark sky night landscape.	Effective light management: No light spillage onto neighbours' properties.	Provide only enough light for the task at hand; don't over-light, and don't spill light off your property.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		neighbours' properties.						
29	Layout and Design	Glare from exposed light bulbs can be distracting.	Retain the existing rural dark sky night landscape.	Effective light management: No glare from light bulbs.	Choose "full-cut-off shielded" fixtures that keep light from going uselessly up or sideways. Full-cut-off fixtures produce minimum glare.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
30	Layout and Design	A large, obtrusive perimeter fence creating long lines that wrap over prominent landforms can be visually obtrusive.	A less dominant landscape change to local or neighbouring receptors.	Avoid obtrusive fence lines: Fencing is transparent. Fencing is not installed along the perimeter of the property boundaries but rather around two or more blocks of PV.	Fencing around the solar PV panels needs to appear transparent (preferably electrified) and should not go around the total property or project area, with the exception of existing farm fences being retained along the outside farm boundaries.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
31	Layout and Design	Proximity to ridgeline features and areas of prominence that add to the medium to high levels of local Scenic Quality.	A less dominant landscape change to local or neighbouring receptors.	Minimise the Zone of Visual Influence (visual extent or viewshed).	Avoidance (No-go): Establish a setback that excludes the eastern area adjacent to the locally prominent ridgeline feature.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
31	Layout and Design	Proximity to ridgeline features and areas of prominence that add to the	A less dominant landscape change to local or neighbouring receptors.	Minimise the Zone of Visual Influence (visual extent or viewshed).	Reduction: Powerline pylons should not as far as is practicable be located on top of a ridgeline.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		medium to high levels of local Scenic Quality.						
31	Layout and Design	Neighbours who are sensitive to landscape change; receptor sensitivity to the landscape changes to the existing rural agricultural landscape character, particularly by neighbouring landowners located to the north- and south-east of the development site.	A less dominant landscape change to local or neighbouring receptors.	A less dominant landscape change/maintain visual quality by visually buffering adjacent land uses/farms along north- and south-eastern property boundary (as these owners have indicated concern regarding the semi-industrial type development in a deep rural setting).	Reduction: A 250 m 'visual sensitivity buffer' should be maintained along the boundary with the north- and south-eastern receptors that have indicated higher levels of sensitivity to landscape change (Location of the buildings / substation should be away from prominent landscape features and outside of eastern receptor view area. However, the alignment of the 66 – 132 kV distribution line and the upgrading of the existing road crossing across the watercourse where it enters the south-eastern property boundary is permissible within this buffer)	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
31	Layout and Design	Neighbours who are sensitive to landscape change;	A less dominant landscape change to local or neighbouring receptors.	A less dominant landscape change/maintain visual quality by visually buffering	The buildings should be painted a grey-brown colour and not be located in prominent areas.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		receptor sensitivity to the landscape changes to the existing rural agricultural landscape character, particularly by neighbouring landowners located to the north- and south-east of the development site.		adjacent land uses/farms along north- and south-eastern property boundary (as these owners have indicated concern regarding the semi-industrial type development in a deep rural setting).				
31	Layout and Design	Massing effects created by large scale coverage or expanses of solar PV panels in a rural agricultural landscape setting (with medium to high levels of Scenic Quality).	A less dominant landscape change to local or neighbouring receptors.	Breaking of massing effects created by large scale coverage or expanses of solar PV panels such that the development parcels are more reflective of the landscape carrying capacity and less dominating to sensitive receptors located in the northern areas.	Reduction: The solar PV facility should be developed in lower lying valley areas or grasslands that reflect pockets of development that are better aligned with the lay of the land and the hydrology drainage of the site (VIA Scoping Report page 34 and 42).	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
31	Layout and Design	Massing effects created by large scale coverage or expanses of solar PV panels in a rural agricultural landscape setting (with medium to high levels of Scenic Quality).	A less dominant landscape change to local or neighbouring receptors.	Breaking of massing effects created by large scale coverage or expanses of solar PV panels such that the development parcels are more reflective of the landscape carrying capacity and less dominating to sensitive receptors located in the northern areas.	Reduction: Reduce the massing effects by establishing a 'massing buffer' at the head of an apparent tributary north of the main watercourse, effectively segregating the northern-most PV development area into two separate clusters.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
31	Layout and Design	Massing effects created by large scale coverage or expanses of solar PV panels in a rural agricultural landscape setting (with medium to high levels of Scenic Quality).	A less dominant landscape change to local or neighbouring receptors.	Breaking of massing effects created by large scale coverage or expanses of solar PV panels such that the development parcels are more reflective of the landscape carrying capacity and less dominating to sensitive receptors located in the northern areas.	Reduction: Reduce the massing effects created by the location of the adjacent Phase 2 development by establishing a 'massing buffer' along the low ridgeline between the two projects thereby limiting visual interface between the two developments through topographic screening.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
31	Layout and Design	Loss of landscape character from the current rural agricultural sense of place to the semi-industrial RE landscape	A less dominant landscape change.	Height of PV panels not above 4m above ground	Limit the height of the PV panels to a maximum of 4 m above ground level.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
31	Layout and Design	Loss of landscape character from the current rural agricultural sense of place to the semi-industrial RE landscape	A less dominant landscape change.	Internal power line cable is buried	All internal power line cables need to be buried to reduce visual intrusion to the local landscape.	Holder, Engineer, Contractor	Planning and Design Phase Construction	Compliance to be verified by ECO and IEA.
31	Layout and Design	Rock from the irregularly shaped dolerite sill traversing Phase 3 (represented by localities P20, P24, P26, P27, P28, P29, P35, P36, P38) as well as the adjacent baked sediments may be utilized as construction materials.	A less dominant landscape change.	Quarry visual screening: is outside of any buffers.	In the event that the engineers decide to create a new quarry in the project area (as opposed to lawfully mining from any of the other existing quarries in the area), then rock from the locality P24 (in Figure 2 of the Geotechnical Assessment Report) including the adjacent baked sediments may be utilized as construction materials as long as it remains further then 100 m	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					from the ecological buffer.			
31	Layout and Design	Rock from the irregularly shaped dolerite sill traversing Phase 3 (represented by localities P20, P24, P26, P27, P28, P29, P35, P36, P38) as well as the adjacent baked sediments may be utilized as construction materials.	A less dominant landscape change.	Quarry visual screening: buffer	Given the location of the Quarry P24 in a "visual" sensitivity buffer its exact siting relative to/distance from the farm boundary must be agreed to with the south-eastern receptor (neighbouring farmer).	Holder	Planning and Design Phase	Compliance to be verified by ECO and IEA.
31	Layout and Design	Rock from the irregularly shaped dolerite sill traversing Phase 3 (represented by localities P20, P24, P26, P27, P28, P29, P35, P36, P38) as well as the adjacent baked sediments may be utilized as construction materials.	A less dominant landscape change.	Quarry visual screening: cut into north facing slopes and screening	The responsible engineer(s) should as far as is practical ensure that the quarry is visually sheltered by cutting into the northern facing slopes, screening the cutting from southern receptors.	Holder, Engineer; Contractor	Planning and Design Phase Construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
31	Layout and Design	The dolerite dyke running sub-parallel to the southwestern boundary (represented by localities P11, P30, P31 and P34) has a width of between 20 and 50 m and a quarry for utilization of dolerite from this dyke can be located anywhere along the strike of the dyke.	A less dominant landscape change.	Site P34 is not used for a quarry	Given the potential archaeological and visual sensitivity of the proposed quarry site represented by locality P34, use of this site is forbidden	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
31	Layout and Design	Decrease in the "sense of place" as it relates to noise, visual and light pollution.	A less dominant landscape change.	Screening of facility	Screening the solar facility from the neighbouring properties in a way acceptable to the landowners must be investigated and agreed to.	Holder, Engineer, Contractor	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
31	Layout and Design	Decrease in the "sense of place" as it relates to noise, visual and light pollution.	A less dominant landscape change.	Buffer zone and written agreement	Where the proposed solar field is directly adjacent to a neighbour's fence line there should be a buffer zone between the panels and the fence as agreed in	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					writing between Soventix and the directly affected neighbours during the EIA process, to ensure that it is included in the EIA authorisation. Recommendations made in the Visual Impact Assessment should be considered in the discussion about and development of the buffer zone.			

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
29	L	L	L	-I	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
29	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
30	M	L	M	-I	M	M	1	L	L	0

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
30	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
31	M	L	M	-I	M	M	1	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
31	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

- The residual risk of light pollution (**29**), fencing (**30**) and massing effects (**31**) on visual aesthetic values after mitigation is estimated to be Medium to Low, but generally acceptable.

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Reg: 2006/023163/23

Receiving Environment: Heritage and Culture

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Layout and Design	Installing panel arrays and associated infrastructure (from racks to field transformers) including within 100 m of a watercourse or 500 m of a wetland/pan	Heritage	I**mpact:** Disturbance to or destruction of Stone Cairns indicating an old Wagon Road (Sites: 19-25) by construction activities, e.g., clearing and grubbing activities. **Consequence:** Loss/damage of heritage resource.	N/A	32

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 32 (Archaeology)

- A total of 31 sites were identified during the 2022 assessment in the study and development area (Sites 26-31 are located outside of the proposed development footprint). They included a fairly larger number of open-air Stone Age surface sites (with varying degrees of density), a recent stone kraal and some stone cairns that are most likely associated with an old road.
- Although the age, origin and function of this possible old road is not known, it could date to the late 19th/early 20th century, with some cultural material dating to this period found in association (Martini Henry cartridge). This was likely an old wagon road linking farmsteads with each other, as well as these with Hanover and other towns. From this point of view this road and related features (cairns) are relatively significant from a Cultural Heritage point of view and at least should in part be preserved. Stone cairns can be demolished in sections where they cannot be avoided by development actions. The exact age and historical origin should also be researched.
- The study area is not within a World Heritage Site or within 10 km of a World Heritage Site according to the PAR.

Impact 32 (Palaeontology)

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

- The **Very High** Palaeontology theme according to the Screening Report was confirmed in the Site Sensitivity Verification Report.
- The project area is underlain at depth by potentially fossiliferous continental bedrocks of the Lower Beaufort Group (Karoo Supergroup) of Middle Permian age that have yielded sparse but scientifically important vertebrate remains in the Hanover area as well as commoner petrified wood. Also present are unfossiliferous dolerite intrusions and Late Caenozoic superficial sediments (e.g., alluvium, surface gravels) which might contain important fossil mammal and other remains as well as reworked fossil wood blocks. Satellite imagery suggests that bedrock exposure is limited but not insignificant within all three study sites. (*Dr. John Almond, NATURA VIVA cc*)
- "The most likely outcome, based on comparable project areas in the Hanover - De Aar region of the Great Karoo, is that comparatively few scientifically useful fossil sites will be recorded, while No-Go palaeontological areas are very unlikely to be designated. Most Karoo fossil sites are of limited extent and can be effectively mitigated in the pre-construction phase, so palaeontological constraints on the project footprint are not anticipated, although they cannot be completely excluded in advance." (*Dr. John Almond, NATURA VIVA cc*).

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	**Intensity**	**Spatial**	**Duration**	**Status**	**Nature**	**Prob.**	**MAGNITUDE**	**Accept.**	**Prob.**	**IMPORTANCE**
32	M	L	L	-R	M	M	1	H	M	1
Reversibility	L	**Irreplaceability**	L	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

- Preserve the section of old wagon road in the development footprint demarcated by the Heritage Specialist in a kmz file and stone cairns at sites 19 to 22.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- A Report on a Phase 1 Archaeological & Heritage Impact Assessment prepared by A.J. Pelser dated August 2022 (Report: APAC022/49).
- National Heritage Resources Act, 1999 (Act No. 25 of 1999)
    - *Structures*
        - No person may alter or demolish any structure or part of a structure, which is older than 60 years without a permit issued by the LIHRA [2] (Section 34(1) of NHRA).
    - *Archaeological Sites and Remains*
        - In terms of Section 35(3) of the NHRA, any person who discovers archaeological or palaeontological objects or material or a meteorite during development or an agricultural activity must **immediately report the find** to the LIHRA.
        - In terms of Section 35(4) of the NHRA, **no person may without a permit** issued by the LIHRA destroy, damage, excavate, alter, deface, or otherwise disturb any archaeological or palaeontological site or any meteorite, or remove from its original position any archaeological, or palaeontological material or object or any meteorite.
    - *Graves*
        - In terms of Section 36(6) any person who during development discovers the location of a grave **must immediately cease such activity and report the discovery** to the LIHRA. The LIHRA must then, in co-operation with the SAPS, carry out an investigation.
        - In terms of Section 36(3) of the NHRA, **no person may, without a permit** issued by LIHRA, destroy, damage, alter, exhume, or remove from its original position or otherwise disturb the grave of a victim of conflict, any burial ground or part thereof which contains such graves, or any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority (Section 36(3) of NHRA).

Mitigations:

Impact Management Outcome(s):

- Preservation of heritage resources and expansion of knowledge of the archaeology of the area.

Targets:

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

- Section of the old wagon road is preserved.
- Stone cairns preserved.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
32	Layout and Design	Disturbance to or destruction of Stone Cairns indicating an old Wagon Road (Sites: 19-25) by construction activities, e.g., clearing and grubbing activities.	Preservation of heritage resources and expansion of knowledge of the archaeology of the area.	Mapping data of heritage sites provided to SAHRA	All mapping data of sites must be provided to SAHRA prior to construction.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
32	Layout and Design	Disturbance to or destruction of Stone Cairns indicating an old Wagon Road (Sites: 19-25) by construction activities, e.g., clearing and grubbing activities.	Preservation of heritage resources and expansion of knowledge of the archaeology of the area.	Section of the old wagon road section is preserved.	Preserve the section of old wagon road in the development footprint demarcated by the Heritage Specialist in a kmz file and stone cairns at sites 19 to 22.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
32	Layout and Design	Disturbance to or destruction of Stone Cairns indicating an old Wagon Road (Sites: 19-25) by	Preservation of heritage resources and expansion of knowledge of the archaeology of the area.	30 m buffer around section of the wagon road	A buffer of 30 m must be adhered to around the wagon road (points 19 -25).	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		construction activities, e.g., clearing and grubbing activities.						
32	Layout and Design	Disturbance to or destruction of Stone Cairns indicating an old Wagon Road (Sites: 19-25) by construction activities, e.g., clearing and grubbing activities.	Preservation of heritage resources and expansion of knowledge of the archaeology of the area.	Report on the Section of the old wagon road.	A report containing the research, recording, mapping and further recommendations for the road must be submitted to SAHRA for comment prior to construction;	Holder, Heritage specialist	Planning and Design Phase	Compliance to be verified by ECO and IEA.
32	Layout and Design	Disturbance to or destruction of Stone Cairns indicating an old Wagon Road (Sites: 19-25) by construction activities, e.g., clearing and grubbing activities.	Preservation of heritage resources and expansion of knowledge of the archaeology of the area.	Stone cairns preserved.	As far as possible avoid destruction or demolition of other stone cairns, including but not limited to sites 23 to 25. These cairns may only be destroyed if they can't be avoided.	Holder, Engineer, Contractor	Planning and Design Phase Construction	Compliance to be verified by ECO and IEA.

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
32	L	L	L	neutral	L	L	0	L	L	0

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
32	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- The residual risk of damage to a cultural heritage resource/knowledge (**32**) after mitigation is estimated to be Low.

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Reg: 2006/023163/23

PREFERRED ALTERNATIVE IMPACT ASSESSMENT

PRE-CONSTRUCTION PHASE

TABLE OF CONTENTS

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Identification (and assessment) of impacts and risks for the preferred alternative

3(1) A EIA report… must include –

(h) a full description of the process followed to reach the proposed development footprint within the approved site, as contemplated in the accepted scoping report, including;

(v) the impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts- (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated;

(vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;

(viii) the possible mitigation measures that could be applied and level of residual risk;

Appendix 3 (Content of the EIA Report) of the EIA Regulations, 2014 as amended

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Reg: 2006/023163/23

Pre-Construction Phase

Receiving Environment: Legal System

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Contractor Readiness	Awarding of preferred bidder		**Impact:** Contractor is unaware of EA and EA and EMP: **Consequence:** Poor implementation of environmental management or mitigations resulting in significant impacts (Risk)	N/A	01
Contractor Readiness	Acquiring permits, licenses, Letters of consent and permissions	Permission: No mechanical equipment shall be used in the vicinity of Eskom's apparatus and/or services without prior written permission having been granted by Eskom (Eskom letter dated 14 March 2017 ref: Invest14/03/2017)	**Impact:** The construction of the 66 - 132 kV powerline will impact Eskom's power lines servitude. Construction without permission will constitute an offence in terms of the relevant legislation. **Consequence:** - The applicant can be fined and/or imprisoned as a result of damage to Eskom's apparatus (Section 27(3) of Electricity Act, 1987 (Act No. 41 of 1987), as amended in 1994)	N/A	01

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Reg: 2006/023163/23

Contractor Readiness		EMPr	**Impact:** Once the Minister has identified, through a government notice that a generic EMPr is relevant to an application for EA, that generic EMPr must be applied by all parties involved in the EA process, including but not limited to the applicant and the competent authority (CA). **Consequences:** - In terms of 49A (Offences) of NEMA, 1998 as amended, "(1) A person is guilty of an offence if that person -(c) fails to comply with or contravenes a condition of an environmental authorisation granted for a listed activity or specified activity or an approved environmental management programme;"	N/A	01
Contractor Readiness	Employment of labour	Influx of job-seekers and construction workers into the area.	**Impact:** Conditions of EA and EMP are not enforced or penalised through employment contracts. **Consequence:** Significant Impacts on different aspects of the environment (Risk).	N/A	01
Contractor Readiness		Training	**Impact:** Lack of environmental awareness **Consequence:** significant environmental impacts (direct)	N/A	01
Site Establishment (Layout)	Fuel storage and refuelling area		**Impact:** non-compliance **Consequence:** fine	N/A	01

*The source of information used in identifying the impact is either the Leipold Matrix (Matrix), Interested and Affected Parties (I&APs) and/or Specialist studies (Specialist)

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 01 (Generic EMPrs)

- In terms of GN No. 435 of 22 March 2019, applications for environmental authorisation for substation and overhead electricity transmission and distribution infrastructure, when such facilities trigger activity 11 or 47 of Environmental Impact Assessment Regulations Listing Notice 1 of 2014, as amended, and any other listed and specified activities necessary for the realisation of such facilities; or activity 9 of Environmental Impact Assessment Regulations Listing Notice 2 of 2014, as amended and any other listed or specified activities necessary for the realisation of such facilities; must use the generic Environmental Management Programme, contemplated in Regulations 19(4), 23(4) and Appendix 4 to the

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Reg: 2006/023163/23

Environmental Impact Assessment Regulations, 2014, as amended. – **listed activity 11 of listing notice 1 is amongst the activities forming part of this application for environmental authorisation.**

- The objective of these generic EMPrs is to prescribe and pre-approve generally accepted impact management outcomes and impact management actions, which can commonly and repeatedly be used for the avoidance, management and mitigation of impacts and risks associated with the development or expansion of substation infrastructure for the transmission and distribution of electricity. The use of a generic EMPr is intended to reduce the need to prepare and review individual EMPrs for applications of a similar nature.
- Generic EMPr are attached as **Appendix F: Annexure A** of the Draft EIA report.

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
01	NA	NA	NA	-I	NA	NA	NA	H	H	1
Reversibility	NA	**Irreplaceability**	NA	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- The proposed activities do not include operational aspects. Consequently, the environmental authorization is required for development only, including the following phases: planning and design, pre-construction, construction, and post-construction (rehabilitation and monitoring).The

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Reg: 2006/023163/23

validity period of the environmental authorisation shall be the maximum permissible period given the scale of the project, anticipated time to complete construction, and the uncertainty of when a water use license will be granted.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Generic EMPrs published in GN No. 435 of 22 March 2019 in terms of Section 24(5) of NEMA, 1998
- National Environmental Management Act, 1998 (Act No. 107 of 1998); Section 49A (1) A person is guilty of an offence if that person - (c) fails to comply with or contravenes a condition of an environmental authorisation granted for a listed activity or specified activity or an approved environmental management programme
- Renewable Energy Generation Plant Setbacks to Eskom Infrastructure Revision 02 compiled on 15/09/2020 (Unique Identifier 240-65559775)
- Environmental Impact Assessment Regulations, 2014 as amended including EIA Regulations Listing Notice 1 (and 3) of 2014, as amended

Mitigations:

Impact Management Outcome(s):

- Lawful commencement of construction activities within Eskom's 132 kV powerlines servitude.
- Compliance with the EA and EMPr
- Reduced occurrence of labour being non-compliant with EA and EMPr
- Environmentally sensitive and responsible conduct by employees
- Lawful dangerous goods storage

Targets:

- A Letter of Consent from Eskom.
- Written approval from the SACAA.
- Two generic EMPrs completed by the contractor and accepted (signed) by the Holder.
- Generic EMPr method statements prepared by contractor (signed by Holder).
- Eskom Agreement.
- Contractor has an environmental file on site including the EA and EMPr.
- Clause within labour employment contracts relating to a penalty system for incidences of non-compliance with the EA and EMPr.
- Signed attendance register and course outline of Environmental Awareness training.
- Fuel storage is below 30 cubic meters

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
01	Contractor Readiness	Unlawful activities relating to heritage resources	Lawful commencement of Section 35 of the NHRA	NHRA Permit	Permits in terms of section 35 of the National Heritage Resource Act (NHRA) must be applied for from SAHRA for the collection of archaeological material prior to construction. No construction may commence without a permit in this regard.	Holder, Contractor	Prior to commencement	Compliance to be verified by ECO and IEA.
01	Contractor Readiness	Contractor is unaware of EA and EA and EMP.	Compliance with the EA and EMPr	Contractor has an environmental file on site including the EA and EMPr	Contractor must be provided with a copy of the EA and EMPr	Holder, Contractor	Pre-construction	Compliance to be verified by ECO and IEA.
01	Contractor Readiness	The construction of the 66 - 132 kV powerline will impact Eskom's power lines servitude. Construction without permission will constitute an offence in terms of the relevant legislation	Lawful commencement of construction activities within Eskom's 132 kV powerlines servitude.	A Letter of Consent from Eskom.	The Holder of the EA must apply for co-use of Eskom's 132 kV powerline servitude by submitting a formal application entitled "Annex A Application for the co-use of an Eskom right or restriction area", as well as all required supporting documents that are indicated in the form. The application should be submitted to Nomzamo Mdunyelwa ST(SA)0991, Land & Rights Officer, Land Development, Northern Cape Operating Unit, Eskom (Tel: 053 830 5947, Mobile: 081 046 5341,	Holder	Pre-construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					Email:MdunyeNC@eskom.co.za) at least 30 days before the intended date of commencement to prevent any unnecessary delays. A separate application will need to be submitted for: (1) upgrading the existing two-track service road to a 5m to 6m-wide road by grading it, importing material, reshaping it, and compacting it, and (2) constructing the 66 to 132 kV powerline from the on-site substation on Phase 3 across/underneath Eskom's 132 kV powerline.			
01	Contractor Readiness	Once the Minister has identified, through a government notice that a generic EMPr is relevant to an application for EA, that generic EMPr must be applied by all parties involved in the EA process, including but not limited to the applicant	Compliance with the Generic EMPr	Two generic EMPrs completed by the contractor and accepted (signed) by the Holder.	(1) Part B Section 1 of (a) the generic EMPr for the development and expansion of substation infrastructure for the transmission and distribution of electricity, and (b) the generic EMPr for the development and expansion for overhead electricity transmission and distribution infrastructure, must be completed by the contractor, and each completed page must be signed and dated by the holder of the EA prior to the commencement of the activity.	Holder, Contractor	Pre-construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		and the competent authority (CA)						
01	Contractor Readiness	Once the Minister has identified, through a government notice that a generic EMPr is relevant to an application for EA, that generic EMPr must be applied by all parties involved in the EA process, including but not limited to the applicant and the competent authority (CA)	Compliance with the Generic EMPr	Generic EMPr method statements prepared by contractor (signed by Holder)	Appendix 1 of (a) the generic EMPr for the development and expansion of substation infrastructure for the transmission and distribution of electricity, and (b) the generic EMPr for the development and expansion for overhead electricity transmission and distribution infrastructure, contains method statements that must be prepared by the contractor and agreed to by the holder of the EA prior to the commencement of the activity. Each method statement must be signed and dated on each page by the holder of the EA.	Holder, Contractor	Pre-construction	Compliance to be verified by ECO and IEA.
01	Contractor Readiness	Conditions of EA and EMP are not enforced or penalised through employment contracts: Significant Impacts on different	Reduced occurrence of labour being non-compliant with EA and EMPr	Clause within labour employment contracts relating to a penalty system for incidences of non-compliance with the EA and EMPr	Contractor should include in labour employment contracts a penalty system regarding incidences of non-compliance with the EA and EMPr	Contractor	Pre-construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		aspects of the environment.						
01	Contractor Readiness	Lack of environmental awareness: Significant environmental impacts	Environmentally sensitive and responsible conduct by employees	Signed attendance register of Environmental Awareness training	All contractors, sub-contractors and their workers shall participate in an Environmental Awareness Training before being allowed to enter site. Refresher environmental awareness training is available as and when required.	Contractor, ECO	Pre-construction	Compliance to be verified by ECO and IEA.
01	Contractor Readiness	Lack of environmental awareness: Significant environmental impacts	Environmentally sensitive and responsible conduct by employees	Signed attendance register of Environmental Awareness training	The Contractor must allow for sufficient sessions to train all personnel with no more than 20 personnel attending each course	Contractor, ECO	Pre-construction	Compliance to be verified by ECO and IEA.
01	Contractor Readiness	Lack of environmental awareness: Significant environmental impacts	Environmentally sensitive and responsible conduct by employees	Course outline of Environmental Awareness training	All staff are aware of the conditions and controls linked to the EA and within the EMPr and made aware of their individual roles and responsibilities in achieving compliance with the EA and EMPr;	Contractor, ECO	Pre-construction	Compliance to be verified by ECO and IEA.
01	Contractor Readiness	Lack of environmental awareness: Significant environmental impacts	Environmentally sensitive and responsible conduct by employees	Course outline of Environmental Awareness training	Environmental awareness training must include as a minimum the following: a) Description of significant environmental impacts, actual or potential, related to their work activities; b) Mitigation measures to be implemented when carrying out specific activities;	Contractor, ECO	Pre-construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					c) Emergency preparedness and response procedures; d) Procedures to be followed when working near or within sensitive areas; e) Wastewater management procedures; f) Water usage and conservation; g) Solid waste management procedures; h) Sanitation procedures; i) Fire prevention; and j) Disease prevention.			
01	Contractor Readiness	Lack of environmental awareness: Significant environmental impacts	Environmentally sensitive and responsible conduct by employees	Signed attendance register of Environmental Awareness training	A record of all environmental awareness training courses undertaken as part of the EMPr and staff attendance registers must be available	Contractor, ECO	Pre-construction	Compliance to be verified by ECO and IEA.
01	Contractor Readiness	Lack of environmental awareness: Significant environmental impacts	Environmentally sensitive and responsible conduct by employees	Course outline of Environmental Awareness training	Course material must be available and presented in appropriate languages that all staff can understand.	Contractor, ECO	Pre-construction	Compliance to be verified by ECO and IEA.
01	Site establishment	Non-compliance with regards to dangerous goods (fuel) storage	Lawful dangerous goods storage	Fuel storage is below 30 cubic meters	Combined fuel storage capacity must remain below 30 cubic meters	Contractor, ECO	Pre-construction	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

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Reg: 2006/023163/23

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
01	NA	NA	NA	+I	NA	NA	NA	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
01	NA	NA	NA	+I	NA	NA	NA	L	L	0

Residual Risk (feeds back into "Mitigations"):

- The residual risk of undertaking unlawful activities (**01**) after mitigation is assumed to be Low.
- A person may feel compelled to commence with construction without a water use license if an environmental authorisation has been granted by the competent authority and the validity period requires the applicant to conclude the authorised activity within a restrictive timeframe that is limited to one dry season.

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Reg: 2006/023163/23

Receiving Environment: Terrestrial fauna

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Planning	Stakeholder Engagement Plan	Communication	**Impact:** The construction of a solar electricity generating facility and its associated infrastructure will lead to a change of land use and livelihoods. **Consequence:** Change of land use can potentially impact negatively on the livelihood of the affected farmer, which is sheep farming.	Quantity	02
Planning	Stakeholder Engagement Plan	Grievance Mechanism	**Impact:** Farm gates being left open, or not being closed properly by construction teams. **Consequence:** Loss of livestock	Quantity	02
Contractor Readiness	Employment of labour	Training	**Impact:** Farm gates being left open, or not being closed properly by construction teams. **Consequence:** Loss of livestock	Quantity	02
Monitoring	N/A	N/A	**Impact:** Possible bat fatalities incurred from collisions with infrastructure associated with the solar PV facility including solar arrays, security fencing, transmission lines, and buildings. **Consequence:** Decline in bat population due to injury/death	Quantity	03
Contractor Readiness	Employment of labour	Training	**Impact:** Poaching **Consequence:** Loss of fauna/livestock	Quantity	03
Site Establishment (Layout)	Site Selection	N/A	**Impact:** Active mammals or nesting birds could be injured or increase in mortalities **Consequence**: Injury/death of fauna/birds	Quantity	03
Site Establishment (Layout)	Perimeter/boundary fence	N/A	**Impact:** Tortoises and other animals become stuck against fences and are electrocuted to death. **Consequence:** Loss/injury to faunal species.	Quantity	03

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Reg: 2006/023163/23

Site Establishment (Layout)	Site Offices	N/A	**Impact:** Animals may enter the contraction camp and have access to waste, hazardous substances, equipment, etc. **Consequence:** Injury or death (Risk)	Quantity	03
Site Establishment (Layout)	Lighting	N/A	**Impact:** Light pollution **Consequence:** Alter species composition, foraging patterns and predation rate of bats.	Quantity	03

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 02 (Social/Damage to property)

- During the construction phase all livestock would need to be moved to different parts of the farm as the construction activities may be distressing for the animals.
- The movement of workers and vehicles on the site could cause damage to farm infrastructure (e.g., fencing, water troughs and gates), during construction and operation.
- Farm owners are concerned about the impact of fences on water flow during heavy rain. If fences are not kept clear of debris, there is a risk that it can affect the waterflow into dams in the area, which is critical in a dry area like the Karoo.
- There is a risk of stock loss due to farm gates being left open, or not being closed properly by construction teams.
- There are concerns that poaching incidents may increase, especially when the fencing is erected and when a number of construction teams are active in the area.

Impact 03 (Lighting)

- Although the facility will not be lit up during the night time period, selected infrastructure will have to be illuminated. These comparatively small, illuminated areas can still impact the surrounding ecological functioning (including biological systems) of the adjacent landscape through spill over lighting and sky glow.
  Artificial lighting is well known to disrupt the flow of information to organisms, provides misleading clues and can cause interspecific competition for food resources by extending diurnal species foraging activity into the night-time period. As such, the spill-over of artificial lighting beyond the proposed solar PV facility into dark, natural spaces must be prevented.
  Over fine and large scales, bats can be impacted by all types of conventional lighting.
  Known impacts of artificial lighting on bats are; delayed emergence and reduced number of individuals from roosts, changes in navigation and commuting behaviour, foraging behaviour alterations, the creation of “barriers” limiting the connectivity of habitats in the landscape and the

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Reg: 2006/023163/23

effective dispersal of species (isolating habitat patches and populations from immigration), and decreased growth rates of young bats if adult bats incur higher energetic losses and experience decreased foraging time if they have to forage further afield from maternity roosts.
Artificial lighting appears to benefit some bat species (light-tolerant) through increasing their foraging efficiency by identifying and exploiting insects swarming around lights. Typical bat species that make use of the foraging opportunities under lights are often open-air and clutter-edge forager bat species with echolocation calls adapted for open and semi-open habitats created around artificial lighting, thus there is an expectation that L. capensis and T. aegyptiaca may benefit from artificial lighting. Laephotis capensis has been shown to forage around lights.
Light intolerant bat species are often slow flying and highly manoeuvrable, adapted for foraging in cluttered environments such as Rhinolophids and Nycterids. One reason for these species avoiding lit areas is that their echolocation call structure is not well suited for foraging in the open habitat associated with artificial lighting. A second reason for certain bat species to avoid artificially lit areas is the sensitivity of bat eyes to light. As light intensity increases, bat's visual sensitivity decreases.
Lighting, particularly in arid regions can have significant impacts on arid bat communities where bats may reduce drinking activity due to artificial lighting.

- A combination of mitigation strategies could effectively reduce the impact of ecological light pollution.

Impact 03 (Animal Species)

- Annual monitoring during preconstruction, construction and during the operational phase will provide much needed insight into the changes in bat activity, species composition and ecology over the affected property.
- By following monitoring guidelines, data sets can be gathered that are comparable with other large-scale renewable energy projects that impact bats and consolidated to understand the extent of the impacts of these projects and define effective mitigation strategies.
- The risk of direct collisions of bats with solar PV panels is unknown and the perception of smooth surfaces by bats is not well studied. If bats perceive smooth surfaces as voids, solar PV panels left in a resting position perpendicular or more than 45 degrees in relation to the ground could pose a collision risk. However, this risk is negated for the proposed Phase 3 since single-axis tracker that allows the panels to be stowed horizontally at night to reduce wind-load and if bats are "confused" by the smooth surface or perceive it as a potential drinking source may approach the surface at a slower speed and not collide with it.
- A 1.8 m high galvanised diamond razor mesh security fence will be installed around each of the four PV Blocks within the facility. The risk of the security fence in relation to bat collisions and bat injury/mortality is largely unknown.
- Sedentary animals pose a higher risk of harm than active animals.

<u>Assessment without mitigation:</u>

Legend

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Reg: 2006/023163/23

Criteria		Reversibility, Irreplaceability, & Mitigatory Potential		Significance (Impact Magnitude & Impact Importance	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
02	M	M	M	-I	M	H	1	H	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
03	M	M	M	-I	M	H	1	H	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Social Impact Assessment Report prepared by Ilse Aucamp of Equispectives Research & Consulting Services dated August 2022.
- Chiropteran Specialist Report for Phase 3 of the Proposed Soventix-Solar Africa Solar PV Facility, Hanover, Northern Cape Prepared by: Dawn Cory Toussaint dated July 2022.
- Terrestrial Animal Species Compliance Statement – Soventix Phase 3 Pv Project (Second Draft) prepared by Simon Todd of 3 Foxes Biodiversity Solutions dated September 2022.

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Reg: 2006/023163/23

- Terrestrial Biodiversity Specialist Assessment – Soventix Phase 3 Pv Project prepared by Simon Todd of 3 Foxes Biodiversity Solutions dated September 2022.

Mitigations:

Impact Management Outcome(s):

- Minimize disturbance to local famers
- Ensure least impact on bat species and behaviour.
- Ensure the protection of fauna aves and livestock
- Faunal mortalities as a result of fencing are reduced

Targets:

- No impacts on bat species due to lighting.
- Construction programme received by farmers
- Grievance mechanism/complaints register
- Signed attendance register of Environmental Awareness training
- Bat monitoring results and bat carcasses
- No poaching (snares etc.)
- Photographic evidence of relocation operation.
- Electric fence wire is above ground and original tension
- No fauna/aves carcasses
- Concrete sill beneath gates
- Consent from landowner
- No incidents of animals entering the construction camp

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
02	Planning	The construction of a solar electricity	Minimize disturbance to local famers	Construction programme received by farmers	The farmers must be given a construction programme with sufficient leeway to	Contractor	Pre-construction	Compliance to be verified by

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		generating facility and its associated infrastructure will lead to a change of land use and livelihoods			ensure that they can move their livestock before construction activities commence.			ECO and IEA.
02	Planning	Farm gates being left open, or not being closed properly by construction teams.	Minimize disturbance to local famers	Grievance mechanism	Develop a grievance mechanism using the Grievance Mechanism Protocol (Appendix I).	Holder, Contractor	Pre-construction	Compliance to be verified by ECO and IEA.
02	Planning	Farm gates being left open, or not being closed properly by construction teams.	Minimize disturbance to local famers	Grievance mechanism	The grievance mechanism must be in place and shared with all the stakeholders before the construction commences.	Holder, Contractor	Pre-construction	Compliance to be verified by ECO and IEA.
02	Planning	Farm gates being left open, or not being closed properly by construction teams.	Minimize disturbance to local famers	Grievance complaints register	The grievance mechanism must include a complaints procedure that allows the landowners to log their grievance and submit a claim for damages.	Holder, Contractor	Pre-construction and On-going	Compliance to be verified by ECO and IEA.
02	Contractor Readiness	Farm gates being left open, or not being closed properly by construction teams.	Minimize disturbance to local famers	Signed attendance register of Environmental Awareness training	The construction teams must be educated about the closing/locking farm gates, through toolbox talks.	Contractor, ECO	Pre-construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
03	Monitoring	Possible bat fatalities incurred from collisions with infrastructure associated with the solar PV facility including solar arrays, security fencing, transmission lines, and buildings.	Ensure least impact on bat species and behaviour.	Bat monitoring results	Perform continuous bat monitoring using passive bioacoustic recording systems in line with the South African Good Practice Guidelines for Surveying Bats at WEF's (Sowler and Stoffberg, 2014) and SAGPG for Operational Monitoring (Aronson et al. 2014) for one year pre-construction, during construction and two years post-construction (operation). During the first two years of operation, it is expected that any changes in bat activity and perceived impacts will be most evident.	Holder, ECO, Specialist	One year pre-construction, during construction and two years post-construction (operation)	Compliance to be verified by ECO and IEA.
03	Monitoring	Possible bat fatalities incurred from collisions with infrastructure associated with the solar PV facility including solar arrays, security fencing, transmission	Ensure least impact on bat species and behaviour.	Bat monitoring results	A specialist should maintain these systems and determine the impacts of solar PV facility and associated infrastructure on bat populations in relation to landscape changes in both the physical changes with the installation of the solar PV panels, the resulting change in	Holder, Specialist	One year pre-construction, during construction and two years post-construction (operation)	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		lines, and buildings.			vegetation structure underneath the solar PV panels and the management strategy of the operational facility			
03	Monitoring	Possible bat fatalities incurred from collisions with infrastructure associated with the solar PV facility including solar arrays, security fencing, transmission lines, and buildings.	Ensure least impact on bat species and behaviour.	Bat carcasses	Mortality searches near infrastructure and along the security fence line must be conducted to determine if the security fences pose a threat to bats	Contractor, ECO, Specialist	On-going	Compliance to be verified by ECO and IEA.
03	Contractor Readiness	Loss of fauna/ livestock through poaching	Ensure the protection of fauna and livestock	No poaching (snares etc.)	Soventix must have a zero-tolerance policy regarding poaching, and make it clear what the punishment and consequences would be	Contractor, ECO	Pre-construction	Compliance to be verified by ECO and IEA.
03	Site Establishment	Active mammals or nesting birds could be injured or increase in mortalities	Ensure the protection of fauna, and aves.	Photographic evidence of relocation operation.	If any sedentary animals or ground nesting birds are found, then these are to be relocated to a suitable distance and habitat by the ECO.	Contractor, ECO.	Ongoing	Compliance to be verified by ECO and IEA.
03	Site Establishment	Tortoises and other animals	Faunal mortalities as	Electric fence wire is above ground.	The design should ensure that there is no	Contractor, ECO	Pre-construction	Compliance to be

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		become stuck against fences and are electrocuted to death.	a result of fencing are reduced	No fauna/aves carcasses	electrical fencing around substations (and associated battery facilities) or other features within 30cm of the ground as tortoises become stuck against such fences and are electrocuted to death. Alternatively, a guard wire set at 20cm can be used to keep larger tortoises away from the fence.			verified by ECO and IEA.
03	Site Establishment	Tortoises and other animals become stuck against fences and are electrocuted to death.	Faunal mortalities as a result of fencing are reduced	Concrete sill beneath gates	Where gates are installed in jackal proof fencing, a suitable reinforced concrete sill must be provided beneath the gate	Contractor, ECO	Pre-construction	Compliance to be verified by ECO and IEA.
03	Site Establishment	Tortoises and other animals become stuck against fences and are electrocuted to death.	Faunal mortalities as a result of fencing are reduced	Tension of fence wires	Original tension must be maintained in the fence wires	Contractor, ECO	Ongoing	Compliance to be verified by ECO and IEA.
03	Site Establishment	Tortoises and other animals become stuck against fences and are	Faunal mortalities as a result of fencing are reduced	Consent from landowner	Any temporary fencing to restrict the movement of life-stock must only be erected with the permission of the land owner.	Contractor, ECO	Ongoing	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		electrocuted to death.						
03	Site Establishment	Animals may enter the contraction camp and have access to waste, hazardous substances, equipment, etc.	Ensure the protection of fauna	No incidents of animals entering the construction camp	Erect and maintain a barrier (e.g., shade cloth fence) around the perimeter of the construction camp.	Contractor	Ongoing	Compliance to be verified by ECO and IEA.
03	Site Establishment	Light pollution	Ensure least impact on animal behaviour.	No impacts on bat species due to lighting.	The number and position of lights required must be limited and installed in areas where it is absolutely necessary.	Contractor	Ongoing	Compliance to be verified by ECO and IEA.
03	Site Establishment	Light pollution	Ensure least impact on animal behaviour.	No impacts on bat species due to lighting.	A light shield/lamp shade should be used to focus the beam downwards onto the ground to prevent sky glow as well as to prevent light from trespassing beyond the development area into the surrounding naturally dark areas.	Contractor	Ongoing	Compliance to be verified by ECO and IEA.
03	Site Establishment	Light pollution	Ensure least impact on animal behaviour.	No impacts on bat species due to lighting.	The intensity of the lighting is lowered (dim the lights). Alternatively, in conjunction with substantially dimming the lights, motion	Holder, Contractor	Ongoing	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					sensors could be installed.			
03	Site Establishment	Light pollution	Ensure least impact on animal behaviour.	No impacts on bat species due to lighting.	The spectrum of light chosen has longer wavelengths to reduce the attractiveness of light to insects.	Contractor	Ongoing	Compliance to be verified by ECO and IEA.
03	Site Establishment	Light pollution	Ensure least impact on animal behaviour.	No impacts on bat species due to lighting.	If possible, the duration of the lighting period should be limited, and lights switched on shortly after the peak night-time emergence of clutter-edge forager bats ~60min after sunset.	Holder, Contractor	Ongoing	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
02	L	L	L	-I	M	M	1	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
02	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
03	L	L	M	-I	M	M	1	L	L	0

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Reg: 2006/023163/23

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
03	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- The residual risk of social impacts (loss of livestock) which thus affects livelihoods (**02**) after mitigation is assumed to be Low.
- Sedentary or burrowing fauna (**03**), as well as ground nesting birds, may occupy the development site after their observed absence during the environmental impacts assessment process.
- Overall, the residual risk of loss/disturbance of terrestrial fauna (**03**) after mitigation is assumed to be Low.

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Reg: 2006/023163/23

Receiving Environment: Terrestrial flora

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Contractor Readiness	Acquiring permits, licenses, Letters of consent and permissions Employment of labour	Fire management plan and Training	**Impact:** Risk of veld fires caused by workers during the construction of the facility. **Consequence:** - Runaway fires on neighbouring properties will result in a loss of grazing for livestock and/or wild game, increasing the running costs to provide supplementary feed.	Quantity	04
Contractor Readiness	Employment of labour	Training	**Impact:** Direct loss of terrestrial plants from construction activities on land. **Consequence:** - the loss of threatened (Red Data) species may result in a loss of biodiversity and ecosystem resilience to climate change (direct). - the loss of threatened keystone species may alter the functioning of an ecosystem (direct).	Quantity	05
Site Establishment (Layout)	Site selection and area	N/A	**Impact:** Direct loss of terrestrial plants from construction camp footprint. **Consequence:** - the loss of threatened (Red Data) species may result in a loss of biodiversity and ecosystem resilience to climate change (direct). - the loss of threatened keystone species may alter the functioning of an ecosystem (direct).	Quantity	05

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 04 (Fire)

- The De Aar area falls within the Nama Karoo biome. Runaway fires could result in a decrease in grazing capacity.

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Reg: 2006/023163/23

Impact 05 (Plant species)

- Northern Upper Karoo has not been significantly affected by transformation and is still approximately 96% intact and is classified as Least Threatened.
- Within the study area, the vegetation consists of a mosaic of grassy and more shrubby areas, with shrubs being more prevalent on the stony and shallow soils of the site. No indigenous trees are present within the site and the vegetation consists of low grassland shrubland.
- There are no threated vegetation types or specialised plant communities present within the site.
- No plant species of conservation concern were observed within the site and overall, the site is considered low sensitivity from a Plant Species Theme perspective

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
04	L	M	L	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

05	L	M	L	-I	M	M	1	M	M	1	
Reversibility	H		**Irreplaceability**	H		**Mitigatory Potential**	H				

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- National Veld and Forest Fire Act, 1998 (Act No. 101 of 1998)
- Plant Species Compliance Statement – Soventix Phase 3 Pv Project (Second Draft) prepared by Simon Todd of 3 Foxes Biodiversity Solutions dated September 2022.

Mitigations:

Impact Management Outcome(s):

- Fire management plan.
- Firefighting personal.
- Preserve protected plant species that may not have been identified during the EIA Phase.

Targets:

- No run-away (uncontrolled) fires.
- Signed register of attendance, and content of induction.
- No disturbance to protected or threatened plants, unless necessary.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
04	Contractor Readiness	Risk of veld fires caused by workers during the	Fire management plan	No run-away (uncontrolled) fires - no open fires	Undertake a risk analysis to determine inter alia the probability and frequency of a	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		construction of the facility.			wildfire during construction and operation and prepare a fire management plan accordingly.			
04	Contractor Readiness	Risk of veld fires caused by workers during the construction of the facility.	Firefighting personal	No run-away (uncontrolled) fires - no open fires	Appoint a responsible person (or agent) who will extinguish a fire or assist in doing so. If no agent is appointed, a team of designated firefighting personal shall be trained and readily available to immediately deal with any runaway veld fires.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.
05	Contractor Readiness	Direct loss of terrestrial plants from construction activities on land.	Preserve protected plant species that may not have been identified during the EIA Phase	Signed register of attendance, and content of induction.	The contractor's staff must be made aware of the prohibition on harvesting any plant or plant part.	Contractor, ECO.	Prior to site establishment.	Compliance to be verified by ECO and IEA.
05	Site establishment (Layout)	Direct loss of terrestrial plants from construction camp footprint.	Preserve protected plant species that may not have been identified during the EIA Phase	No disturbance to protected or threatened plants, unless necessary.	Undertake a pre-construction walk through of the development footprint to locate protected plant species that should be relocated outside of the development footprint.	ECO	Prior to commencement of clearing and grubbing.	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
05	Site establishment (Layout)	Direct loss of terrestrial plants from construction camp footprint.	Preserve protected plant species that may not have been identified during the EIA Phase	No disturbance to protected or threatened plants, unless necessary.	Only apply for permit(s) and/or a license to "pick" a threatened or protected plant if it is not possible to relocate the footprint.	Applicant, Contractor	Prior to commencement of clearing and grubbing.	Compliance to be verified by ECO and IEA.
05	Site establishment (Layout)	Direct loss of terrestrial plants from construction camp footprint.	Preserve protected plant species that may not have been identified during the EIA Phase		High visibility flags must be placed near protected plants to avoid any damage or destruction of these species.	Contractor, SEO	Ongoing	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
04	L	M	L	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
04	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
05	L	M	L	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
05	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- The residual risk of loss of grazing material due to uncontrolled fires (**04**) after mitigation is assumed to be Low.
- The residual risk of loss/damage to protected plant species (**05**) particularly during clearing and site establishment of the laydown area, site selection and site area) after mitigation is assumed to be Low.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Receiving Environment: Soil and Rock

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Site establishment (Layout)	Machinery (parking area)	N/A	**Impact:** Parking of vehicles will compact the ground: **Consequence:** Increasing surface water run-off and erosion.	Quantity	06
Site establishment (Layout)	Maintenance and workshops)	N/A	**Impact:** Spills or other waste from the maintenance of construction vehicles and other machinery can contaminate the topsoil. **Consequences**: - sterile habitat for fauna and flora (direct).	Quality	06
Site establishment (Layout)	Fuel storage and refuelling	N/A	**Impact:** Spills from fuel storage and refuelling in camp can contaminate the topsoil: **Consequence:** sterile habitat for fauna and flora (indirect).	Quality	06
Site establishment (Layout)	Pollution control	N/A	**Impact:** Rain accumulation on waste storage areas can cause leaching. **Consequence:** Contaminate soil	Quality	06

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

- During the rainy season terrain mobility on high clay soils in low lying areas with drainage lines will be difficult and might increase soil erosion when drainage lines are disturbed.
- Construction plant normally stays on site for cost, road impact and time saving reasons.
- There will be no machinery service/wash bay areas on site.

Impact 06 (Soils)

- The entire site has very thin soils and either bedrock sub-outcrop at less than 0,5 metres depth below ground surface or bedrock outcrop/dispersed outcrop. The thickest soils of 1,0 to 1,2 metres thickness over minor parts occur in areas of either gully wash material, alluvial deposits or pediplain positions (at low landscape localities). These soils are generally of a silty sand to clayey sand nature.

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Reg: 2006/023163/23

- Most of the soils are very shallow with an average depth of less than 30cm. Clay content ranges from sandy loam to very clayey. Calcareous soils are covering relatively small areas. Soils are unsuitable for most types of agriculture.
- No severe donga erosion has been observed in the study areas. Minor to moderate plate erosion is present. Severe donga and sheet erosion have been observed on flood plains outside the study areas.
- It is not envisaged that the proposed development will result in major soil erosion or any other degradation of the soils of the focus areas if there is proper runoff management from roads and other bare areas.

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
06	H	L	H	-I	H	M	1	M	L	0
Reversibility	L	**Irreplaceability**	M	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
06	H	L	M	-I	H	M	1	H	M	1
Reversibility	M	**Irreplaceability**	M	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

- Proper runoff management from roads and other bare areas is to be implemented.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Hydrological Assessment (Version – Final 3) 01 September 2022 GCS Project Number: 22-0076 by Hendrik Botha.
- Soil Mapping Report prepared by Hennie van den Burg of Iris International and Francois Botha of Eco Soil dated June 2022.
- Geotechnical Assessment Study prepared by FDJ Stapelberg of the Council for Geoscience dated 11 May 2022 (CO2017-5806 (Phase 80)).

Mitigations:

Impact Management Outcome(s):

- Minimise erosion
- Avoid contamination of soil from leaking machinery
- Control or contain soil pollution
- To reduce the amount of soil pollution

Targets:

- Revegetation and Rehabilitation Plan is developed
- No formation of soil erosion rills
- No services/workshop on site
- Bunded area located within construction camp.
- Spill response equipment.
- Adequate number of drip trays available.
- A designated waste storage area is contained

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
06	Site establishment (Layout)	Parking of vehicles will compact the ground	Minimise erosion	Revegetation and Rehabilitation Plan is developed.	Develop a revegetation and rehabilitation plan.	Contractor	Pre-construction	Compliance to be verified by

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
								ECO and IEA.
06	Site establishment (Layout)	Parking of vehicles will compact the ground	Minimise erosion	No formation of soil erosion rills	Identify and avoid no-go areas or areas sensitive to compaction on the site plan. Parking areas should as far as practical be located on flat ground.	Contractor	Pre-construction	Compliance to be verified by ECO and IEA.
06	Site establishment (Layout)	Parking of vehicles will compact the ground	Minimise erosion	No formation of soil erosion rills	All activities remain strictly within demarcated routes and areas.	Contractor	On-going	Compliance to be verified by ECO and IEA.
06	Site establishment (Layout)	Parking of vehicles will compact the ground	Minimise erosion	No formation of soil erosion rills	Once the intervention has been completed, break the crust on bare compacted areas to enhance vegetation establishment.	Contractor	On-going	Compliance to be verified by ECO and IEA.
06	Site establishment (Layout)	Spills or other waste from the maintenance of construction vehicles and other machinery can contaminate the topsoil.	Avoid contamination of soil from leaking machinery	No services/workshop on site	No planned maintenance and workshop area is permitted within the construction site and construction camp.	Contractor, SEO	Ongoing	Compliance to be monitored by SEO and verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
06	Site establishment (Layout)	Hydrocarbon and other hazardous material spills (concrete slurry) can contaminate the soil	Control or contain soil pollution	Bunded area located within construction camp.	Fuel storage tanks must be placed on an impermeable bund that can hold 110% volume of the tank.	Contractor	Ongoing	Compliance to be verified by ECO and IEA
06	Site establishment (Layout)	Hydrocarbon and other hazardous material spills (concrete slurry) can contaminate the soil	Control or contain soil pollution	Spill response equipment.	Provide accidental spill response equipment at the construction camp.	Contractor	Ongoing	Compliance to be verified by ECO and IEA.
06	Site establishment (Layout)	Hydrocarbon and other hazardous material spills (concrete slurry) can contaminate the soil	To reduce the amount of soil pollution	Adequate number of drip trays available.	Enough drip trays must be available for all construction plant.	Contractor	Ongoing	Compliance to be verified by ECO and IEA.
06	Site establishment (Layout)	Hydrocarbon and other hazardous material spills/leaching can contaminate the soil	To reduce the amount of soil pollution	A designated waste storage area is contained – waste is not in direct contact with the ground.	Designate and contain a temporary waste storage area within the construction camp (e.g., covered skips, scavenger proof bins, etc.)	Contractor	Ongoing	Compliance to be verified by Compliance to be verified by ECO and IEA

Assessment with mitigation:

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
06	L	L	L	-I	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
05	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- The residual risk of soil erosion/pollution (**06**) after mitigation is assumed to be Low.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Receiving Environment: Ground and Surface Water

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Monitoring	N/A	N/A	**Impact:** It is anticipated that soils downstream of the proposed development, and the non-perennial streams (feeding into temporary livestock watering dams) are the receivers of any sediment runoff or poor-quality runoff from the site. Suspended sediment (or turbidity) during construction in the watercourse can influence water quality. **Consequences:** - making it unfit for agricultural use (irrigation), affecting crop yield by photosynthetic activity reducing films, reducing infiltration rate and/or seedling emergence because of a soil surface crust being deposited by suspended solids, clogging of drip irrigation systems as well as accelerated wear and tear of sprinkler irrigation nozzles (indirect). - making it unfit for domestic water use, by having aesthetics effects (appearance, taste, and odour), and affecting human health (indirect).	Quality	07
Site establishment	Batching plant/Cement-mixing area	N/A	**Impact:** Concrete slurry from the batching plant can contaminate surface water flows. **Consequence:** Decrease in water/land quality due to batching plant	Quality	07
Contractor readiness	Commencement	N/A	**Impact:** Construction of linear infrastructure across the ephemeral drainage system will involve temporary diversion works, changing the surface water hydrology or flow patterns. **Consequence:** - Altered flow patterns can slow down the stream flow, causing deposition of sediment or increase the velocity and turbulence of the water, causing erosion (direct).	Behaviour	08

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Reg: 2006/023163/23

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 07 (Water Quality - Sedimentation)

- Considering the District Municipality's Climate Change Response Plan highlighted the risk of reduced deterioration in (surface) water quality due to increased salt concentrations in dams, wetlands and soil/plant systems from enhanced evaporation rates, and the farmer has 'always' supplied his livestock with groundwater via boreholes, it is assumed that no further treatment is required for livestock production.
- Groundwater is vulnerable to pollution (DHS Redbook, Section J)
- Almost a third of the households in Ward 6 get their water from a borehole.
- Erosion and sedimentation are only likely to take place during severe storm events (e.g., 1:2 to 1:100y events). Incidental rainfall will likely not cause sedimentation.
- Most of the soils are very shallow with an average depth of less than 30cm. Clay content ranges from sandy loam to very clayey. Calcareous soils are covering relatively small areas. Soils are unsuitable for most types of agriculture.
- No severe donga erosion has been observed in the study areas. Minor to moderate plate erosion is present.

Impact 08 (Surface Water Hydrology)

- The drainage systems are predominantly ephemeral, which means that the stream flows briefly in direct response to precipitation in the immediate vicinity, and the channel is at all times above the ground-water reservoir. These systems have a far less predictable flow regime compared to perennial or seasonal rivers and are frequently dry for long periods in arid regions. These ephemeral drainage lines are tributaries of the Brak River and considered to be in a largely natural ecological state.
- Available rainfall data suggest a MAP ranging from 112.4 (30th percentile) to 738.9 (90th percentile) mm/yr, based on a historical record of 69 years (e.g., 1920 to 1989). The average rainfall is in the order of 320 mm/yr.
- The site falls within evaporation zone 17A, of which Mean Annual Evaporation (MAE) ranges from 2 000 to 2 150 mm/yr. The MAE far exceeds the MAP for the site, which implies greater evaporative losses when compared to incident rainfall. Due to evaporation being about 85% more than local rainfall, non-perennial streams and rivers will only have water when there are flooding events (e.g., 1:2, 1:5, 1:50 and 1:100 year flood events). Lowest average rainfall (mm) is from May to September and lowest estimated monthly run-off (mm) is from May to November.
- The project area is located within a Strategic Water Source Area (Screening Report). Strategic Water Source Areas (SWSAs) are defined as areas of land that (a) supply a disproportionate (e.g., relatively large) quantity of mean annual surface water runoff in relation to their size and so are considered nationally important; and/or (b) have high groundwater recharge and where the groundwater forms a nationally important resource. **The protection and restoration of strategic water source areas is of direct benefit to all downstream users.** This dependence needs to be considered in decisions relating to these primary headwater catchments. **The protection of both water quantity (flows) and quality must be addressed. Any failure to address impacts on water quality or quantity will have impacts on the water security of all**

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Reg: 2006/023163/23

those depending on that water downstream. Groundwater is the main or only source of water for numerous towns and settlements across the country so protecting the capture zone, specifically for municipal supply well-fields, the recharge area, and the integrity of the aquifers is important as well.

- The project area falls within quaternary catchment D62D and the Orange Water Management Area. (Hydrology Assessment)
- The project area contains 3 Hydrological Response Units (HRU). Ninety-six percent (96%) of the project area falls within HRU2. The average slope of HRU2 (21,738 km^2) is 0,56%. Sixteen percent (16,51%) of HRU2 has a 3-10% slope, which is mostly restricted to the western and eastern corners of the project area. Consequently, the topography of the study area is generally flat with elevations on the site typically ranging from 1 335 to 1 370 m above mean sea level. (Hydrology Assessment)
- Drainage is generally towards the north-west via multiple non-perennial drainage lines towards the ephemeral Brak River, approximately 6,6 km further downstream. However, the drainage channels or flow paths are not clearly defined. Sheet flow occurs from micro sub-catchments towards lower topographical areas or isolated depressions forming temporarily flooded areas. Irregular occurrences of ponded water were visible across the project area, even in areas with no defined drainage lines or stream channels. (Hydrology Assessment)
- In the absence of clearly defined drainage channels or streams the area is prone to exhibit ponded flood occurrence zones. Micro sub-catchment sheet flow towards lower-lying areas within the non-perennial river flood plains is likely to dominate flood propagation, and isolated flooded areas are predicted to occur. (Hydrology Assessment)
- Considering run-off is directly related to rainfall intensity, and longer precipitation events, both monthly rainfall and run-off, peak from January to April. The run-off during these peak months, ranges from 0,3 to 1,1 mm/yr over the surface area of quaternary catchment D62D. The annual run-off from natural (unmodified) catchments in D62D is approximately 0,9% of the MAP. (Hydrology Assessment)
- Accounting for changes in soil type, slope angle and rainfall intensity, ground cover beneath solar arrays was found to have the most significant impact on run-off rates. So, if vegetation cover beneath the solar arrays is maintained, no significant increase in surface water run-off (run-off volumes, peak rates, or time to peak rates) is anticipated compared to greenfield run-off rates. (Hydrology Assessment)

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		

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Reg: 2006/023163/23

-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
07	H	M	M	-I	H	M	1	H	M	1
Reversibility	H		**Irreplaceability**	H		**Mitigatory Potential**	H			

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
08	M	L	M	-I	M	M	1	M	M	1
Reversibility	M		**Irreplaceability**	M		**Mitigatory Potential**	H			

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

The civil construction phase should be restricted to the dry winter months (e.g., April/May to September), that is commence with such activities as clearing or grading, excavating and importing material at the end of the wet season/beginning of the dry season whilst the soil is still moist to reduce dust and as far as is practical, be completed in, the dry winter months with a decreased probability of storm events.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Hydrological Assessment (Version – Final 2) 11 April 2022 GCS Project Number: 22-0076 by Hendrik Botha
- Geohydrological Assessment Report (Final Rev 3) prepared by GCS Water and Environmental Consultants dated 10th August 2022 (GCS Project Number: 22-0401).
- Aquatic Biodiversity Impact Assessment, Section 21(c) and (i) Risk Assessment and Wetland Delineation Verification by Dr Andrew Deacon August 2022.
- Social Impact Assessment Report prepared by Ilse Aucamp of Equispectives Research & Consulting Services dated August 2022.

Mitigations:

Impact Management Outcome(s):

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

- To reduce sedimentation.
- To reduce the amount of soil/water pollution.
- Altered aquatic ecosystem structure and function.

Targets:

- Preserve aquatic ecosystem structure and function.
- A designated batching plant is contained – deflects surface water runoff.
- Construction during dry months and clearing/grubbing end of wet season.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
07	Monitoring	It is anticipated that soils downstream of the proposed development, and the non-perennial streams (feeding into temporary livestock watering dams) are the receivers of any sediment runoff or poor-quality runoff from the site. Suspended sediment (or turbidity) during construction in the watercourse can influence water quality.	To reduce sedimentation	Preserve aquatic ecosystem structure and function.	Implement the Surface and Groundwater Monitoring Protocol during construction and operation (Appendix D).	Contractor, Holder	Construction and operation	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
07	Site establishment (Layout)	Concrete slurry from the batching plant can contaminate surface water flows	To reduce the amount of soil/water pollution	A designated batching plant is contained – deflects surface water runoff.	Designate and contain a concrete batching plant within the construction camp by deflecting surface water runoff on the up-and down-slope side using, for example, sandbags.	Contractor	Ongoing	Compliance to be verified by ECO and IEA
08	Contractor readiness	Construction of linear infrastructure across the ephemeral drainage system will involve temporary diversion works, changing the surface water hydrology or flow patterns.	Altered aquatic ecosystem structure and function.	Construction during dry months and clearing/grubbing end of wet season	The civil construction phase should be restricted to the dry winter months (e.g., April/May to September), that is commence with such activities as clearing or grading, excavating and importing material at the end of the wet season/beginning of the dry season whilst the soil is still moist to reduce dust and as far as is practical, be completed in, the dry winter months with a decreased probability of storm events	Holder, Contractor	Pre-construction	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
07	L	L	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
07	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
08	L	L	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
08	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

- The residual risk of surface and water pollution (**07**) after mitigation is assumed to be Low.
- The residual risk of erosion caused by changed surface water flow patterns (**08**) after mitigation is assumed to be Low.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Receiving Environment: Terrestrial and Avian Ecosystem

Description of potential impacts:

Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Site establishment (Layout)	Site selection	N/A	**Impact:** The largest risk is potential run-off and stormwater discharge from the site into the surrounding causing soil erosion. (Hydrology Assessment) **Consequences:** - Erosion can result in a degraded or dysfunctional ecosystem (direct) and loss of ecosystem services (indirect)	Transformation	09
Site establishment (Layout)	Site area (size)	N/A	**Impact:** The physical footprint of solar PV facility will result in a loss of local terrestrial habitat. **Consequence:** - reduced habitat for terrestrial fauna and Aves (direct). - reduced productivity and carrying capacity (direct).	Quantity	10
Site establishment (Layout)	Site area (size)	N/A	**Impact:** Transformation of ecosystems and construction camp creep **Consequence:** Disturbance	Transformation	10
Site establishment (Layout)	Access restricted areas	N/A	**Impact:** Environmentally sensitive areas are disturbed due to uncontrolled access. **Consequence:** disturbance. loss of important flora/fauna species.	Transformation	10
Site establishment (Layout)	Quarry and crushing plant	N/A	**Impact:** The physical footprint of the quarry will result in a loss of local terrestrial habitat. **Consequence:** - reduced habitat for terrestrial fauna and Aves (direct). - reduced productivity and carrying capacity (direct).	Quantity	10
Site establishment (Layout)	Temporary road access	N/A	**Impacts:** damage to the environment due to unplanned movement of vehicles. **Consequence:** disturbance	Transformation	10
Site establishment (Layout)	Lighting	N/A	**Impact**: Disruption/alteration of ecological life cycles due to light pollution. **Consequence:** altering breeding, migration, feeding cycles of fauna.	Transformation	11

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

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Reg: 2006/023163/23

- A surface area of approximately 2 ha will be required for the borrow pit and 4 ha for the construction camp.

Impact 09 (Surface Water Hydrology)

- The project area is located within a Strategic Water Source Area (Screening Report). Strategic Water Source Areas (SWSAs) are defined as areas of land that (a) supply a disproportionate (e.g., relatively large) quantity of mean annual surface water runoff in relation to their size and so are considered nationally important; and/or (b) have high groundwater recharge and where the groundwater forms a nationally important resource. **The protection and restoration of strategic water source areas is of direct benefit to all downstream users.** This dependence needs to be considered in decisions relating to these primary headwater catchments. The protection of both water quantity (flows) and quality must be addressed. Any failure to address impacts on water quality or quantity will have impacts on the water security of all those depending on that water downstream. Groundwater is the main or only source of water for numerous towns and settlements across the country **so protecting the capture zone, specifically for municipal supply well-fields, the recharge area, and the integrity of the aquifers is important as well**.
- The largest risk is potential run-off and stormwater discharge from the site into the surrounding causing soil erosion and should be managed according to the CSWMP and Monitoring Plan (for the Storm Water Management System and ground and surface water resources. (Hydrology Assessment)
- Considering run-off is directly related to rainfall intensity, and longer precipitation events, both monthly rainfall and run-off, peak from January to April. The run-off during these peak months ranges from 0,3 to 1,1 mm/yr over the surface area of quaternary catchment D62D. The annual run-off from natural (unmodified) catchments in D62D is approximately 0,9% of the MAP. (Hydrology Assessment)
- The solar panels are going to have an impact on rainfall runoff, especially along the dripline of the panels, and that will probably be an area of ongoing management, as well as channelling from the “two-spoor” roads in-between the panel arrays and along the perimeter fence, necessary for inspection and cleaning. As the panels need to be largely north facing (although they will be single-axis tracking units), at face value, the orientation of the panels and associated service roads will lie largely on the contour, which will be important for minimising runoff down the slope.
- Accounting for changes in soil type, slope angle and rainfall intensity, ground cover beneath solar arrays was found to have the most significant impact on run-off rates. It is therefore anticipated, that maintaining natural vegetation cover will assist in preventing increases in peak flow to the non-perennial streams/rivers. Hence, a marginal impact in terms of post-development peak flows on a sub-catchment scale is anticipated. It is predicted that there may only be an impact on the sub-catchment flood peak flows, if severe erosion and vegetation clearing activities take place, with inadequate stormwater management. So, if vegetation cover beneath the solar arrays is maintained, no significant increase in surface water run-off (run-off volumes, peak rates or time to peak rates) is anticipated compared to greenfield run-off rates.

Impact 10 (Terrestrial Biodiversity)

- Although there are no CBAs within the affected area, the whole of the Soventix Phase 3 site falls within an extensive ESA. According to the reasons layer that accompanies the CBA map, the ESA is based on the selection of the area as Northern Upper Karoo, the Platberg - Karoo

Conservancy Important Bird Area, the presence of natural wetlands, rivers, and wetland FEPAs. However, the aquatic features listed above have been excluded from the development footprint, with the result that the impact of the development on these features would be minimal.

- There are no impacts associated with the development of the Soventix Phase 3 site on terrestrial biodiversity that cannot be mitigated to an acceptable level.
- Northern Upper Karoo is one of the most extensive vegetation types in the country and occupies over 40 000km2 of the interior Karoo. The vegetation consists of shrubland dominated by dwarf Karoo shrubs, grasses and Acacia mellifera subsp. detinens, and other low trees particularly on the sandy soils. Four plant species are known to be endemic to the vegetation type, Lithops hookeriana, Stomatium pluridens, Galenia exigua and Manulea deserticola. Northern Upper Karoo has not been significantly affected by transformation and is still approximately 96% intact and is classified as Least Threatened.

Impact 11 (Lighting)

- Although the facility will not be lit up during the nighttime period, selected infrastructure will have to be illuminated. These comparatively small, illuminated areas can still impact the surrounding ecological functioning (including biological systems) of the adjacent landscape through spill over lighting and sky glow.
- Artificial lighting is well known to disrupt the flow of information to organisms, provides misleading clues and can cause interspecific competition for food resources by extending diurnal species foraging activity into the night-time period. As such, the spill-over of artificial lighting beyond the proposed solar PV facility into dark, natural spaces must be prevented.
- Known impacts of artificial lighting on bats are; delayed emergence and reduced number of individuals from roosts, changes in navigation and commuting behaviour, foraging behaviour alterations, the creation of “barriers” limiting the connectivity of habitats in the landscape and the effective dispersal of species (isolating habitat patches and populations from immigration), and decreased growth rates of young bats if adult bats incur higher energetic losses and experience decreased foraging time if they have to forage further afield from maternity roosts.
- Artificial lighting appears to benefit some bat species (light-tolerant) through increasing their foraging efficiency by identifying and exploiting insects swarming around lights.
- Light intolerant bat species are often slow flying and highly manoeuvrable, adapted for foraging in cluttered environments such as Rhinolophids and Nycterids. One reason for these species avoiding lit areas is that their echolocation call structure is not well suited for foraging in the open habitat associated with artificial lighting. A second reason for certain bat species to avoid artificially lit areas is the sensitivity of bat eyes to light. As light intensity increases, bat’s visual sensitivity decreases.
- Lighting, particularly in arid regions can have significant impacts on arid bat communities where bats may reduce drinking activity due to artificial lighting.

<u>Assessment without mitigation:</u>

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Reg: 2006/023163/23

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
09	H	L	M	-I	H	H	1	H	H	1
Reversibility	M	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
10	M	L	M	-I	M	H	1	M	H	1
Reversibility	M	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
11	H	L	M	-I	H	M	1	H	M	1
Reversibility	M	**Irreplaceability**	H	**Mitigatory Potential**	H					

<u>Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):</u>

- Commencement with construction, specifically civil works may only take place after the peak monthly rainfall and run-off period (from January to April), and preferably during the winter months (e.g., June to September) when there is a decreased probability of storm events. Civils works should as far as is practical be completed before the next rainfall season.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Chiropteran Specialist Report for Phase 3 of the Proposed Soventix-Solar Africa Solar PV Facility, Hanover, Northern Cape Prepared by: Dawn Cory Toussaint dated July 2022
- Aquatic Biodiversity Impact Assessment, Section 21(c) & (i) Risk Assessment and Wetland Delineation Verification Report prepared by Dr Andrew Deacon dated August 2022.
- Hydrological Assessment (Version – Final 3) 01 September 2022 GCS Project Number: 22-0076 by Hendrik Botha.
- National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds, Commonwealth of Australia 2020
- Soil Mapping Report prepared by Hennie van den Burg of Iris International and Francois Botha of Eco Soil dated June 2022.
- Grazing Potential Assessment prepared by Francois de Wet of Enviro Pulse and Shobie Arnoldi of Topveld dated June 2022.
- Terrestrial Biodiversity Specialist Assessment – Soventix Phase 3 Pv Project (Final) prepared by Simon Todd of 3 Foxes Biodiversity Solutions dated September 2022.

Mitigations:

Impact Management Outcome(s):

- Altered aquatic ecosystem structure and function.
- Minimize habitat loss.
- Ensure least impact on animal behaviour.

Targets:

- Construction during dry months and clearing/grubbing end of wet season.
- No construction creep beyond demarcated boundaries.
- Method statement (camp layout plan).
- Fenced camp.
- No disturbance of undisturbed or sensitive vegetation units.
- Aerial or overhead equipment used where possible.
- Barrier around restricted areas.
- Natural vegetation is retained.
- Contractor has an environmental file on site.

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Reg: 2006/023163/23

- No unplanned access roads.
- No impacts on animal species due to lighting.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
09	Contractor readiness	Construction of linear infrastructure across the ephemeral drainage system will involve temporary diversion works, changing the surface water hydrology or flow patterns.	Altered aquatic ecosystem structure and function.	Construction during dry months and clearing/grubbing end of wet season	The civil construction phase should be restricted to the dry winter months (e.g., April/May to September), that is commence with such activities as clearing or grading, excavating and importing material at the end of the wet season/beginning of the dry season whilst the soil is still moist to reduce dust and as far as is practical, be completed in, the dry winter months with a decreased probability of storm events	Holder, Contractor	Pre-construction	Compliance to be verified by ECO and IEA.
10	Site establishment (Layout)	Transformation of ecosystems and	Minimize habitat loss	No construction creep beyond	The construction camp, including planned	Contractor, ECO	Pre-construction	Compliance to be verified by

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		construction camp creep		demarcated boundaries.	operational area, shall not exceed 4 ha in size.			ECO and IEA.
10	Site establishment (Layout)	Transformation of ecosystems and construction camp creep	Minimize habitat loss	Method statement (camp layout plan)	A method statement must be provided by the contractor prior to any onsite activity that includes the layout of the construction camp in the form of a plan showing the location of key infrastructure and services (where applicable), including but not limited to offices, overnight vehicle parking areas, stores, stockpile and lay down areas, hazardous materials storage areas (including fuels), the batching plant (if one is located at the construction camp), designated	Contractor	Pre-construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					access routes, equipment cleaning areas, cooking and ablution facilities, waste and wastewater management			
10	Site establishment (Layout)	Transformation of ecosystems and construction camp creep	Minimize habitat loss	Fenced camp	The camp must be fenced	Contractor	Pre-construction	Compliance to be verified by ECO and IEA.
10	Site establishment (Layout)	Transformation of ecosystems and construction camp creep	Minimize habitat loss	No disturbance of undisturbed or sensitive vegetation units.	Minimise the development footprint as far as possible, which includes locating temporary-use areas such as construction camps and lay-down areas in low sensitivity or previously disturbed areas.	Contractor, ECO	Pre-construction	Compliance to be verified by ECO and IEA.
10	Site establishment (Layout)	Transformation of ecosystems and construction camp creep	Minimize habitat loss	No disturbance of undisturbed or sensitive vegetation units.	Minimise the development footprint near watercourses and other ecologically significant features.	Contractor, ECO	On-going	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
10	Site establishment (Layout)	Transformation of ecosystems and construction camp creep	Minimize habitat loss	Aerial or overhead equipment used where possible	Avoid the construction of a crossing or staging area by either choosing an alternative route or by using aerial or overhead equipment.	Contractor, ECO	On-going	Compliance to be verified by ECO and IEA.
10	Site establishment (Layout)	Environmentally sensitive areas are disturbed due to uncontrolled access.	Minimize habitat loss	No disturbance of undisturbed or sensitive vegetation units.	Identification of access restricted areas is to be informed by the environmental assessment, site walk through and any additional areas identified during development.	Contractor, ECO	Pre-construction	Compliance to be verified by ECO and IEA.
10	Site establishment (Layout)	Environmentally sensitive areas are disturbed due to uncontrolled access.	Minimize habitat loss	Barrier around restricted areas	Erect, demarcate and maintain a temporary barrier with clear signage around the perimeter of any access restricted area, colour coding could be used if appropriate.	Contractor	Pre-construction	Compliance to be verified by ECO and IEA.
10	Site establishment (Layout)	Environmentally sensitive areas are disturbed due to	Minimize habitat loss	No disturbance of undisturbed or sensitive vegetation units.	Unauthorised access and development related activity	Contractor, ECO	Laying underground cables/pipelines	Compliance to be verified by

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		uncontrolled access.			inside access restricted areas is prohibited except for the laying of underground cables/pipelines			ECO and IEA.
10	Site establishment (Layout)	The physical footprint of the quarry will result in a loss of local terrestrial	Minimize habitat loss.	Natural vegetation is retained.	The quarry shall not exceed 2 ha in size.	Contractor	On-going	Compliance to be verified by ECO and IEA.
10	Site establishment (Layout)	The physical footprint of the quarry will result in a loss of local terrestrial	Minimize habitat loss.	Natural vegetation is retained.	The borrow pit may only be used to source suitable material for improvements to the property that it is located on.	Contractor	On-going	Compliance to be verified by ECO and IEA.
10	Site establishment (Layout)	Damage to the environment due to unplanned movement of vehicles.	Minimize habitat loss.	Contractor has an environmental file on site	All contractors must be made aware of all these access routes.	Contractor	On-going	Compliance to be verified by ECO and IEA.
10	Site establishment (Layout)	Damage to the environment due to unplanned movement of vehicles.	Minimize habitat loss.	No disturbance of undisturbed or sensitive vegetation units.	Maximum use of both existing servitudes and existing roads must be made to minimize further disturbance through the development of new roads	Contractor	On-going	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
10	Site establishment (Layout)	Damage to the environment due to unplanned movement of vehicles.	Minimize habitat loss.	Planned access roads	Access roads in flattish areas must follow fence lines and tree belts to avoid fragmentation of vegetated areas or croplands.	Contractor, ECO	On-going	Compliance to be verified by ECO and IEA.
10	Site establishment (Layout)	Damage to the environment due to unplanned movement of vehicles.	Minimize habitat loss.	No unplanned access roads	Access roads must only be developed on a pre-planned and approved roads.	Contractor, ECO	On-going	Compliance to be verified by ECO and IEA.
11	Site establishment (Layout)	Disruption/alteration of ecological life cycles due to light pollution.	Ensure least impact on animal behaviour.	No impacts on animal species due to lighting.	Any outside lighting should be minimised, positioned at or below roof height and directed away from highly sensitive areas, e.g., downwards.	Contractor, ECO	On-going	Compliance to be verified by ECO and IEA.
11	Site establishment (Layout)	Disruption/alteration of ecological life cycles due to light pollution.	Ensure least impact on animal behaviour.	No impacts on animal species due to lighting.	Fluorescent and mercury vapor lighting should be avoided, and sodium vapor (green/red) lights should be used wherever possible."	Contractor, ECO	On-going	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

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Reg: 2006/023163/23

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
09	L	L	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
09	H	L	H	-I	H	M	1	M	M	1

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
10	L	L	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
10	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
11	L	L	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
11	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

- The residual risk of lost biodiversity from erosion (**09**) after mitigation is assumed to be Low.
- The residual risk of losing terrestrial ecosystems, including through fragmentation (**10**) after mitigation is assumed to be Low.
- The residual risk of disrupted life cycles from artificial lighting (**11**) after mitigation is assumed to be Low.

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Reg: 2006/023163/23

Receiving Environment: Aquatic Ecosystem

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Planning	Waste management plan	N/A	**Impact:** Pollution due to accidental releases of contaminated liquids. **Consequence:** Loss of flora and fauna	Transformation	12
Site establishment (Layout)	Fuel storage and refuelling	N/A	**Impact:** Chemical pollution of the soil and water resources. **Consequence:** Loss of flora and fauna	Transformation	12
Contractor readiness	Development of method statements	N/A	**Impact:** Loss of riparian systems and disturbance of the alluvial water courses. **Consequence:**	Transformation	12
Contractor readiness	Commencement	N/A	**Impact:** The generation of excessive wind-blown dust could 'choke' the ecologically sensitive ephemeral drainage line system. **Consequence:** Turbid waters reduce light penetration, decreasing photosynthesis and primary production, reducing food availability for aquatic organisms higher up the food chain. Suspended solids may interfere with the feeding mechanisms of filter-feeding organisms such as certain macroinvertebrates, and the gill functioning, foraging efficiency (due to visual disturbances) and growth of fish, leading to changes in invertebrate and fish assemblages. Suspended solids that settle out may cover spawning grounds (places to lay eggs), smother or abrade benthic plants and animals, resulting in changes to the nature of the substratum where invertebrates live, causing either change in the structure of the biotic community by the replacement of these organisms with organisms that burrow in soft sediments, or massive declines in fish populations. Sensitive species may be permanently	Transformation	12

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Reg: 2006/023163/23

			eliminated if the source of the suspended solids is not removed. Alter feeding and breeding behaviour (lowering vigour and reproductivity), species composition and aquatic ecosystem functioning.		
Site establishment (Layout)	Site selection	N/A	**Impact:** Surface water run-off laden with sediment from the construction camp area/hydrocarbon spills can enter the watercourse, increasing turbidity: **Consequence:** turbidity or increased Total Suspended Solids can alter ecosystem structure and function.	Transformation	13

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 12 (Aquatic Biodiversity)

- An Aquatic Biodiversity Impact Assessment was commissioned to inter alia Identify, describe, delineate, and demarcate ecological buffers around watercourses, including wetlands.
- The drainage systems are predominantly classified as ephemeral, which means that the stream flows briefly in direct response to precipitation in the immediate vicinity, and the channel is at all times above the ground-water reservoir. These ephemeral tributaries of the Brak River and considered to be in a largely natural ecological state. These systems have a far less predictable flow regime compared to perennial or seasonal rivers, and are frequently dry for long periods in arid regions. The ephemeral drainage system consists of one major ephemeral drainage channel which are fed by upstream catchment areas beyond the project area fence line. Three smaller tributaries are feeding into the main drainage line in the project area. The ecological importance and sensitivity category (EISC) of the ephemeral drainage system and associated alluvial floodplains is classified as “High” and therefore considered as a "no-go area" for all infrastructure apart from access roads, pipelines, cables and pylons. The no-go area includes the ecological buffer.
- The delineated ephemeral drainage system is of conservation importance as it is considered a Freshwater Ecosystem Protected Area (FEPA) category. The entire sub-quaternary catchment indicates that the surrounding land and smaller stream network need to be managed in a way that maintains the good condition (A or B ecological category) of the river reach.
- A buffer of 20 m wide on both sides of the drainage line delineation is required during the construction and operational phases to protect the Phase 3 PV facility in its current condition from any degradation. This buffer width is obtained whenever the following mitigation measures are applied to the model: (a) the management of surface water runoff, (b) erosion monitoring, and (c) constraints regarding the clearing of vegetation within these areas.

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Reg: 2006/023163/23

- The generation of excessive wind-blown dust could 'choke' the ecologically sensitive ephemeral drainage line system (pers. comm. Sam Laurence). The recovery of a stream from sediment deposition is dependent on the elimination of the sediment source and the potential for the deposited material to be flushed out by stream flow.

Impact 13 (Surface Water Hydrology)

- The project area is located within a Strategic Water Source Area (Screening Report). Strategic Water Source Areas (SWSAs) are defined as areas of land that (a) supply a disproportionate (e.g., relatively large) quantity of mean annual surface water runoff in relation to their size and so are considered nationally important; and/or (b) have high groundwater recharge and where the groundwater forms a nationally important resource. **The protection and restoration of strategic water source areas is of direct benefit to all downstream users.** This dependence needs to be considered in decisions relating to these primary headwater catchments. The protection of both water quantity (flows) and quality must be addressed. Any failure to address impacts on water quality or quantity will have impacts on the water security of all those depending on that water downstream. Groundwater is the main or only source of water for numerous towns and settlements across the country **so protecting the capture zone, specifically for municipal supply well-fields, the recharge area, and the integrity of the aquifers is important as well**.
- The project area falls within quaternary catchment D62D and the Orange Water Management Area. (Hydrology Assessment)
- The ephemeral drainage line running through the project area is an unnamed tributary to the D62D – 05610 tributary with its confluence just downstream of the Project Area. (Plan of Study prepared by Dr Andrew Deacon)
- The project area contains 3 Hydrological Response Units (HRU). Ninety-six percent (96%) of the project area falls within HRU2. The average slope of HRU2 (21,738 km2) is 0,56%. Sixteen percent (16,51%) of HRU2 has a 3-10% slope, which is mostly restricted to the western and eastern corners of the project area. Consequently, the topography of the study area is generally flat with elevations on the site typically ranging from 1 335 to 1 370 m above mean sea level. (Hydrology Assessment)
- Drainage is generally towards the north-west via multiple non-perennial drainage lines towards the ephemeral Brak River, approximately 6,6 km further downstream. (At least) Three small capacity in-stream dams occur within the development area. (Hydrology Assessment)
- The rivers are ephemeral and only have water shortly after storm events. (Hydrology Assessment) – **Construction of watercourse crossings during the dry winter months will minimise the risk of sedimentation and increased TSS or turbidity.**
- It is anticipated that soils downstream of the proposed development, and the non-perennial streams (feeding into temporary livestock watering dams) are the receivers of any sediment runoff or poor-quality runoff from the site. (Hydrology Assessment)
- It is proposed that four (4) bi-annual water monitoring points be established in the non-perennial stream and temporary dams constructed by the landowner. These are the only areas where there will likely be sufficient water to sample and monitor the impact of the development on pH, Electrical Conductivity (EC)/Total Dissolved Solids (TDS), and Temperature. It is proposed that monitoring take place up to 2 years after the completion of the development (Hydrology Assessment) – **Baseline measurements will need to be obtained prior to the commencement of construction**.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
12	M	L	M	-I	M	M	1	H	M	1
Reversibility	M		**Irreplaceability**	H		**Mitigatory Potential**	H			

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
13	M	L	M	-I	M	M	1	M	M	1
Reversibility	H		**Irreplaceability**	H		**Mitigatory Potential**	H			

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- Commencement with construction, specifically civil works may only take place after the peak monthly rainfall and run-off period (from January to April), and preferably during the winter months (e.g., June to September) when there is a decreased probability of storm events. Civils works should as far as is practical be completed before the next rainfall season.

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Reg: 2006/023163/23

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Hydrological Assessment (Version – Final 3) 01 September 2022 GCS Project Number: 22-0076 by Hendrik Botha
- Aquatic Biodiversity Impact Assessment, Section 21(c) and (i) Risk Assessment and Wetland Delineation Verification by Dr Andrew Deacon August 2022.
- Soil Mapping Report prepared by Hennie van den Burg of Iris International and Francois Botha of Eco Soil dated June 2022.
- National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds, Commonwealth of Australia 2020
- The National Water Act, 1998 (Act No. 36 of 1998) requirements with regards to *inter alia* classification of water resources and Resource Quality Objectives (RQO's) must be adhered to.
- The White Paper on a National Water Policy for South Africa (1997), states that effective resource protection requires two separate sets of measures. The first are resource-directed measures, which set clear objectives for the desired level of protection for each resource. The second are source-directed controls which aim to control what is done to the water resource by way of registration of sources of impact, standards for waste discharges, best management practices, permits, Water Use Authorisations, impact assessments and environmental management plans - so that the resource protection objectives are achieved.

Mitigations:

Impact Management Outcome(s):

- Ensure legal compliance with the prevailing and pertinent legislation.
- Avoid pollution.
- Reduce the amount of waste disposed to landfill.
- Minimise dust generation
- Preserve aquatic ecosystem structure and function.

Targets:

- Integrated waste management plan.
- Refuelling points are located outside of sensitive areas.
- Method statement and compliance thereof for the ephemeral drainage line and buffer.
- Construction during dry months with mining from quarry during wet summer season.
- Areas of infrastructure placement have been graded flat.
- Roads are at natural ground level.
- Sources of pollution are contained – deflects surface water runoff.

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Reg: 2006/023163/23

- Construction camp outside of buffers.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
12	Planning	Pollution due to accidental releases of contaminated liquids.	Ensure legal compliance with the prevailing and pertinent legislation. Avoid pollution. Reduce the amount of waste disposed to landfill.	Integrated waste management plan	Develop and implement an integrated waste management plan that (a) adopts the cradle-to-grave approach extending from waste prevention and minimization to generation, storage, collection, transportation, treatment, and final disposal of waste, (b) incorporates all aspects of the waste management hierarchy, and (c) is aligned with the Waste Classification and Management Regulations (GN No. 634 of 23rd August 2013).	Contractor	Ongoing	Compliance to be verified by ECO and IEA
12	Site establishment (Layout)	Chemical pollution of the soil and water resources.	No incidents of chemical pollution of land/watercourses	Refuelling points are located outside of sensitive areas	Sites of oiling and refuelling points must be located more than 100m away from surface water sewers or edge of a watercourse.	Contractor	Ongoing	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
12	Contractor readiness	Loss of riparian systems and disturbance of the alluvial water courses.	Riparian systems and alluvial water courses are maintained as far as possible.	Method statement for the ephemeral drainage line and buffer.	A construction method statement should be compiled and approved prior to the commencement of construction activities in the ephemeral drainage line and its buffer. The method statement should take cognisance of: (a) the mitigation measures identified in the Aquatic Biodiversity Impact Assessment Report, as well as mitigation measures specified by each of the environmental specialists. (b) the conditions of the Environmental Authorisation and Integrated Water Use License. (c) the Environmental Management Programs (EMPr's)	Contractor	Pre-construction	Compliance to be verified by ECO and IEA
12	Contractor readiness	Loss of riparian systems and disturbance of	Riparian systems and alluvial water courses are	Compliance with the method statement for the ephemeral	The Environmental Control Officer (ECO) must ensure that the contractor	ECO	Pre-construction and Construction	Compliance to be verified by

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		the alluvial water courses.	maintained as far as possible.	drainage line and buffer.	adheres to the method statement.			ECO and IEA
12	Site establishment (Layout)	Loss of riparian systems and disturbance of the alluvial water courses.	Riparian systems and alluvial water courses are maintained as far as possible.	Areas of infrastructure placement have been graded flat	Areas of infrastructure placement must be graded flat so as not to cause vegetation root mat loss or restriction to sub surface flow.	Contractor	Pre-construction and construction	Compliance to be verified by ECO and IEA.
12	Site establishment (Layout)	Loss of riparian systems and disturbance of the alluvial water courses.	Riparian systems and alluvial water courses are maintained as far as possible.	Roads are at natural ground level	Construction of roads must occur at natural ground level (not below) to minimize to restricting water flow.	Contractor	Pre-construction and construction	Compliance to be verified by ECO and IEA.
12	Contractor readiness	The generation of excessive wind-blown dust could 'choke' the ecologically sensitive ephemeral drainage line system.	Minimise dust generation	Construction of Linear infrastructure during dry months	The construction of linear infrastructure across parts of the ephemeral drainage system, should be restricted to the dry winter months (e.g., May to September), that is commence with such activities as clearing or grading, excavating and importing material at the end of the wet season/beginning of the dry season whilst the soil is still moist and as far as	Contractor	Pre-construction and construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					is practical, be completed in, the dry winter months.			
12	Contractor readiness	The generation of excessive wind-blown dust could 'choke' the ecologically sensitive ephemeral drainage line system.	Minimise dust generation	Construction during dry months	The civil construction phase should be restricted to the dry winter months (e.g., April/May to September), that is commence with such activities as clearing or grading, excavating and importing material at the end of the wet season/beginning of the dry season whilst the soil is still moist to reduce dust and as far as is practical, be completed in, the dry winter months with a decreased probability of storm events.	Contractor	Pre-construction and construction	Compliance to be verified by ECO and IEA.
12	Contractor readiness	The generation of excessive wind-blown dust could 'choke' the ecologically sensitive ephemeral drainage line system.	Minimise dust generation	Mining from quarry during wet summer season.	Mining of suitable material from a quarry for road construction and associated rock crushing should as far as is practical take place during the wet summer season	Contractor	Pre-construction and construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					prior to the commencement of the civil construction phase.			
13	Site establishment (Layout)	Surface water run-off laden with sediment from the construction camp area/hydrocarbon spills can enter the watercourse, increasing turbidity.	Preserve aquatic ecosystem structure and function.	Construction camp outside of buffers	The construction camp shall be located within PV Block 4 at least 100 m from the delineated edge of the ecological buffer surrounding the ephemeral drainage system.	Contractor, ECO	Pre-construction	Compliance to be verified by ECO and IEA.
13	Site establishment (Layout)	Surface water run-off laden with sediment from the construction camp area/hydrocarbon spills can enter the watercourse, increasing turbidity.	Preserve aquatic ecosystem structure and function.	Sources of pollution are contained – deflects surface water runoff.	Designate and contain potential sources of pollution, e.g., concrete batching area, within the construction camp by deflecting surface water runoff on the up-and down-slope side using, for example, sandbags.	Contractor	Ongoing	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
12	L	L	L	neutral	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

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Reg: 2006/023163/23

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
12	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
13	L	L	L	neutral	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
13	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- Despite the mitigations to avoid significant suspended sediment in the river, strong flows or a flash flood during summer would render any watercourse diversion works futile.
- The residual risk of transformation of the aquatic ecosystem (**12**) after mitigation is assumed to be Low to zero.
- The residual risk of increased turbidity due to sedimentation/contamination (**13**) after mitigation is assumed to be zero.

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Reg: 2006/023163/23

Receiving Environment: Economical

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Planning	Stakeholder Engagement Plan	Grievance mechanism	**Impact:** Damage to farm infrastructure **Consequence:** Economic costs in replacing damaged infrastructure.	N/A	14
Planning	Traffic Management Plan	N/A	**Impact:** Transport of abnormal roads could be delayed. **Consequence:** Delays in construction	N/A	15
Contractor readiness	Acquiring permits, licenses, Letters of consent and permissions	Other approvals	**Impact:** Failure to obtain approvals, licenses or permits. **Consequence:** Delayed commencement of construction and increased project cost (indirect).	N/A	15
Site establishment (Layout)	Site selection	N/A	**Impact:** Commercially available sources of concrete aggregate may prove to be too distant. **Consequence:** Distant sources of material may be too expensive for utilization on site.	N/A	15

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 14 (Damage to Property/Vehicles)

- This impact is not addressed here as the **impact has been addressed under the Receiving Environment: Terrestrial Fauna.**

Impact 15 (Transport/Distance)

- The primary access to the proposed 400 MW solar PV facility will be at the junction of the N10 with the existing Burgerville (District) Road. The shoulder sight distance (> 450 m) to the left of the primary site access location will be sufficient (at a design speed of 120 km/hr). Sight distance to the right, however, was measured as approximately 320 m, which is sufficient for Passenger vehicles (P), but not a Single-Unit Truck (SU). It therefore is proposed that appropriate traffic accommodation be placed on the eastern approach of the N10, indicating a construction access ahead with a possible flagman to alert drivers and slow them down.

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Reg: 2006/023163/23

- There are three alternative routes for the haulage of imported materials to the proposed PV facility, including from (a) the Cape Town harbour, (b) Port of Ngqura, and (c) Port of Saldanah. The preferred route is from the Port of Ngqura as it is the shortest (445 km) and fastest route to the site, following the N2 from the Port before turning north onto the N10 past Hanover and up to the access at Burgerville Road.
- Solar panels, frames and inverters are to be transported in 40-foot containers (which have exterior dimensions of 12.19m long x 2.44m wide x 2.59m high) on double axel trucks within the road freight limitations of South Africa.
- Better quality material (sandstone) which appears to be intermittently used in road layers occurs at a large dormant quarry near the N10 national road (at coordinates 30,87990° S; 24,23715° E). This quarry is located 16 kilometres by road from the Phase 3 site.
- In the event that the engineers decide to create a new quarry in the project area (as opposed to lawfully mining from any of the other existing quarries in the area), then rock from the locality P24 (in Figure 2 of the Geotechnical Assessment Report) including the adjacent baked sediments may be utilized as construction materials as long as it remains further then 100 m from the ecological buffer.

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
15	M	L	M	-I	M	H	1	M	H	1

Reversibility	H	Irreplaceability	H	Mitigatory Potential	H

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

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Reg: 2006/023163/23

- None

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Soil Mapping Report prepared by Hennie van den Burg of Iris International and Francois Botha of Eco Soil dated June 2022.
- Geotechnical Assessment Study prepared by FDJ Stapelberg, Council for Geoscience (Project No. CO2017-5806 (Phase 80)), dated 11th May 2022.
- Traffic Impact Assessment prepared by Annebet Krige of Sturgeon Consulting (Pty) Ltd dated September 2022 (Project No.: STUR0352).

Mitigations:

Impact Management Outcome(s):

- Maintain financial feasibility of the project.
- Safe (unobstructed) delivery of abnormal loads to site.
- Legal compliance.
- Good quality material for aggregate/roads.

Targets:

- Minimise travel distances of materials.
- Abnormal loads are delivered to site timeously.
- Approvals/licences/permits.
- Material tests (aggregate).

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
15	Planning	Haulage of imported materials incur a cost relating to distance travelled and time.	Maintain financial feasibility of the project.	Minimise travel distances of materials	The engineers should consider the feasibility of the preferred alternative route for the haulage of imported materials from the Port of Ngqura to the proposed PV facility as recommended in the Traffic Impact Assessment Report.	Holder, Engineer	Pre-construction	Compliance to be verified by ECO and IEA.
15	Planning	Transport of abnormal roads could be delayed.	Safe (unobstructed) delivery of abnormal loads to site.	Abnormal loads are delivered to site timeously.	The appointed engineers should investigate the route to the site to ensure that the abnormal loads are not obstructed at any point by geometric, height and width limitations along the route.	Holder, Engineer	Pre-construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

15	Contractor readiness	Failure to obtain approvals, licenses or permits	Legal compliance	Approvals/licences/permits	Obtain at least all the approvals identified in the Planning and Design Phase (under ""Legal Compliance"") prior to commencing construction.	Holder, Contractor, ECO	Pre-construction	Compliance to be verified by ECO and IEA.
15	Site establishment (Layout)	Commercially available sources of concrete aggregate may prove to be too distant.	Good quality material for aggregate/roads	Material tests (aggregate)	Dolerite rock or baked sediments from the Phase 3 terrain can be considered for sources of concrete aggregate or road surfacing but materials will need to be tested for grading distribution, Atterberg limits, compaction-moisture density values and durability.	Contractor	Pre-construction	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
15	M	M	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

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Reg: 2006/023163/23

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
15	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

- The residual risk of damage to property (**14**) has been **addressed under the Receiving Environment: Terrestrial Fauna.**
- The residual risk of reducing the financial feasibility (transport and distances) of the project (**15**) after mitigation is assumed to be Low.

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Reg: 2006/023163/23

Receiving Environment: Social

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Planning	Social Impact Management Plan	Social Impact Management Plan	**Impact:** Cumulative social impacts as it relates to social ills such as increases in crimes, theft, HIV rates, unemployment levels etc. **Consequences:** Increases in HIV rates, crimes. energy field and the local and district municipality.	N/A	16
Planning	Stakeholder Engagement Plan	Communication	**Impact:** There is an expectation from the affected communities and municipalities that the Soventix project will result in similar benefits and opportunities as other existing renewable projects in the area. **Consequence:** If Soventix does not manage stakeholder expectations from the beginning of the project, it can result in reputational damage for the company, bad stakeholder relationships and in the worst-case scenario violent protests	N/A	16
Planning	Stakeholder Engagement Plan	Communication	**Impact:** There is a level of uncertainty amongst the directly affected landowners with regards to timelines for the project. **Consequences:**	N/A	16
Planning	Stakeholder Engagement Plan	Grievance Mechanism	**Impact:** Vulnerable group's susceptible to negative influences in society such as prostitution, relationships with minors, alcohol and drug abuse, gambling and fighting due to the presence of people from outside the area. **Consequence:** Higher rates of crimes, HIV rates.	N/A	16
Planning	Corporate Social Responsibility	N/A	**Impact:** Economic benefits may not be achieved by residents/service providers. **Consequence:** Limited real benefits to local communities.	N/A	16
Planning	Recruitment	Recruitment	**Impact:** The proposed project will create positive economic impacts in the area. The most direct impact on a community level is job creation. **Consequence:** The increase in disposable income (via the project workers) will result in increased demand for goods and services, and greater spending within the local community.	N/A	16
Planning	Procurement	Procurement	**Impact:** Economic benefits may not be achieved by local residents/service providers. **Consequence:** Limited real benefits to local communities.	N/A	16
Contractor Readiness	Employment of labour	Influx of job-seekers and construction	**Impact:** Vulnerable group's susceptible to negative influences in society such as prostitution, relationships with minors, alcohol and drug abuse, gambling and fighting due to the presence of people from	N/A	16

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Reg: 2006/023163/23

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
		workers into the area.	outside the area. **Consequence:** Higher rates of crimes, HIV rates.		
Planning	Traffic Management Plan	Traffic	**Impact:** Noise pollution due to traffic. **Consequence:** Decrease in sense of place due to noise generated by traffic.	N/A	17
Planning	Traffic Management Plan	Traffic	**Impact:** Potential congestion and delays on the surrounding road network. **Consequence**: Disruptions and delays to local farmers in the area due to increase traffic volumes. Longer time periods for transportation of goods.	N/A	17

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 16 (Social aspect)

- A significant part of the population of De Aar can be seen as a vulnerable group susceptible to negative influences in society.
- Community relations go hand in hand with expectations. Community relations will remain important throughout the project, but the basis for future relations is established in the beginning phases of a project.
- In a 2004 study it was found that in De Aar, 120 out of every 1 000 (12%) children starting school showed some sign of being touched by Foetal Alcohol Syndrome Disorder (FASD). This is the highest rate in South Africa (Urban et al, 2008). South Africa has the highest FASD in the world. Many of the children also showed signs of malnutrition (Olivier et al, 2016). FASD may lead to primary disabilities such as intellectual disability, learning difficulties, poor impulse control, problems with attention, memory loss, social perception, reasoning and using judgement, cognitive processing, mathematics and language deficits, and developmental lags. Some secondary disabilities also associated with FASD include mental health problems, disrupted school experience, trouble with the law, custody, inappropriate sexual behaviour, and alcohol/drug problems (Streissguth et al, 2004). This means that a significant part of the population of De Aar can be seen as a vulnerable group susceptible to negative influences in society.
- Safety concerns mentioned by people from Hanover and De Aar include social ills such as prostitution, relationships with minors, alcohol and drug abuse, gambling and fighting due to the presence of people from outside the area.
- The municipality indicated that people coming from outside the area to work in the existing solar projects had a definite impact on the community. Different value systems lead to changes in behaviour, such as taverns being open on Sundays, sexual assaults, and an increase in the HIV rates. This may be a perception, as these aspects has been present in the community for a long time, but it must be acknowledged that these

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Reg: 2006/023163/23

social ills are typically associated with an influx of people because of development. A massive influx of people is not expected, since there should be some skilled labour in the area as a result of the other solar projects that have been established in the last few years. However, if the number of solar developments in a 30 km radius of the proposed development are all constructed at the same time, there may be cumulative impacts.

- A significant impact on basic services such as schools, health care, sanitation, and other municipal services are not expected due to the fact that a small number of temporary workers will enter the area for a limited period. The municipality indicated that there is a shortage of housing at the moment.
- Soventix assume that there will be 650 construction staff during peak construction and 55 staff during operation.
- Although the construction phase jobs are temporary and will not contribute to the unemployment levels in the long term, it would have a significant positive impact on the short term. The increase in disposable income (via the project workers) will result in increased demand for goods and services, and greater spending within the local community. Local businesses confirmed that during the construction of previous renewable energy facilities there was a definite positive economic impact in the town. Some of the positive impacts remained present, as a business owner reported a 40% increase of business, despite the recession.
- However, with an increase in economic activity from a boom-bust cycle created by construction events there are inherent risks. A local businessman explained that during the construction phase for another renewable energy facility there was an increase in eateries opening in De Aar. Lots of people applied for restaurant licences, but most places have subsequently closed. The sustainability of businesses created during boom periods must be ensured and prospective first-time business owners must be educated about the potential risks with opening a business.
- It can be anticipated that there are semi-skilled and unskilled labour present in the area that has experience of construction work during the establishment of the existing solar farms in the area. The municipality noted that they feel that the skills transfer from renewable energy companies up to now has been limited, and they would like to see more skills transfer programmes on a local level.
- Apart from the direct employment opportunities, there will also be significant indirect economic opportunities for local entrepreneurs. Opportunities include transport, fencing, road maintenance, accommodation, meals, and laundry services. Several people reported that they established businesses that provide services to the renewable sector and has benefitted from the presence of these facilities in the area. The highly skilled technical people will need accommodation and other hospitality services while they reside in the area during the construction period. Some of the adjacent farms offer accommodation, which may be a viable option for some of the workers. Whilst some of the technical jobs need highly skilled people that are not available locally, service providers must make use of the secondary opportunities that are available locally.
- The Department of Energy (DoE), through the RFP document, requires that all renewable energy bidders must illustrate how the Project will benefit the local community. At present, the DoE is stipulating that one percent of revenue generated by the project must be contributed towards socio-economic development. In accordance with the relevant BBBEE legislation and guidelines, up to four percent of profit after tax could be

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Reg: 2006/023163/23

used for community development over and above that associated with expenditure in the area. The BBBEE Scorecard specifies the following contributions (totalling four percent):
    - Enterprise development – maximum of 15 points awarded for the contribution of three percent of profit after tax, or more; and
    - Socio-economic development – maximum of five points awarded for the contribution of one percent of profit after tax, or more.
- If these contributions are realised, the project has the opportunity to make a real difference in the local community. Between NGOs that serve the interest of the community as a whole and the municipality Soventix can be assisted with identifying worthwhile projects that will be sustainable and lead to direct local benefits in the communities that will be affected by the project.
- The grievance mechanism must be communicated to the affected communities. It is imperative for Soventix and the municipality to have a good relationship, since the parties will need each other to ensure that societal impacts can be mitigated.
- There is still a level of uncertainty amongst the directly affected landowners. The timelines for the project are not clear to them, they would like greater clarity about when the construction will start, how long it would be and what the layout and design of the solar panels will be. Other landowners have technical questions about practicalities and the implementation of the project. The farming community is close-knit, and people discuss the project amongst themselves. Soventix may harm their social license to operate if they do not clarify these aspects, since the uncertainty can change into mistrust, which is difficult to undo.

Impact 17 (Traffic)

- The main gravel road, Burgerville Road, in the vicinity of the proposed development is in a fair to poor condition. The main surfaced road, the N10, in the vicinity of the proposed development is in a good condition.
- Road freight, transport, specifically heavy vehicle transport, significantly contributed to the deterioration of the road surfaces and the maintenance of these roads are not always adequate.
- The annual growth rate in Average Daily Traffic (ADT) increased by approximately 6% between 2007 (435) and 2022 (1018). However, a significant increase in ADT and heavy vehicle traffic is evident from 2020 onwards, possibly be attributed to increased mining activities and renewable energy projects. It should however be noted that the capacity of a Class 1 road is in the order of 2000 vehicles per hour and therefore the traffic volumes recorded on this road is still significantly less than the capacity of the road.

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant

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Reg: 2006/023163/23

L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
16	M	M	M	-R	M	M	1	H	M	1
Reversibility	M		**Irreplaceability**	M		**Mitigatory Potential**	H			

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
17	M	M	L	-I	M	M	1	H	M	1
Reversibility	M		**Irreplaceability**	M		**Mitigatory Potential**	H			

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Traffic Impact Assessment prepared by Annebet Krige of Sturgeon Consulting (Pty) Ltd dated September 2022 (Project No.: STUR0352).
- Social Impact Assessment Report prepared by Ilse Aucamp of Equispectives Research & Consulting Services dated August 2022.

Mitigations:

Impact Management Outcome(s):

- Social responsibility.
- Build and maintain trusting relationships with affected stakeholders.
- Community Upliftment.
- Skills development.

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Reg: 2006/023163/23

- Community protection.
- Minimise noise caused by traffic.
- Minimise risk of congestion and delays to local farmers.

Targets:

- Cumulative impact management
- Social Impact Management Plan, Stakeholder Engagement Plan and Communication protocol.
- Small business development and skills development
- Green energy investment
- Local goods and services used
- Member of local police forum
- Renewable energy forum established
- Consultation with municipality
- Meeting register with landowner and neighbours.
- Community Liaison Officer appointed.
- Grievance Mechanism and Community Trust.
- Identification of projects aligned with IDP.
- Consultation with other renewable facilities in the area.
- Corporate Social Responsibility projects.
- Recruitment Policy with locals employed
- On the job training
- Skills development project
- List of skills required
- No recruitment on site.
- Local Procurement Policy and local procurement prioritised.
- List of local service providers
- Signed code of conduct.
- Disciplinary Hearings.
- Induction Programme.
- No signs of speeding.
- Planned deliveries and staff trips.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
16	Planning	Cumulative social impacts as it relates to social ills such as increases in crimes, theft, HIV rates, unemployment levels etc.	Social responsibility	Cumulative impact management	The management of cumulative impacts must be a joint effort between Soventix, other players in the renewable energy field and the local and district municipality.	Holder	On-going	Compliance to be verified by ECO and IEA
16	Planning	Cumulative social impacts as it relates to social ills such as increases in crimes, theft, HIV rates, unemployment levels etc.	Social responsibility	Social Impact Management Plan	Implement the Social Impact Management Plan during all phases of the project (Appendix J).	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA
16	Planning	Cumulative social impacts as it relates to social ills such as increases in crimes, theft, HIV rates, unemployment levels etc.	Social responsibility	Small business development	It is recommended to invest in the development of SMME's or create a business incubator.	Holder	On-going	Compliance to be verified by ECO and IEA
16	Planning	Cumulative social impacts as it relates to social ills such as increases in crimes, theft, HIV rates, unemployment levels etc.	Social responsibility	Skills development	It is recommended to assist with the development of skills required in the construction and management of renewable energy facilities.	Holder, Contractor	Construction and Operational	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
16	Planning	Cumulative social impacts as it relates to social ills such as increases in crimes, theft, HIV rates, unemployment levels etc.	Social responsibility	Skills development	It is recommended to provide in-service training for candidates with potential.	Holder, Contractor	Construction and Operational	Compliance to be verified by ECO and IEA
16	Planning	Cumulative social impacts as it relates to social ills such as increases in crimes, theft, HIV rates, unemployment levels etc.	Social responsibility	Green energy investment	It is recommended to invest in solar energy in the town, e.g., for water pumps and other municipal infrastructure.	Holder	On-going	Compliance to be verified by ECO and IEA
16	Planning	Cumulative social impacts as it relates to social ills such as increases in crimes, theft, HIV rates, unemployment levels etc.	Social responsibility	Local goods and services used	It is recommended to encourage local manufacturing and maintenance service providers.	Holder, Contractor	Construction and Operational	Compliance to be verified by ECO and IEA
16	Planning	Cumulative social impacts as it relates to social ills such as increases in crimes, theft, HIV rates, unemployment levels etc.	Social responsibility	Member of local police forum	It is recommended to become part of the community police forum and invest in security measures such as cameras and lights.	Holder, Contractor	Construction and Operational	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
16	Planning	Cumulative social impacts as it relates to social ills such as increases in crimes, theft, HIV rates, unemployment levels etc.	Social responsibility	Renewable energy forum established	It is recommended to create a renewable energy forum that meets on a quarterly basis. Discuss potential projects and alignment between different parties in this forum.	Holder	Construction and Operational	Compliance to be verified by ECO and IEA
16	Planning	Cumulative social impacts as it relates to social ills such as increases in crimes, theft, HIV rates, unemployment levels etc.	Social responsibility	Consultation with municipality regarding social plans	It is recommended to discuss and develop social plans in conjunction with the municipality.	Holder	Pre-construction	Compliance to be verified by ECO and IEA
16	Planning	Cumulative social impacts as it relates to social ills such as increases in crimes, theft, HIV rates, unemployment levels etc.	Social responsibility	Consultation with municipality regarding siting of construction camp	It is recommended to discuss siting of construction camps with the town planning teams of the municipality and pool resources to ensure sustainability.	Holder	Pre-construction	Compliance to be verified by ECO and IEA
16	Planning	There is an expectation from the affected communities and municipalities that the Soventix project will result in similar benefits and	Build and maintain trusting relationships with affected stakeholders.	Stakeholder Engagement Plan	Develop a Stakeholder Engagement Plan during the pre-construction phase of the project using the Stakeholder Engagement Plan Protocol (Appendix H).	Holder	Pre-construction	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		opportunities as other existing renewable projects in the area.						
16	Planning	There is an expectation from the affected communities and municipalities that the Soventix project will result in similar benefits and opportunities as other existing renewable projects in the area.	Build and maintain trusting relationships with affected stakeholders.	Stakeholder Engagement Plan	The Stakeholder Engagement Plan must be implemented for the life of the project and adapted as required.	Holder, ECO	On-going	Compliance to be verified by ECO and IEA
16	Planning	There is an expectation from the affected communities and municipalities that the Soventix project will result in similar benefits and opportunities as other existing renewable projects in the area.	Build and maintain trusting relationships with affected stakeholders.	Communication protocol	A protocol on communication must be agreed upon and be in place before construction commences.	Holder	Pre-construction	Compliance to be verified by ECO and IEA
16	Planning	There is an expectation from	Build and maintain	Communication protocol	The plan (or strategy) must communicate in	Holder	Pre-construction	Compliance to be verified

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		the affected communities and municipalities that the Soventix project will result in similar benefits and opportunities as other existing renewable projects in the area.	trusting relationships with affected stakeholders.		an open and honest way what kind of jobs will be created, who will qualify and how the recruitment process will work.			by ECO and IEA
16	Planning	There is an expectation from the affected communities and municipalities that the Soventix project will result in similar benefits and opportunities as other existing renewable projects in the area.	Build and maintain trusting relationships with affected stakeholders.	Communication protocol	The plan (or strategy) should employ different media, including social media, printed media, meetings, and a community liaison officer.	Holder	Pre-construction	Compliance to be verified by ECO and IEA
16	Planning	There is an expectation from the affected communities and municipalities that the Soventix project will result in similar	Build and maintain trusting relationships with affected stakeholders.	Communication protocol	The plan (or strategy) must include liaison with the local municipality about project opportunities, as the municipality is often the first port of call for the community - the municipality can	Holder	Pre-construction	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		benefits and opportunities as other existing renewable projects in the area.			be an important ally for Soventix if the relationship is based on mutual trust and respect.			
16	Planning	There is a level of uncertainty amongst the directly affected landowners with regards to timelines for the project.	Build and maintain trusting relationships with affected stakeholders.	Meeting register with landowner and neighbours	Hold a direct meeting between the affected landowners (directly affected landowner and owners of neighbouring properties) and Soventix during the planning and design and/or pre-construction phases. The meeting should provide greater clarity about when the construction will start, how long it will be, what the layout and design of the solar facility will be, as well as answer any technical questions about practicalities and the implementation of the project.	Holder, Contractor	Pre-construction	Compliance to be verified by ECO and IEA
16	Planning	There is a level of uncertainty amongst the directly affected landowners with regards to	Build and maintain trusting relationships with affected stakeholders.	Community Liaison Officer appointed	A community liaison officer that is trusted by the community and has the necessary skills must be appointed before	Holder, Contractor	Pre-construction	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		timelines for the project.			construction commences to interface and build trust between Soventix and the landowners.			
16	Planning	There is a level of uncertainty amongst the directly affected landowners with regards to timelines for the project.	Build and maintain trusting relationships with affected stakeholders.	Community Liaison Officer appointed	The community liaison officer must be bilingual with a solid knowledge of Afrikaans, as it is the language that most stakeholders are comfortable with (excluding the local government, where English would be sufficient).	Holder, Contractor	Pre-construction	Compliance to be verified by ECO and IEA
16	Planning	Vulnerable group's susceptible to negative influences in society such as prostitution, relationships with minors, alcohol and drug abuse, gambling and fighting due to the presence of people from outside the area.	Build and maintain trusting relationships with affected stakeholders.	Grievance mechanism	Establish a grievance mechanism. The grievance mechanism must be communicated to the affected communities.	Holder, Contractor	Pre-construction	Compliance to be verified by ECO and IEA
16	Planning	Economic benefits may not be achieved by local	Build and maintain trusting relationships	Community Trust	It is recommended that Soventix establish a community trust.	Holder	On-going	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		residents/service providers.	with affected stakeholders.					
16	Planning	Economic benefits may not be achieved by local residents/service providers.	Build and maintain trusting relationships with affected stakeholders.	Community Trust	The final percentage contribution to the trust could only be calculated upon finalisation of the feed-in tariff as part of the Power Purchase Agreement, which is assumed not to be calculated at the time of writing of this report.	Holder	On-going	Compliance to be verified by ECO and IEA
16	Planning	Economic benefits may not be achieved by local residents/service providers.	Build and maintain trusting relationships with affected stakeholders.	Community Trust	The trust should be administered by a board comprising a range of representatives including representatives from the local community.	Holder	On-going	Compliance to be verified by ECO and IEA
16	Planning	Economic benefits may not be achieved by local residents/service providers.	Build and maintain trusting relationships with affected stakeholders.	Community Trust	The structure and operational objectives of the Community Trust should be determined at the time. It is envisaged that the development objectives/ projects identified and supported by the trust will be identified in collaboration with the local municipality, community representatives and NPOs in the area.	Holder	On-going	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
16	Planning	Economic benefits may not be achieved by local residents/service providers.	Build and maintain trusting relationships with affected stakeholders.	Identification of projects aligned with IDP	Projects should be aligned with key needs as identified in the municipal Integrated Development Plan (IDP) and with input from local NPOs to ensure benefits are locally relevant.	Holder	On-going	Compliance to be verified by ECO and IEA
16	Planning	Economic benefits may not be achieved by local residents/service providers.	Build and maintain trusting relationships with affected stakeholders.	Consultation with other renewable facilities in the area	The renewable facilities in the area should combine their efforts and contributions to socio-economic and enterprise development to make a bigger positive impact instead of diluting the impact with small, unrelated projects.	Holder	On-going	Compliance to be verified by ECO and IEA
16	Planning	Economic benefits may not be achieved by local residents/service providers.	Build and maintain trusting relationships with affected stakeholders.	Corporate Social Responsibility projects	Soventix must consider the recommendations regarding Corporate Social Responsibility (CSR) projects (Appendix G)	Holder	On-going	Compliance to be verified by ECO and IEA
16	Planning	The proposed project will create positive economic impacts in the area. The most direct impact on a community	Community Upliftment	Locals employed	As far as possible local labour must be used for the project. Local labour must be prioritised. The definition of “local” must be clarified with	Holder, Contractor	Pre-construction	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		level is job creation.			the affected stakeholders.			
16	Planning	The proposed project will create positive economic impacts in the area. The most direct impact on a community level is job creation.	Community Upliftment	Recruitment Policy	Soventix must develop a recruitment policy and liaise with the Local Economic Development section of the municipality, local leaders, and NGOs during its development to ensure it is in line with the local practices and taps into existing knowledge.	Holder	Construction	Compliance to be verified by ECO and IEA
16	Planning	The proposed project will create positive economic impacts in the area. The most direct impact on a community level is job creation.	Community Upliftment	Recruitment Policy	The recruitment policy must set reasonable targets for the employment of local people and women. Soventix and the municipality should identify these targets before recruitment commences.	Holder	Construction	Compliance to be verified by ECO and IEA
16	Planning	The proposed project will create positive economic impacts in the area. The most direct impact on a community level is job creation.	Skills development	On the job training	If there is a need for transferable skills, Soventix must ensure that people get on the job training as far as possible.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
16	Planning	The proposed project will create positive economic impacts in the area. The most direct impact on a community level is job creation.	Skills development	Skills development project	A skills development project where skills required for renewable energy and the Fourth Industrial Revolution are taught locally must be considered.	Holder	On-going	Compliance to be verified by ECO and IEA
16	Planning	The proposed project will create positive economic impacts in the area. The most direct impact on a community level is job creation.	Community Upliftment	List of skills required	Soventix must provide the local municipality with a list of skills required before the construction period commences, and the municipality must distribute the list to all stakeholders to allow them to prepare for the opportunities.	Holder	Pre-construction	Compliance to be verified by ECO and IEA
16	Planning	The proposed project will create positive economic impacts in the area. The most direct impact on a community level is job creation.	Community Upliftment	No recruitment on site	All labour opportunities must be accessed through a labour desk in town, and no recruitment must be allowed on site.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA
16	Planning	Economic benefits may not be achieved by local residents/service	Community Upliftment	Local Procurement Policy	Soventix must develop a local procurement policy.	Holder	Pre-construction	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		providers.						
16	Planning	Economic benefits may not be achieved by local residents/service providers.	Community Upliftment	Local procurement prioritised.	The specialised equipment needed for the project will not be available locally, but as far as possible everything else must be procured locally. Local procurement must be prioritised.	Holder	On-going	Compliance to be verified by ECO and IEA
16	Planning	Economic benefits may not be achieved by local residents/service providers.	Community Upliftment	List of local service providers	Workers from outside the area must be provided with a list of local service providers for their accommodation and other social needs.	Holder	On-going	Compliance to be verified by ECO and IEA
16	Planning	Economic benefits may not be achieved by local residents/service providers.	Community Upliftment	List of local service providers	People that provided services to other solar farms in the area should be offered an opportunity to put their names on a list at the municipality to ensure that Soventix is aware of the available resources.	Holder	On-going	Compliance to be verified by ECO and IEA
16	Contractor readiness	Vulnerable group's susceptible to negative influences in society such as prostitution, relationships with minors,	Community protection	Signed code of conduct	Any person that does any work on site must sign the Code of Conduct and presented with a copy.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		alcohol and drug abuse, gambling and fighting due to the presence of people from outside the area.						
16	Contractor readiness	Vulnerable group's susceptible to negative influences in society such as prostitution, relationships with minors, alcohol and drug abuse, gambling and fighting due to the presence of people from outside the area.	Community protection	Code of conduct	The Code of Conduct must include the following aspects: (a) Respect for local residents, their customs and property. (b) Respect for farm infrastructure and agricultural activities. (c) No hunting or un-authorised taking of products or livestock. (d) Zero tolerance of illegal activities by construction personnel including: prostitution; illegal sale or purchase of alcohol; sale, purchase or consumption of drugs; illegal gambling or fighting. (e) Compliance with the Traffic Management Plan and all road regulations; and (f) Description of disciplinary measures for violation of the	Holder, Contractor	Pre-construction	Compliance to be verified by ECO and IEA

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					Code of Conduct and company rules.			
16	Contractor readiness	Vulnerable group's susceptible to negative influences in society such as prostitution, relationships with minors, alcohol and drug abuse, gambling and fighting due to the presence of people from outside the area.	Community protection	Disciplinary Hearings	If workers are found to be in contravention of the Code of Conduct, which they will be required to sign at the beginning of their contract, they will face disciplinary procedures that could result in dismissal. Stock theft should be noted as a dismissible offence.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA
16	Contractor readiness	Vulnerable group's susceptible to negative influences in society such as prostitution, relationships with minors, alcohol and drug abuse, gambling and fighting due to the presence of people from outside the area.	Community protection	Induction Programme	Develop an induction programme that includes a Code of Conduct for all workers (including sub-contractors). The induction programme must include HIV/AIDS awareness, substance abuse programmes and education about alcohol abuse and gender-based violence.	Holder, Contractor	Pre-construction	Compliance to be verified by ECO and IEA
17	Planning	Noise pollution due to traffic.	Minimise noise caused by traffic	No signs of speeding	Enforce speed control through speed limit road signage and fines.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					Management Outcome: Minimal noise generated by traffic.			
17	Planning	Potential congestion and delays on the surrounding road network.	Minimise risk of congestion and delays to local farmers	Planned deliveries	Stagger delivery trips and schedule deliveries outside of the peak traffic periods.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA
17	Planning	Potential congestion and delays on the surrounding road network.	Minimise risk of congestion and delays to local farmers	Planned staff trips	Staff trips should also occur outside of the peak hours where possible.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
16	M	M	M	-R	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
16	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
17	M	M	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
17	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- The residual risk of social ills such as increases in crime, HIV rates, economic benefits, job recruitment etc (**16**) after mitigation and implementation of various social plans is assumed to be Low.
- The residual risk of noise pollution and disturbance cause by an increase in traffic (**17**) after mitigation is estimated to be Low.

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Reg: 2006/023163/23

Receiving Environment: Land Use

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Planning	Stakeholder Engagement Plan and Procurement	Compensation and claims	**Impact:** The construction of a solar electricity generating facility and its associated infrastructure will lead to a change of land use and livelihoods. **Consequence:** Change of land use can potentially impact negatively on the livelihood of the affected farmer, which is sheep farming.	N/A	18

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 18 (Social)

- Although it will be a hybrid agrivoltaic system, fewer grazing areas may require the farmer reduce his herd size (production rates), which would impact negatively on his livelihood. It is possible for sheep to graze in between the solar panels, but to achieve that the farmer would need more labour than he is currently using. The reason for this is that he would need to divide his flocks and have them graze in separate areas. This entails the movement of the flock between camps and managing of the flock in the solar area. While it is true that the landowner will lose productive grazing areas, it must be considered that he will be compensated for the use of the land through a commercial transaction with Soventix. This should allow him to find an alternative source of grazing, either by buying or renting additional land. In addition, the design of the solar farm is such that the land will still be used for grazing purposes.
- Changing the land use means that the land in question must be rezoned from agricultural to renewable energy infrastructure (Draft ELM Land Use Scheme, 2021). This has tax implications for the farmer, as taxes on renewable energy infrastructure is higher than taxes on agricultural land. Neighbouring farmers are also concerned that their property tax may be increased due to the development. The increase in his taxes should also be considered in the renting transaction.
- Farmers are also concerned about the impact of the quality of the roads on their quality of life and ability to transport their goods.
- During the construction phase all livestock would need to be moved to different parts of the farm as the construction activities may be distressing for the animals. This is also the case with game, but it is not that easy to move game around on the farms. Farmers indicated that they would not be able to introduce new game on their properties during the construction phase due to the sensitivity of game to environmental factors such as noise and constant movement. Construction traffic may impact on the movement of the livestock around the farm.

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Reg: 2006/023163/23

- In some cases, the neighbouring farmers will benefit from the construction of the facility since they can offer accommodation or other related services that can supplement their income.

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
18	H	L	H	-I	H	H	1	H	H	1
Reversibility	M	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Social Impact Assessment Report prepared by Ilse Aucamp of Equispectives Research & Consulting Services dated August 2022.

Mitigations:

Impact Management Outcome(s):

- Build and maintain trusting relationships with affected stakeholders.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Targets:

- Compensation Protocol
- Claims Procedure

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
18	Planning	The construction of a solar electricity generating facility and its associated infrastructure will lead to a change of land use and livelihoods	Build and maintain trusting relationships with affected stakeholders.	Compensation	The contractor must compensate the farmer for any losses of livestock due to irresponsible behaviour by the construction teams.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.
18	Planning	The construction of a solar electricity generating facility and its associated infrastructure will lead to a change of land use and livelihoods	Build and maintain trusting relationships with affected stakeholders.	Compensation Protocol	A protocol on compensation must be agreed upon and be in place before construction commences.	Holder, Contractor	Pre-construction	Compliance to be verified by ECO and IEA.
18	Planning	The construction of a solar electricity generating facility and its associated infrastructure	Build and maintain trusting relationships with affected stakeholders.	Claims Procedure	A claims procedure must be in place and shared with all the stakeholders before the construction commences.	Holder, Contractor	Pre-construction	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		will lead to a change of land use and livelihoods						

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
18	L	L	L	neutral	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
18	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- The residual risk of change of land use to agricultural potential and traffic safety (**18**) after mitigation is estimated to be Low to zero.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Receiving Environment: Health and Safety

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Planning	Stakeholder Engagement Plan	Communication	**Impact:** Workers on site may be at risk to stray bullets or hunting accidents. **Consequences:** Loss/injury to personnel.	N/A	19
Planning	Traffic Management Plan	Safety and Security	**Impact:** Potential impact on traffic safety and increase in accidents with other vehicles or animals. **Consequence:** Death/injury to humans and loss/injury of livestock.	N/A	19
Contractor readiness	Employment of Labour	Training	**Impact:** During the clearing of the site this may pose a risk to the workers and during the operation there may also be snake encounters. **Consequence:** Loss/injury to personnel.	N/A	19
Site establishment (Layout)	Site Offices	N/A	**Impact:** Lack on environmental and OHS awareness **Consequence:** injury/death to personnel.	N/A	19

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 19 (Traffic)

- The construction phase will generate significant additional traffic on the roads – just the transport of the workers will mean two trips per day, and then the delivery of construction material and management activities must also be considered. At the moment the local farmers do a lot of the road maintenance. They are concerned about the condition that the road will be in after the construction period.
- The municipality indicated that the road infrastructure in town started deteriorating when the first renewable projects started in the area.
- It is acknowledged that Soventix will not be the only road user, but it must be considered that their presence will add significant wear and tear to the road.

Impact 19 (Venomous snakes)

- There are venomous snakes, and during the clearing of the site this may pose a risk to the workers. There is always a risk of snakes in the area and during the operation there may also be snake encounters.

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Reg: 2006/023163/23

- The municipality indicated that the road infrastructure in town started deteriorating when the first renewable projects started in the area.

Impact 19 (Hunting)

- Another safety concern is the hunting activities that take place on the adjacent farms. Although hunting is allowed throughout the year, hunting activities peak in the winter. With people permanently stationed on the Solar PV plant, there is a risk that they may be in danger from stray bullets or hunting accidents. High calibre guns are used for hunting, especially for bigger game

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
19	L	M	L	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
19	M	L	M	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

- None.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Social Impact Assessment Report prepared by Ilse Aucamp of Equispectives Research & Consulting Services dated August 2022.
- Traffic Impact Assessment prepared by Annebet Krige of Sturgeon Consulting (Pty) Ltd dated September 2022 (Project No.: STUR0352).

Mitigations:

Impact Management Outcome(s):

- Build and maintain trusting relationships with affected stakeholders.
- Road and traffic safety.
- Avoid injury or fatality amongst staff.
- To ensure effective Health and Safety implementation.

Targets:

- Monthly check-ins with direct neighbours.
- Road signage.
- No signs of speeding.
- An attendance register signed by all applicable staff.
- Trained staff to deal with snake relocation and First Aid Certificates.
- CV of appointed HSO.
- Information posters.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
19	Planning	Workers on site may be at risk to stray bullets or hunting accidents.	Build and maintain trusting relationships with affected stakeholders.	Monthly check-ins with direct neighbours	Soventix should check in with the direct neighbours once a month to ensure all grievances are dealt with and that the different parties remain	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					informed about any planned activities.			
19	Planning	Potential impact on traffic safety and increase in accidents with other vehicles or animals.	Road and traffic safety	Road signage	The necessary road signage must be erected on the affected roads to warn road users about the construction activities and traffic	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.
19	Planning	Potential impact on traffic safety and increase in accidents with other vehicles or animals.	Road and traffic safety	No signs of speeding	Consider speed control by means of stop and go systems.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.
19	Planning	Potential impact on traffic safety and increase in accidents with other vehicles or animals.	Road and traffic safety	No signs of speeding	Enforce speed control through speed limit road signage and fines.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.
19	Contractor readiness	Snake encounters during the clearing of the site may pose a risk to the workers and during the operation	Avoid injury or fatality amongst staff.	An attendance register signed by all applicable staff.	Workers and contractors must be educated about safety aspects in areas where there are wild animals. This could be done through toolbox talks.	Holder, Contractor	Construction and Operation	Compliance to be verified by ECO and IEA.
19	Contractor readiness	During the clearing of the site this may pose a risk to	Avoid injury or fatality amongst staff.	Trained staff to deal with snake relocation	At least one person on site needs to be trained to relocate venomous snakes.	Holder, Contractor	Construction and Operation	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		the workers and during the operation there may also be snake encounters.						
19	Contractor readiness	During the clearing of the site this may pose a risk to the workers and during the operation there may also be snake encounters.	Avoid injury or fatality amongst staff.	First Aid Certificates	The person responsible for first aid must be trained in dealing with snake bites.	Holder, Contractor	Construction and Operation	Compliance to be verified by ECO and IEA.
19	Site establishment (Layout)	Lack on environmental and OHS awareness	To ensure effective Health and Safety implementation	CV of appointed HSO	Appoint a suitably qualified HSO to implement OHSA (Act 85 of 1993)	Contractor	Construction	Compliance to be verified by HSO
19	Site establishment (Layout)	Lack on environmental and OHS awareness	To ensure effective Health and Safety implementation	Information posters	The Contractor must erect and maintain information posters at key locations on site, and the posters must include the following information as a minimum: a) Safety notifications	Contractor	Construction	Compliance to be verified by HSO

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
19	L	L	L	neutral	M	L	0	L	L	0

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
19	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- The residual risk to safety due to venomous snakes, traffic and stray bullets from neighbouring hunting farms (**19**) after mitigation is assumed to be Low.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Receiving Environment: Security

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Planning	Stakeholder Engagement and Traffic Management Plan	Communication Safety and security	**Impact:** Increases in stock theft and other crimes. **Consequence:** Economic losses due to loss of livestock/game/property	N/A	20
Site establishment (Layout)	Perimeter boundary fence And Accommodation		**Impact:** Increased potential for criminal activity, including stock theft, game poaching, property theft, emotional and/or physical harm to victims, etc. **Consequences:** - Loss of farming revenue - Injury or loss of life	N/A	20
Contractor readiness	Employment of Labour	Influx of job-seekers and construction workers into the area.	**Impact:** Increases in stock theft and other crimes. **Consequence:** Economic losses due to loss of livestock/game/property	N/A	20
Planning	Traffic Management Plan	Traffic	**Impact:** Stakeholders are concerned about the quality of the roads, increases in traffic and traffic safety. **Consequence:** Increase in accidents, longer time periods in transportation of goods.	N/A	20

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 20 (Security - Crime)

- Farmers are concerned that the presence of the construction workers in the area will cause an increase in stock theft, due to people becoming aware of where the stock are kept. There is also a possibility that petty theft or opportunistic crimes can take place. The municipality indicated that general crime levels increased during the construction phases of the renewable developments around the town.
- Farm safety is a concern in the rural areas of South Africa. Although there is a low incidence of farm attacks in the Karoo, farmers and farm workers are soft targets due to the isolation on farms and distance from emergency services. More people moving around in the area will make it easier for opportunistic criminals to enter the area without being noticed. Stock theft is a problem in the area, and one farmer reported that

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Reg: 2006/023163/23

during the times that Transnet contractors work in the area they lose up to ten sheep a week. Farmers are concerned that the presence of the construction workers in the area will cause an increase in stock theft, due to people becoming aware of where the stock are kept. There is also a possibility that petty theft or opportunistic crimes can take place. The municipality indicated that general crime levels increased during the construction phases of the renewable developments around the town. The municipality reported that once the construction teams left, they perceive that there is an increase in local petty crimes such as housebreaking which they attribute to loss of income amongst some community members. There will be less people in the area during the operational phase and fewer permanent workers onsite. Theft or vandalism of the PV panels or associated infrastructure may be of some concern during the operation phase.

Impact 20 (Security - Traffic)

- The construction phase will generate significant additional traffic on the roads – just the transport of the workers will mean two trips per day, and then the delivery of construction material and management activities must also be considered. At the moment the local farmers do a lot of the road maintenance. They are concerned about the condition that the road will be in after the construction period.
- The municipality indicated that the road infrastructure in town started deteriorating when the first renewable projects started in the area.
- It is acknowledged that Soventix will not be the only road user, but it must be considered that their presence will add significant wear and tear to the road.

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
20	M	M	L	-I	M	M	1	H	M	1

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Reg: 2006/023163/23

Reversibility	H	Irreplaceability	H	Mitigatory Potential	H

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
20	M	M	L	-I	M	M	1	H	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Social Impact Assessment Report prepared by Ilse Aucamp of Equispectives Research & Consulting Services dated August 2022.
- Richard Vimpany (Neighbouring landowner and registered Interested and Affected Party).

Mitigations:

Impact Management Outcome(s):

- A secure solar PV facility

Targets:

- Roster given to landowners and security company schedule.
- Member of farm watch group.
- Farm access protocol plan with a signed farm access protocol and security plan.
- Existing security systems utilized.
- Perimeter fence.
- No staff residing on site.
- Signed code of conduct and meeting register.
- Disciplinary hearings.
- Marked vehicles.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
20	Planning	Increases in stock theft and other crimes	A secure solar PV facility	Roster given to landowners	A roster stating dates and approximate times that contractors will be on the farms must be given directly to affected landowners. All access arrangements should be made at least 24 hours before farm access is required.	Holder, Contractor	Construction	Compliance to be verified by ECO and IEA.
20	Planning	Increases in stock theft and other crimes	A secure solar PV facility	Security company schedule	If a security company is used, their schedules should be communicated to the landowners.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.
20	Planning	Increases in stock theft and other crimes	A secure solar PV facility	Member of farm watch group	Soventix should become a member of existing farmers' security groups and farmers' associations.	Holder	Pre-construction	Compliance to be verified by ECO and IEA.
20	Planning	Increases in stock theft and other crimes	A secure solar PV facility	Farm access protocol and security plan	Soventix should work with landowners, existing farmers' security groups and farmers' associations to create (a) a farm access protocol for everybody that need to access the properties, and (b) a security/safety plan.	Holder	Pre-construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

20	Planning	Increases in stock theft and other crimes	A secure solar PV facility	Signed farm access protocol	The protocol on farm access must be agreed upon and be in place before construction commences.	Holder	Pre-construction	Compliance to be verified by ECO and IEA.
20	Planning	Increases in stock theft and other crimes	A secure solar PV facility	Existing security systems utilized	Soventix should use existing security systems, which include the use of cameras, to avoid any duplication.	Holder	On-going	Compliance to be verified by ECO and IEA.
20	Planning	Increases in stock theft and other crimes	A secure solar PV facility	Meeting register	Soventix must meet with the landowners before the construction phase commences to formalise security arrangements.	Holder	Pre-construction	Compliance to be verified by ECO and IEA.
20	Site establishment (Layout)	Increased potential for criminal activity, including stock theft, game poaching, property theft, emotional and/or physical harm to victims, etc.	A secure solar PV facility	Perimeter fence	Security during construction will be mitigated by erecting the permitter fence at the onset of construction to prevent any movement out of the development footprint.	Holder, Contractor	Pre-construction	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

20	Site establishment (Layout)	Increased potential for criminal activity, including stock theft, game poaching, property theft, emotional and/or physical harm to victims, etc.	A secure solar PV facility	No staff residing on site	No accommodation shall be provided for contractors, sub-contractors and their workers on the construction site.	Contractor	Pre-construction	Compliance to be verified by ECO and IEA.
20	Contractor readiness	Increases in stock theft and other crimes.	A secure solar PV facility	Signed code of conduct	Any person that does any work on site must sign the Code of Conduct and presented with a copy.	Contractor	On-going	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

20	Contractor readiness	Increases in stock theft and other crimes.	A secure solar PV facility	Code of conduct	The Code of Conduct must include the following aspects: (a) Respect for local residents, their customs and property. (b) Respect for farm infrastructure and agricultural activities. (c) No hunting or un-authorised taking of products or livestock. (d) Zero tolerance of illegal activities by construction personnel including: prostitution; illegal sale or purchase of alcohol; sale, purchase or consumption of drugs; illegal gambling or fighting. (e) Compliance with the Traffic Management Plan and all road regulations; and (f) Description of disciplinary measures for violation of the Code of Conduct and company rules.	Contractor	Pre-construction	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

20	Contractor readiness	Increases in stock theft and other crimes.	A secure solar PV facility	Disciplinary hearings	If workers are found to be in contravention of the Code of Conduct, which they will be required to sign at the beginning of their contract, they will face disciplinary procedures that could result in dismissal. Stock theft should be noted as a dismissible offence.	Contractor	On-going	Compliance to be verified by ECO and IEA.
20	Planning	Stakeholders are concerned about the quality of the roads, increases in traffic and traffic safety.	A secure solar PV facility	Marked vehicles	Vehicles must be clearly marked.	Contractor	On-going	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
20	L	L	L	-R	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
20	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

- The residual risk of criminal activity during construction and operation (**20**) after mitigation is estimated to be Low.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Receiving Environment: Public Services

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Planning and Contractor readiness	Traffic Management Plan and Employment of labour	Traffic and Training	**Impact:** Stakeholders are concerned about the quality of the roads, increases in traffic and traffic safety. **Consequence:** Increase in accidents, longer time periods in transportation of goods.	N/A	21
Contractor readiness	Acquiring permits, licenses, Letters of consent and permissions	Other approvals	**Impact:** Transport of abnormal roads could be delayed. **Consequence:** Delays in construction	N/A	21
Monitoring			**Impact:** It is anticipated that soils downstream of the proposed development, and the non-perennial streams (feeding into temporary livestock watering dams) are the receivers of any sediment runoff or poor-quality runoff from the site. Sedimentation (or turbidity) caused by working in the watercourse can increase the cost of treating drinking water. **Consequence:** Increased cost of treating water, or if there is limited capacity to treat the water (financial, technical, etc.) then poorer quality drinking water, including appearance, odour and taste problems.	N/A	22

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 21 (Traffic)

- During the dry season the area is very dry and dusty. During the wet season, the roads can become muddy, and vehicles can get stuck easily. The access road is used by a number of farmers in the area to access their properties. It also traverses or is adjacent to some of the neighbouring properties. The construction phase will generate significant additional traffic on the roads – just the transport of the workers will mean two trips per day, and then the delivery of construction material and management activities must also be considered. At the moment the local farmers do a lot of the road maintenance. They are concerned about the condition that the road will be in after the construction period.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

- The municipality indicated that the road infrastructure in town started deteriorating when the first renewable projects started in the area.
- It is acknowledged that Soventix will not be the only road user, but it must be considered that their presence will add significant wear and tear to the road.
- Farmers are also concerned about the impact of the quality of the roads on their quality of life and ability to transport their goods.
- The primary access to the proposed 400 MW solar PV facility will be at the junction of the N10 with the existing Burgerville (District) Road. The shoulder sight distance (> 450 m) to the left of the primary site access location will be sufficient (at a design speed of 120 km/hr). Sight distance to the right, however, was measured as approximately 320 m, which is sufficient for Passenger vehicles (P), but not a Single-Unit Truck (SU). It therefore is proposed that appropriate traffic accommodation be placed on the eastern approach of the N10, indicating a construction access ahead with a possible flagman to alert drivers and slow them down.
- There are three alternative routes for the haulage of imported materials to the proposed PV facility, including from (a) the Cape Town harbour, (b) Port of Ngqura, and (c) Port of Saldanah. The preferred route is from the Port of Ngqura as it is the shortest (445 km) and fastest route to the site, following the N2 from the Port before turning north onto the N10 past Hanover and up to the access at Burgerville Road.

Impact 22 (Water quality – sedimentation)

- It is advised that groundwater boreholes be monitored for the decline in water levels/yields, as well as water quality as the boreholes are used as the main water supply for livestock / domestic use.
- Drainage is generally towards the north-west via multiple non-perennial drainage lines towards the ephemeral Brak River, approximately 6,6 km further downstream. However, the drainage channels or flow paths are not clearly defined. Sheet flow occurs from micro sub-catchments towards lower topographical areas or isolated depressions forming temporarily flooded areas. Irregular occurrences of ponded water were visible across the project area, even in areas with no defined drainage lines or stream channels. (Hydrology Assessment)
- The project area falls within a spring to summer rainfall area (October to April), ranging from 112,4 to 738,9 mm/yr but averaging 320 mm/yr. The Mean Annual Evaporation (2 000 – 2 150 mm/yr) exceeds the Mean Annual Precipitation (MAP) by about 85%, so non-perennial streams and rivers will only have water when there are flooding events. (Hydrology Assessment)
- Considering run-off is directly related to rainfall intensity, and longer precipitation events, both monthly rainfall and run-off, peak from January to April. The run-off during these peak months, ranges from 0,3 to 1,1 mm/yr over the surface area of quaternary catchment D62D. The annual run-off from natural (unmodified) catchments in D62D is approximately 0,9% of the MAP. (Hydrology Assessment)
- Accounting for changes in soil type, slope angle and rainfall intensity, ground cover beneath solar arrays was found to have the most significant impact on run-off rates. So, if vegetation cover beneath the solar arrays is maintained, no significant increase in surface water run-off (run-off volumes, peak rates, or time to peak rates) is anticipated compared to greenfield run-off rates. (Hydrology Assessment)

<u>Assessment without mitigation:</u>

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
21	H	L	H	-I	H	H	1	H	H	1
Reversibility	M	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
22	H	M	M	-I	H	M	1	H	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Social Impact Assessment Report prepared by Ilse Aucamp of Equispectives Research & Consulting Services dated August 2022.
- Hydrological Assessment (Version – Final 3) 01 September 2022 GCS Project Number: 22-0076 by Hendrik Botha.
- Traffic Impact Assessment prepared by Annebet Krige of Sturgeon Consulting (Pty) Ltd dated September 2022 (Project No.: STUR0352).

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Reg: 2006/023163/23

Mitigations:

Impact Management Outcome(s):

- Good quality road network.
- Safe (unobstructed) delivery of abnormal loads to site.
- To reduce sedimentation.

Targets:

- Roads are maintained in good condition.
- Road maintenance agreement and protocol.
- Traffic Management Plan.
- Course outline of Environmental Awareness training.
- Abnormal load permits.
- Preserve aquatic ecosystem structure and function.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
21	Planning and Contractor readiness	Stakeholders are concerned about the quality of the roads, increases in traffic and traffic safety.	Good quality road network	Roads are maintained in good condition	Soventix must contribute to the maintenance of the roads for the life of the project.	Holder	On-going	Compliance to be verified by ECO and IEA.
21	Planning and Contractor readiness	Stakeholders are concerned about the quality of the roads, increases in traffic and traffic safety.	Good quality road network	Road maintenance agreement	An agreement must be formalised between Soventix and the parties currently responsible for road maintenance.	Holder	Pre-construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
21	Planning and Contractor readiness	Stakeholders are concerned about the quality of the roads, increases in traffic and traffic safety.	Good quality road network	Traffic Management Plan	Soventix must have a Traffic Management Plan to address the flow of traffic, including such aspects as speeding, driving while tired, transport of passengers, driving on un-tarred roads and general road safety.	Holder	On-going	Compliance to be verified by ECO and IEA.
21	Planning and Contractor readiness	Stakeholders are concerned about the quality of the roads, increases in traffic and traffic safety.	Good quality road network	Road maintenance protocol	A protocol on road maintenance must be agreed upon and be in place before construction commences.	Holder	Pre-construction	Compliance to be verified by ECO and IEA.
21	Planning and Contractor readiness	Stakeholders are concerned about the quality of the roads, increases in traffic and traffic safety.	Good quality road network	Course outline of Environmental Awareness training	Aspects of the Traffic Management Plan must be included in the induction of workers.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.
21	Contractor readiness	Transport of abnormal roads could be delayed.	Safe (unobstructed) delivery of abnormal loads to site.	Abnormal load permits	The applicable permits to transport abnormal loads should be obtained.	Holder, Contractor	Pre-construction	Compliance to be verified by ECO and IEA.
22	Monitoring	It is anticipated that soils downstream of the proposed development, and the non-	To reduce sedimentation	Preserve aquatic ecosystem structure and function.	Implement the Surface and Groundwater Monitoring Protocol during construction and operation (Appendix D).	Holder, Contractor	Construction and Operational	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		perennial streams (feeding into temporary livestock watering dams) are the receivers of any sediment runoff or poor-quality runoff from the site. Sedimentation (or turbidity) caused by working in the watercourse can increase the cost of treating drinking water.						

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
21	L	L	L	neutral	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
21	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

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Reg: 2006/023163/23

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
22	L	L	L	neutral	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
22	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- The residual risk of change of traffic impacts and road condition (**21**) after mitigation is estimated to be Low.
- The residual risk of sedimentation on water quality (**22**) after mitigation is assumed to be Low.

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Receiving Environment: Visual Aesthetics

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Planning	Stakeholder Engagement	Communication	**Impact:** Decrease in the "sense of place" as it relates to noise, visual and light pollution. **Consequence:** Lower aesthetic values enjoyed by the community.	N/A	23
Site Establishment (Layout)	Site selection	N/A	**Impact:** Excessive signage on the District gravel road can be visually obtrusive to local receptors (farmers). **Consequences:** - Excessive signage can degrade local landscape resources in this rural landscape. Degraded (ecosystem) cultural services, specifically areas of importance for recreation and aesthetic enjoyment, will negatively impact on human well-being.	N/A	23
Site Establishment (Layout)	Perimeter/Boundary fence	N/A	**Impact:** Fencing can obstruct views. **Consequences:** - Fencing can be visually obtrusive.	N/A	23
Site Establishment (Layout)	Site office	N/A	**Impact:** Short-term landscape change from the current rural agricultural sense of place to the semi-industrial RE landscape - Loss of site landscape character due to the removal of vegetation and the construction of the PV structures and associated infrastructure.	N/A	23
Site Establishment (Layout)	Lighting	N/A	**Impact:** Short-term landscape change from the current rural agricultural sense of place to the semi-industrial RE landscape - Loss of site landscape character due to the operation of the PV structures and associated infrastructure - Lights at night have the potential to significantly increase the visual exposure of the proposed project. **Consequences:** - Light spillage into neighbouring properties is intrusive and gives the area an unattractive, trashy look. - Light pollution washes out our view of the stars, degrading ecosystem services, specifically cultural services (e.g., a remote 'sense of place').	N/A	24

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Reg: 2006/023163/23

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
			- Distracting glare (light that beams directly from a bulb into your eye) hampers the vision of local receptors.		
Site Establishment (Layout)	Lighting	N/A	**Impact:** Decrease in the "sense of place" as it relates to noise, visual and light pollution. **Consequence:** Lower aesthetic values enjoyed by the community.		24
Site Establishment (Layout)	Quarry and crushing plant		**Impact:** A new quarry will transform the local habitat. **Consequence:** Transformation may lead to degradation and a loss or alteration of ecosystem function.	N/A	25
Site Establishment (Layout)	Quarry and crushing plant		**Impact:** The dolerite dyke running sub-parallel to the southwestern boundary (represented by localities P11, P30, P31 and P34) has a width of between 20 and 50 m and a quarry for utilization of dolerite from this dyke can be located anywhere along the strike of the dyke.		25
Site Establishment (Layout)	Quarry and crushing plant		**Impact:** Rock from the irregularly shaped dolerite sill traversing Phase 3 (represented by localities P20, P24, P26, P27, P28, P29, P35, P36, P38) as well as the adjacent baked sediments may be utilized as construction materials. **Consequence:** The usage of poor-quality aggregate is unsafe and will increase the costs of maintenance.	N/A	25

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 23 (Visual)

- There is a strong sense and spirit of place associated with the Karoo landscape. The surrounding farms are used for sheep farming, game farming and hunting. The current residents and farm owners have a strong sense of place associated with the farms. Many things can impact on a person's perception of sense of place. Farms are generally noisy places if one considers animal-sounds and farming activities. From the receptors' perspective, this kind of noise is acceptable and even attractive, because this is what living on a farm is all about. Noises such as alarms and reverse hooters are not "normal" and disturb the sense of place and the value that people place on the auditory environment. Although lights are used as a security measure on farms, one of the things people values is the absence of bright lights and that they can see the stars. Lights for any other use than lightening up their direct environment is seen as invasive and disturbs the sense of place. Visual aspects are an important consideration in the experience of sense of place. If people are used to unspoiled vistas, or seeing open fields, the establishment

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Reg: 2006/023163/23

of any buildings or infrastructure that they feel do not belong there can alter their sense of place. Sense of place refers to an individual's personal relationship with his/her local environment, both social and natural, which the individual experiences in his/her everyday daily life (Vanclay et al, 2015). It is highly personal, and once it is affected, it cannot be restored. It is also difficult to quantify. Part of the sense of place is the emotional attachment that the farmers have to their properties, and the hopes that they have for it to serve future generations (their children).

- The spirit of place associated with an area is an important factor in tourism and hunting and the marketing of these activities. Spirit of place refers to the unique, distinctive, and cherished aspects of a place. Aspects that will impact on the sense and spirit of place include an increase in noise and activity levels from construction activities, but this will be a temporary impact during the construction phase. The construction phase will see a total transformation from the current setting and landscape of the proposed site. It is inevitable that the visual impact during the construction phase will be affected by dust, increase in vehicle traffic and other construction activities.
- During the operational phase, visual impacts such as glare from the solar panels, buildings, power lines, lack of vegetation and light at night will also impact on the sense and spirit of place and will be an impact as long as the plant is operational. Modern solar modules are designed to absorb the solar radiation and hence are not susceptible to reflection or glinting. Nonetheless, the contrast between the solar arrays and surrounding vegetation will exist, in colour, form, line and texture. The impact of lights in a dark rural area known for its beautiful night sky is a special concern of landowners. Although the preferred site may not influence the sense of and spirit of place of the Karoo as such, it will have a significant impact on the sense and spirit of place of the direct neighbours.
- Although there is visual and biodiversity impact assessment reports that suggest mitigation, it must be acknowledged that the sense of place will be altered permanently and given the personal experience of this impact from some stakeholders, successful mitigation is extremely hard to do. In the eye of the affected parties the only thing that will not alter the sense and spirit of the place in this instance is to avoid any further development.
- The visual recommendations from the scoping phase reporting were all incorporated into the layout design, accommodating a wide buffer on the adjacent properties, as well as accommodating wide ecological corridors between the four PV blocks. While the local sense of place will be modified, the impacted visual resources are localised to some degree and are not highly significant such that a No-go Option would be preferred. Goede Hoop Farmstead could experience partial views of the panels at 4.5 km (the dwelling is at the fringe of the viewshed analysis), with direct views from Skilpadskuil Farmstead screened by local vegetation.
- Part of the potential visual impacts caused by construction activities will include the visual changes brought about by clearance of vegetation for the solar arrays, ancillary buildings, and laydown areas; visual disturbance caused by construction of roads, buildings, energy collectors, power lines, increased traffic (and number of large vehicles), worker presence and activity, and dust emissions. Other visual disturbances may include soil stockpiles (from excavation for building foundations and other structures), soil scars, as well as potential for invasive plant species to develop on disturbed soils and soil stockpiles, which may contrast with existing vegetation.

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Reg: 2006/023163/23

- Furthermore, a neighbouring landowner has submitted written objections to the proposed activity for *inter alia* the visual impact or massing from 3.3 m solar PV panels located 50m from his farm boundary ('massing' refers when the landscape becomes dominated by a particular theme – in this case, large covering of solar PV panels that result in strong change to the local landscape character).
- *"The negative visual aspect and view of this development when viewed from my property adjacent. My farm has been owned by my family for three generations and the remoteness and unspoiled environment is a key factor of this legacy."* (Richard Vimpany).

Impact 24 (Lighting)

- *Although lights are used as a security measure on farms, one of the things people values is the absence of bright lights and that they can see the stars. Lights for any other use than lighting up their direct environment is seen as invasive and disturbs the sense of place. Visual aspects are an important consideration in the experience of sense of place. If people are used to unspoiled vistas, or seeing open fields, the establishment of any buildings or infrastructure that they feel do not belong there can alter their sense of place.*

Impact 25 (Quarry)

- The risk of visual impacts relating the quarry has been assessed and mitigated under the **Planning and Design Phase "Receiving Environment: Visual Aesthetics"** and therefore does not need to be repeated here.

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE

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Reg: 2006/023163/23

23	M	M	M	-I	M	M	1	M	M	1
Reversibility	H		**Irreplaceability**	H		**Mitigatory Potential**	H			

Alternative Site No. 1 (preferred)

Impact	**Intensity**	**Spatial**	**Duration**	**Status**	**Nature**	**Prob.**	**MAGNITUDE**	**Accept.**	**Prob.**	**IMPORTANCE**
24	M	M	M	-I	M	M	1	M	M	1
Reversibility	H		**Irreplaceability**	H		**Mitigatory Potential**	H			

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Social Impact Assessment Report prepared by Ilse Aucamp of Equispectives Research & Consulting Services dated August 2022.
- Richard Vimpany (Neighbouring landowner and registered Interested and Affected Party).
- Geotechnical Assessment Study prepared by FDJ Stapelberg of the Council for Geoscience dated 11 May 2022 (CO2017-5806 (Phase 80)).
- Personal communication with Steve Stead, Visual Resource Management Africa cc.
- Visual Impact Assessment Report (Final v_2) dated 19th September 2022, prepared by Stephen Stead of Visual Resource Management Africa cc.
- A Report on a Phase 1 Archaeological & Heritage Impact Assessment prepared by A.J. Pelser dated August 2022 (Report: APAC022/49).

Mitigations:

Impact Management Outcome(s):

- Retain the existing rural dark sky night landscape (**29**).
- A less dominant landscape change to local or neighbouring receptors (**30** and **31**).

Targets:

- Effective light management.
- Avoid obtrusive fence lines.

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Reg: 2006/023163/23

- Height of PV panels not above 4m above ground.
- Internal power line cable is buried.
- Quarry visual screening.
- Site P34 is not used for a quarry.
- Buffer zone and written agreement.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
23	Planning	Decrease in the "sense of place" as it relates to noise, visual and light pollution.	A less dominant landscape change to local or neighbouring receptors.	Notification to neighbours	Residents near the development site should be notified 24 hours prior to any planned activities that will be visible.	Contractor	Construction	Compliance to be verified by ECO and IEA.
23	Site establishment (Layout)	Excessive signage on the District gravel road can be visually obtrusive to local receptors (farmers).	A less dominant landscape change to local or neighbouring receptors.	Moderate signage	Signage on the main access and local farm roads should be moderated.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.
23	Site establishment (Layout)	Fencing can obstruct views	A less dominant landscape change to local or neighbouring receptors.	No signs of litter against construction camp/laydown area fencing	Fencing around the construction camp and/or laydown areas should be simple, diamond shaped (to catch wind-blown litter) and appear transparent from a distance. The fences should be checked monthly for the	Contractor	Pre-construction and Construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					collection of litter caught on the fence.			
23	Site establishment (Layout)	Short-term landscape change from the current rural agricultural sense of place to the semi-industrial RE landscape - Loss of site landscape character due to the removal of vegetation and the construction of the PV structures and associated infrastructure.	A less dominant landscape change to local or neighbouring receptors.	Buildings are natural colours	The buildings should be painted a mid-grey or grey-brown colour.	Contractor	Construction and post-construction	Compliance to be verified by ECO and IEA.
23	Site establishment (Layout)	Short-term landscape change from the current rural agricultural sense of place to the semi-industrial RE landscape - Loss of site landscape character due to the removal	A less dominant landscape change to local or neighbouring receptors.	Laydown areas and buildings are away from neighbours.	The laydown and building structures should be located away from neighbouring property farmsteads and banked into the ground to the eastern areas as much as possible.	Contractor	Pre-construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		of vegetation and the construction of the PV structures and associated infrastructure.						
24	Site establishment (Layout)	Short-term landscape change from the current rural agricultural sense of place to the semi-industrial RE landscape - Loss of site landscape character due to the operation of the PV structures and associated infrastructure - Lights at night have the potential to significantly increase the visual exposure of the proposed project.	Retain the existing rural dark sky night landscape.	Effective light management: No murky sky glow.	No overhead security lighting. Rather locate the light source closer to the operation, use directed technology, and aim fixtures either down or to maximise their impact on the targeted area whilst minimizing their impact elsewhere.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
24	Site establishment (Layout)	Short-term landscape change from the current rural agricultural sense of place to the semi-industrial RE landscape - Loss of site landscape character due to the operation of the PV structures and associated infrastructure - Lights at night have the potential to significantly increase the visual exposure of the proposed project.	Retain the existing rural dark sky night landscape.	Light reduction methods are used.	Implement measures to reduce light spillage (e.g., choose "full-cut-off shielded" fixtures that keep light from going up or sideways, locate the light source closer to the operation, use directed LED technology, and aim fixtures either down or to maximise their impact on the targeted area whilst minimizing their impact elsewhere).	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.
24	Site establishment (Layout)	Decrease in the "sense of place" as it relates to noise, visual and light pollution.	Retain the existing rural dark sky night landscape.	Minimal night lighting	Night lighting of the construction sites should be minimised within requirements of safety and efficiency.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
23	L	L	L	-I	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
23	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
24	L	L	L	-I	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
24	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

- The residual risk of fencing, signage etc. (**23**) and light pollution (**24**) on visual aesthetic values after mitigation is estimated to be Medium to Low, but generally acceptable.

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Reg: 2006/023163/23

Receiving Environment: Heritage and Culture

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Contractor readiness	Cultural Heritage Resource rescue and relocation	Stone Age open-air surface scatters	**Impact:** Disturbance to or destruction of Stone Age open-air surface scatters (Sites: 1; 3-15; 17-18) by construction activities, e.g., clearing and grubbing activities. **Consequence:** Loss/damage of heritage resources.	N/A	26
Contractor readiness	Cultural Heritage Resource rescue and relocation	Old wagon road	**Impact:** Disturbance to or destruction of Stone Cairns indicating an old Wagon Road (Sites: 19-25) by construction activities, e.g., clearing and grubbing activities. **Consequence:** Loss/damage of heritage resource.	N/A	26

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 26 (Archaeology)

- A total of 31 sites were identified during the 2022 assessment in the study and development area (Sites 26-31 are located outside of the proposed development footprint). They included a fairly larger number of open-air Stone Age surface sites (with varying degrees of density), a recent stone kraal and some stone cairns that are most likely associated with an old road.
- The open-air sites were all surface scatters with differing densities of material (cores, waste-flakes, more formal tools such as blades, scrapers and broken points) on them.
- Although the sites and finds situated in the proposed development footprint are open-air surface locations and are therefore not located in a primary & stratified context such as those in rock shelters and caves, it is believed that they could contribute to our knowledge of the Stone Age of the specific and larger geographical area. As is the case with the 2017 and 2021 Heritage Assessment, if the sites can't be avoided by the development activities that will be mostly drilling holes to insert the poles that support the solar modules, and two-track dirt roads and need to be destroyed as a result then mitigation is recommended prior to development commencing.
- The study area is not within a World Heritage Site or within 10 km of a World Heritage Site according to the PAR.

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Reg: 2006/023163/23

- Although the age, origin and function of this possible old road is not known, it could date to the late 19th/early 20th century, with some cultural material dating to this period found in association (Martini Henry cartridge). This was likely an old wagon road linking farmsteads with each other, as well as these with Hanover and other towns. From this point of view this road and related features (cairns) are relatively significant from a Cultural Heritage point of view and at least should in part be preserved. Stone cairns can be demolished in sections where they cannot be avoided by development actions. The exact age and historical origin should also be researched.

Impact 26 (Palaeontology)

- The **Very High** Palaeontology theme according to the Screening Report was confirmed in the Site Sensitivity Verification Report.
- The project area is underlain at depth by potentially fossiliferous continental bedrocks of the Lower Beaufort Group (Karoo Supergroup) of Middle Permian age that have yielded sparse but scientifically important vertebrate remains in the Hanover area as well as commoner petrified wood. Also present are unfossiliferous dolerite intrusions and Late Caenozoic superficial sediments (e.g., alluvium, surface gravels) which might contain important fossil mammal and other remains as well as reworked fossil wood blocks. Satellite imagery suggests that bedrock exposure is limited but not insignificant within all three study sites. (*Dr. John Almond, NATURA VIVA cc*)
- "The most likely outcome, based on comparable project areas in the Hanover - De Aar region of the Great Karoo, is that comparatively few scientifically useful fossil sites will be recorded, while No-Go palaeontological areas are very unlikely to be designated. Most Karoo fossil sites are of limited extent and can be effectively mitigated in the pre-construction phase, so palaeontological constraints on the project footprint are not anticipated, although they cannot be completely excluded in advance." (*Dr. John Almond, NATURA VIVA cc*).

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

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Reg: 2006/023163/23

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
26	M	L	L	-R	M	M	1	H	M	1
Reversibility	L	**Irreplaceability**	L	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- Preserve the section of old wagon road in the development footprint demarcated by the Heritage Specialist in a kmz file and stone cairns at sites 19 to 22.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- A Report on a Phase 1 Archaeological & Heritage Impact Assessment prepared by A.J. Pelser dated August 2022 (Report: APAC022/49).
- National Heritage Resources Act, 1999 (Act No. 25 of 1999)
    - *Structures*
        - No person may alter or demolish any structure or part of a structure, which is older than 60 years without a permit issued by the LIHRA [2] (Section 34(1) of NHRA).
    - *Archaeological Sites and Remains*
        - In terms of Section 35(3) of the NHRA, any person who discovers archaeological or palaeontological objects or material or a meteorite during development or an agricultural activity must **immediately report the find** to the LIHRA.
        - In terms of Section 35(4) of the NHRA, **no person may without a permit** issued by the LIHRA destroy, damage, excavate, alter, deface, or otherwise disturb any archaeological or palaeontological site or any meteorite, or remove from its original position any archaeological, or palaeontological material or object or any meteorite.
    - *Graves*
        - In terms of Section 36(6) any person who during development discovers the location of a grave **must immediately cease such activity and report the discovery** to the LIHRA. The LIHRA must then, in co-operation with the SAPS, carry out an investigation.
        - In terms of Section 36(3) of the NHRA, **no person may, without a permit** issued by LIHRA, destroy, damage, alter, exhume, or remove from its original position or otherwise disturb the grave of a victim of conflict, any burial ground or part thereof which contains such graves, or any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority (Section 36(3) of NHRA).

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Reg: 2006/023163/23

Mitigations:

Impact Management Outcome(s):

- Preservation of heritage resources and expansion of knowledge of the archaeology of the area.

Targets:

- Appointed qualified heritage specialist and mapping.
- Landowners' permission letter.
- Sample collection.
- Archaeological permit.
- Heritage sites have been preserved.
- Old wagon road is fenced off.
- Information signage.
- Stone cairns protected.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
26	Contractor readiness	Disturbance to or destruction of Stone Age open-air surface scatters (Sites: 1; 3-15; 17-18) by construction activities, e.g., clearing and grubbing activities	Preservation of heritage resources and expansion of knowledge of the archaeology of the area.	Appointed qualified heritage specialist and mapping	Prior to commencing development, appoint a heritage specialist/archaeologist registered with ASAPA to undertake detailed mapping and determine the extents of the Stone Age open-air surface scatters (sites: 1; 3-15; 17-18) if the sites can't be avoided by development activities. be provided.	Holder, Contractor	Pre-construction	Compliance to be verified by ECO and IEA.
26	Contractor readiness	Disturbance to or destruction of Stone Cairns	Preservation of heritage resources and expansion of	Mapping data of heritage sites provided to SAHRA	All mapping data of sites must be provided to SAHRA prior to construction.	Holder, Engineer	Pre-construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		indicating an old Wagon Road (Sites: 19-25) by construction activities, e.g., clearing and grubbing activities.	knowledge of the archaeology of the area.					
26	Contractor readiness	Disturbance to or destruction of Stone Cairns indicating an old Wagon Road (Sites: 19-25) by construction activities, e.g., clearing and grubbing activities.	Preservation of heritage resources and expansion of knowledge of the archaeology of the area.	30m buffer around section of the wagon road	A buffer of 30 m must be adhered to around the wagon road (points 19 -25).	Contractor	Pre-construction	Compliance to be verified by ECO and IEA.
26	Contractor readiness	Disturbance to or destruction of Stone Age open-air surface scatters (Sites: 1; 3-15; 17-18) by construction activities, e.g., clearing and grubbing activities	Preservation of heritage resources and expansion of knowledge of the archaeology of the area.	Landowners' permission letter	Landowner's permission to undertake the required mitigation work must be provided.	Holder	Pre-construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
26	Contractor readiness	Disturbance to or destruction of Stone Age open-air surface scatters (Sites: 1; 3-15; 17-18) by construction activities, e.g., clearing and grubbing activities	Preservation of heritage resources and expansion of knowledge of the archaeology of the area.	Sample collection	Obtain a representative sample of Stone Age material and types to determine the age of the material and sites through the surface collection of material.	Heritage specialist, Contractor	Pre-construction	Compliance to be verified by ECO and IEA.
26	Contractor readiness	Disturbance to or destruction of Stone Age open-air surface scatters (Sites: 1; 3-15; 17-18) by construction activities, e.g., clearing and grubbing activities	Preservation of heritage resources and expansion of knowledge of the archaeology of the area.	Archaeological permit	For the surface sampling an Archaeological Mitigation Permit must be applied for and issued by SAHRA. A permit will only be issued by SAHRA once Environmental Authorization for the development have been given, Final Comments from SAHRA on the Phase 1 HIA has been provided and an accredited Archaeologist has been appointed to undertake the work.	Holder	Pre-construction	Compliance to be verified by ECO and IEA.
26	Contractor readiness	Disturbance to or destruction of Stone Cairns	Preservation of heritage resources and expansion of	Appointed qualified heritage specialist and mapping	Prior to commencing development, appoint a heritage specialist/archaeologist	Holder, Contractor	Pre-construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		indicating an old Wagon Road (Sites: 19-25) by construction activities, e.g., clearing and grubbing activities.	knowledge of the archaeology of the area.		registered with ASAPA to undertake (a) desktop research on the age, origin and function, as well as (b) detailed mapping and photographic recording of the section of old Wagon Road in the development footprint and demarcated by stone cairns at sites 19 to 25 and 29.			
26	Contractor readiness	Disturbance to or destruction of Stone Cairns indicating an old Wagon Road (Sites: 19-25) by construction activities, e.g., clearing and grubbing activities	Preservation of heritage resources and expansion of knowledge of the archaeology of the area.	Landowners' permission letter	Landowner's permission to undertake the required mitigation work must be provided.	Holder	Pre-construction	Compliance to be verified by ECO and IEA.
26	Contractor readiness	Disturbance to or destruction of Stone Cairns indicating an old Wagon Road (Sites: 19-25) by construction activities, e.g., clearing and	Preservation of heritage resources and expansion of knowledge of the archaeology of the area.	Heritage sites have been preserved	Preserve the section of road demarcated by the Heritage Specialist in a kmz file and including stone cairns at sites 19 to 22	Contractor, ECO	Pre-construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		grubbing activities						
26	Contractor readiness	Disturbance to or destruction of Stone Cairns indicating an old Wagon Road (Sites: 19-25) by construction activities, e.g., clearing and grubbing activities	Preservation of heritage resources and expansion of knowledge of the archaeology of the area.	Old wagon road is fenced off.	The preserved section of old Wagon Road should be cordoned-off during construction.	Contractor, ECO	Pre-construction	Compliance to be verified by ECO and IEA.
26	Contractor readiness	Disturbance to or destruction of Stone Cairns indicating an old Wagon Road (Sites: 19-25) by construction activities, e.g., clearing and grubbing activities	Preservation of heritage resources and expansion of knowledge of the archaeology of the area.	Information signage	Erect information signage on the history of the old Wagon Road	Holder, ECO	Pre-construction	Compliance to be verified by ECO and IEA.
26	Contractor readiness	Disturbance to or destruction of Stone Cairns indicating an old Wagon Road (Sites: 19-25) by construction	Preservation of heritage resources and expansion of knowledge of the archaeology of the area.	Stone cairns protected.	As far as possible avoid destruction or demolition of other stone cairns, including but not limited to sites 23 to 25. These cairns may only be destroyed if they can't be avoided.	Contractor	Pre-construction and Construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		activities, e.g., clearing and grubbing activities						

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
26	L	L	L	neutral	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
26	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- The residual risk of damage to a cultural heritage resource/knowledge (**26**) after mitigation is estimated to be Low to zero.

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Reg: 2006/023163/23

PREFERRED ALTERNATIVE IMPACT ASSESSMENT

CONSTRUCTION PHASE

TABLE OF CONTENTS

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Identification (and assessment) of impacts and risks for the preferred alternative

3(1) A EIA report… must include –

(h) a full description of the process followed to reach the proposed development footprint within the approved site, as contemplated in the accepted scoping report, including;

(v) the impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts- (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated;

(vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;

(viii) the possible mitigation measures that could be applied and level of residual risk;

Appendix 3 (Content of the EIA Report) of the EIA Regulations, 2014 as amended

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Reg: 2006/023163/23

Construction Phase

Receiving Environment: Legal System

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
General and Hazardous waste Management	Handling and Collection (incl. chemical toilets)	Land contamination	**Impact:** Risk of non-compliance **Consequence:** An offence	N/A	01
General and Hazardous waste Management	Storage	Land contamination	**Impact:** Risk of non-compliance **Consequence:** An offence	N/A	01
General and Hazardous waste Management	Transport	Land contamination	**Impact:** Risk of non-compliance **Consequence:** An Offence	N/A	01
General and Hazardous waste Management	Disposal	Land contamination	**Impact:** Risk of non-compliance **Consequence:** An offence	N/A	01
Erecting the 33kV powerline underneath Eskom's 133kV powerline	Working near or under powerlines	Unsafe environment (damage to property and loss of life)	**Impact:** Risk of non-compliance **Consequence:** An offence, injury, or death to staff	N/A	01

*The source of information used in identifying the impact is either the Leipold Matrix (Matrix), Interested and Affected Parties (I&APs) and/or Specialist studies (Specialist)

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 01 (Waste)

- Almost a third of households on a ward level have their own refuse dumps with just over half of the households having their refuse removed by a local authority at least once a week. This is due to the high incidence of farms in the ward.

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Reg: 2006/023163/23

- It is anticipated that both general and hazardous waste types will be generated during construction. Except for domestic wastewater (13 m3/day), volumes cannot be known.

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
01	NA	NA	NA	-I	NA	NA	NA	H	H	1
Reversibility	NA		**Irreplaceability**	NA		**Mitigatory Potential**	H			

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- The proposed activities do not include operational aspects. Consequently, the environmental authorization is required for development only, including the following phases: planning and design, pre-construction, construction, and post-construction (rehabilitation and monitoring).The validity period of the environmental authorisation shall be the maximum permissible period given the scale of the project, anticipated time to complete construction, and the uncertainty of when a water use license will be granted.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- National Environmental Management: Waste Management Act, 2008 (Act 59 of 2008)
- Waste Classification and Management Regulations, 2013.

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Reg: 2006/023163/23

- National Environmental Management Act, 1998 (Act No. 107 of 1998); Section 49A (1) A person is guilty of an offence if that person - (c) fails to comply with or contravenes a condition of an environmental authorisation granted for a listed activity or specified activity or an approved environmental management programme
- Electrical Machinery Regulations of the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993)
- Eskom letter dated 14 March 2017 ref: Invest14/03/2017

Mitigations:

Impact Management Outcome(s):

- Compliance with waste handling and storage.
- Compliance with OHS.

Targets:

- Integrated waste management plan.
- Registration with SAWIS, if required.
- Records of waste management.
- Waste is separated and disposed/recycled within 18 months of generation.
- Labelled waste storage and records of waste storage.
- Licensed service provider used.
- Safety Data Sheets.
- Waste classification.
- Safe working distance from Eskom's live electrical equipment.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
01	Quarry (Sourcing materials (aggregate) for roads and concrete)	Unlawful mining activities	Compliance with Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)	Quarry material used on Portion 3 of the Farm Goede Hoop 26C.	The borrow pit/quarry may only be used to source suitable material for improvements to the property that it is located on.	Contractor	Construction	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
01	General and Hazardous Waste	Risk of non-compliance	Compliance with waste handling and storage	Integrated waste management plan.	Waste shall be managed in accordance with the integrated waste management plan.	Contractor	Construction	Compliance to be verified by ECO and IEA
01	General and Hazardous Waste	Risk of non-compliance	Compliance with waste handling and storage	Registration with SAWIS, if required.	The contractor(s) must determine whether he/she needs to register a waste management activity on the South African Waste Information System (SAWIS) using the South African Waste Information Centre's website, e.g., generators of hazardous waste in excess of 20kg per day must register.	Contractor	Construction	Compliance to be verified by ECO and IEA
01	General and Hazardous Waste	Risk of non-compliance	Compliance with waste handling and storage	Records of waste management.	The waste generator must keep accurate and up to date records of the management of the waste they generate including records that reflect: (a) The classification of the wastes (General waste, including domestic, business, building and demolition waste not containing hazardous waste/chemicals is listed in Annexure 1 of the Waste Classification and Management Regulations, 2013 and therefore do not require formal classification	Contractor	Construction	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					and assessment in terms of the same Regulations); (b) The quantity of each waste generated, expressed in tons or cubic metres per month; (c) The quantities of each waste that has either been reused, recycled, recovered, treated, or disposed of; and (d) By whom the waste was managed.			
01	General and Hazardous Waste	Risk of non-compliance	Compliance with waste handling and storage	Waste is separated	Separate waste into recyclable (glass, metals, paper, plastic) and non-recyclable waste.	Contractor	On-going	Compliance to be verified by ECO and IEA
01	General and Hazardous Waste	Risk of non-compliance	Compliance with waste handling and storage	Waste disposed/recycled within 18 months of generation	Waste generators must ensure that their waste is reused, recycled, recovered, treated and/or disposed of within 18 months of generation.	Contractor	On-going	Compliance to be verified by ECO and IEA
01	General and Hazardous Waste	Risk of non-compliance	Compliance with waste handling and storage	Labelled waste storage	Any container or storage impoundment holding waste must be labelled. If labelling is not possible, then records must be kept.	Contractor	On-going	Compliance to be verified by ECO and IEA
01	General and Hazardous Waste	Risk of non-compliance	Compliance with waste handling and storage	Records of waste storage	Labels and records need to reflect: (a) The date on which the waste was first placed into the container; (b) The date on which the last bit of waste was placed into the container before it	Contractor	On-going	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					was filled, closed, sealed or covered; (c) The dates when, and quantities of, waste added, and waste removed from containers or storage impoundments (if relevant); (d) The specific category or categories of waste in the container or storage impoundment as identified in terms of the National Waste Information Regulations (2012); and (e) The classification of the waste once it has been completed.			
01	General and Hazardous Waste	Risk of non-compliance	Compliance with waste handling and storage	Licensed service provider used	Given the overwhelming legal requirements governing the transport of Hazardous Chemical Substances (HCS) or dangerous goods, and therefore hazardous waste, it is recommended that the services of a licensed service provider be employed to undertake this activity. None the less, the consignor or person who dispatches the hazardous waste remains responsible to ensure that hazardous waste is packaged, transported, treated and disposed of in terms of the legal requirements and that	Contractor	On-going	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					there is an auditable record of the steps involved in storing, collecting and transporting the waste.			
01	General and Hazardous Waste	Risk of non-compliance	Compliance with waste handling and storage	Safety Data Sheets	A Safety Data Sheet (SDS) and Waste Manifest must accompany a load of hazardous waste transported from the point of generation to the waste management facility.	Contractor	On-going	Compliance to be verified by ECO and IEA
01	General and Hazardous Waste	Risk of non-compliance	Compliance with waste handling and storage	Waste classification	Waste transporters may not accept waste that has not been classified in terms of SANS10234, unless it is listed in Annexure 1 of the Waste Classification and Management Regulations, 2013.	Contractor	On-going	Compliance to be verified by ECO and IEA
01	Erecting the 33kV powerline underneath Eskom's 133kV powerline	Risk of non-compliance	Compliance with OHS	Safe working distance from Eskom's live electrical equipment	The clearances between Eskom's live electrical equipment and the proposed construction work shall be observed as stipulated by Regulation 15 of the Electrical Machinery Regulations of the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993)	Contractor	On-going	Compliance to be verified by ECO and IEA

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE

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Reg: 2006/023163/23

01	NA	NA	NA	+I	NA	NA	NA	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
01	NA	NA	NA	+I	NA	NA	NA	L	L	0

Residual Risk (feeds back into "Mitigations"):

- The residual risk of undertaking unlawful activities (**01**) after mitigation is assumed to be Low.
- A person may feel compelled to commence with construction without a water use license if an environmental authorisation has been granted by the competent authority and the validity period requires the applicant to conclude the authorised activity within a restrictive timeframe that is limited to one dry season.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Receiving Environment: Terrestrial fauna

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Drilling and/or Ram Piling (for rack foundations and fence poles)	Drilling Rig on land and in a watercourse (perimeter fence)	Traps	**Impact:** Large antelope can get trapped inside the fenced area and smaller animals such as tortoises could get trapped along the fence line. **Consequence:** Loss of wildlife, damage to property.	Quantity	02
Construction Plant Management including Deliveries	Driving/Transport	Speed (en route to & from site)	**Impact:** Loss of sedentary or active fauna and aves when driving. **Consequences:** Loss/injury to fauna/aves	Quantity	02
Employee management (including appointment, conduct and movement)	Harvesting muthi plants, collecting firewood and/or poaching	Removal of medicinal plants, dead wood and/or wildlife	**Impact:** Poaching **Consequence:** Economic losses due to loss of livestock/game/property	Quantity	02
Construction Plant Management including Deliveries	Driving/Transport	Damage to the environment	**Impact:** Roadkill, electrocutions of fauna during construction and post-construction. **Consequence:** Loss/injury to faunal species.	Quantity	02
Security	N/A	Influx of contractors and workers into the area.	**Impact:** Large antelope can get trapped inside the fenced area and smaller animals such as tortoises could get trapped along the fence line. **Consequence:** Loss of wildlife, damage to property.	Quantity	02
Clearing/Grubbing and Grading	Construction camp (incl. operational area), borrow pit, upgrading existing and new roads, trenches for underground cables and water	Removal of vegetation	**Impact:** Direct loss of local sedentary or burrowing fauna and Aves through construction activities on land. **Consequence:** - the loss of threatened (Red Data) species may result in a loss of biodiversity and ecosystem resilience to climate change (direct). - the loss of threatened keystone species may alter the functioning of an ecosystem (direct).	Quantity	02

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Reg: 2006/023163/23

	pipes, holes for racks, fence posts and pylons, foundations for inverters, field transformers and on-site substation, water storage tanks and deionization plant.				
Clearing/Grubbing and Grading	Construction camp (incl. operational area), borrow pit, upgrading existing and new roads, trenches for underground cables and water pipes, holes for racks, fence posts and pylons, foundations for inverters, field transformers and on-site substation, water storage tanks and deionization plant.	Interfering with biodiversity patterns (fauna and flora)	**Impact:** Removal of vegetation and disruption to the watercourse **Consequences:** (1) Habitat degradation leads to disturbance/alteration of important areas of bat activity such as roosting sites, commuting, foraging and socialising areas. (2) Habitat degradation leads to changes in bat community and abundance of bat species. (3) Cumulative deterioration to the landscape and the loss of habitat due to vegetation clearing and roost disturbance/destruction may cause a shift in the species composition and abundance within the bat community to a bias towards more hardy species such as the Egyptian free-tailed bat, T. aegyptiaca.	Quantity	02
Earthworks	Excavating and Trenching	Traps	**Impact:** Direct loss of fauna through earthworks during construction activities. **Consequence:** Injury/death to animals (both wildlife and domestic)	Quantity	02

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Reg: 2006/023163/23

Construction Plant Management including Deliveries	Driving/Transport	Damage to the environment	**Impact:** The construction of a solar electricity generating facility and its associated infrastructure will lead to a change of land use and livelihoods. **Consequence:** Change of land use can potentially impact negatively on the livelihood of the affected farmer, which is sheep farming.	Quantity	03
Security	N/A	Influx of contractors and workers into the area.	**Impact:** Farm gates being left open, or not being closed properly by construction teams. **Consequence:** Loss of livestock	Quantity	03
Employee management (including appointment, conduct and movement)	Eating (Lunch breaks)	Organic and inorganic waste arisings	**Impact:** Animals could gain access to waste receptacles **Consequence:** Ingestion of plastics could cause death/injury to animals. Waste distributed on the site.	Quantity	04
General and Hazardous Waste Management	Storage	Land contamination	**Impacts:** Loss of fauna if inorganic waste is ingested. **Consequences:** death/injury to fauna.	Quantity	04
General and Hazardous Waste Management	Disposal	Land contamination	**Impact:** Burning of waste as a disposal method increases the risk of veld fires caused by workers during the construction of the facility. **Consequence:** - Veld fires result in a loss of fauna (direct) - Veld fires reduce the carrying capacity and therefore productivity of land (indirect)	Quantity	04
General and Hazardous Waste Management	Mixing concrete on site	Waste arisings (cement bags)	**Impact:** Cement bags disposed of around the site where fauna could come into contact with the waste. **Consequence:** fauna could get injured/death if bags are eaten.	Quantity	04

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Reg: 2006/023163/23

Construction Plant Management including Deliveries	Operating equipment	Generating noise	**Impacts:** Disturbance during construction at both sites can cause active mammals to temporarily emigrate from the area. **Consequence:** Forced redistribution out of home ranges or territories can cause stress and conflict.	Quantity	05
Construction Plant Management including Deliveries	Operating equipment	Generating noise	**Impact:** Disturbance (including of nesting SCC) due to noise such as, machinery movements and maintenance operations during the construction phase the proposed PV solar farm. **Consequence:** Decrease in avifauna population due to loss of offspring/breeding pairs for generation.	Quantity	05
Employee management (including appointment, conduct and movement)	Communicating	Noise generation	**Impact:** Disturbance during construction can cause active mammals and birds to temporarily evade or emigrate from the area. **Consequence:** - Forced redistribution out of home ranges or territories can cause stress and conflict. Conflict can lead to injury or death of individuals.	Quantity	05
QUARRY (Sourcing materials (aggregate) for roads and concrete)	New Quarry & Crushing Plant Operation (and maintenance)	Noise generation	**Impact:** Disturbance during operation of crushing plant can cause active mammals to temporarily emigrate from the area. **Consequence:** - Forced redistribution out of home ranges or territories can cause stress and conflict. Conflict can lead to injury or death of individuals.	Quantity	05

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 02 (Animal Species)

- There are concerns that poaching incidents may increase, especially when the fencing is erected and when a number of construction teams are active in the area.
- Large scale removal of natural vegetation for the installation and operation of solar PV facilities can alter preferred habitats, cause a change in prey availability and thus a change in bat activity in the landscape.

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Reg: 2006/023163/23

- The risk of direct collisions of bats with solar PV panels is unknown and the perception of smooth surfaces by bats is not well studied. If bats perceive smooth surfaces as voids, solar PV panels left in a resting position perpendicular or more than 45 degrees in relation to the ground could pose a collision risk. However, this risk is negated for the proposed Phase 3 since single-axis tracker that allows the panels to be stowed horizontally at night to reduce wind-load and if bats are "confused" by the smooth surface or perceive it as a potential drinking source may approach the surface at a slower speed and not collide with it.
- A 1.8 m high galvanised diamond razor mesh security fence will be installed around each of the four PV Blocks within the facility. The risk of the security fence in relation to bat collisions and bat injury/mortality is largely unknown.
- Sedentary animals pose a higher risk of harm than active animals.

Impact 03 (Social - Livestock and Game breeding)

- During the construction phase all livestock would need to be moved to different parts of the farm as the construction activities may be distressing for the animals.
- Construction traffic may impact on the movement of the livestock around the farm.
- The movement of workers and vehicles on the site could cause damage to farm infrastructure (e.g., fencing, water troughs and gates), during construction and operation.
- There is a risk of stock loss due to farm gates being left open, or not being closed properly by construction teams.
- There are concerns that poaching incidents may increase, especially when the fencing is erected and when a number of construction teams are active in the area.
- There are game on the directly affected and neighbouring properties. The noise of construction activities may keep the animals away from the construction site, but during operation when the site is quieter it may become a risk if a large antelope is trapped inside the fenced area.

Impact 04 (Waste)

- It is anticipated that both general and hazardous waste types will be generated during construction. Except for domestic wastewater (13 m3/day), volumes cannot be known.

Impact 05 (Noise)

- Soventix assume that there will be 650 construction staff during peak construction.
- Construction equipment will include at least: Water tankers; Graders; Tipper trucks; Drilling rigs (down to 2m); Mobile pile ramming machines (down to 3m at the most); Rock crushing plant; Excavators; TLBs; Concrete mixers; Compaction equipment; Light delivery vehicles; and Heavy delivery vehicles (for the transformers).

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Reg: 2006/023163/23

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
02	M	M	M	-I	M	H	1	H	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
03	M	M	M	-I	M	H	1	H	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
04	L	M	L	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

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Reg: 2006/023163/23

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
05	L	M	L	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- Timing construction to May, June, July and August in order to avoid breeding periods of species within the sensitive drainage lines, wetlands and the general region.
- Perform continuous bat monitoring using passive bioacoustic recording systems in line with the South African Good Practice Guidelines for Surveying Bats at WEF's (Sowler and Stoffberg, 2014) and SAGPG for Operational Monitoring (Aronson et al. 2014) for one year pre-construction, during construction and two years post-construction (operation). During the first two years of operation, it is expected that any changes in bat activity and perceived impacts will be most evident.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Social Impact Assessment Report prepared by Ilse Aucamp of Equispectives Research & Consulting Services dated August 2022.
- Chiropteran Specialist Report for Phase 3 of the Proposed Soventix-Solar Africa Solar PV Facility, Hanover, Northern Cape Prepared by: Dawn Cory Toussaint dated July 2022.
- Avifauna Specialist Assessment (Final) prepared by Enviro-Insight CC (Sam Laurence and A.E. van Wyk) dated October 2022.
- Terrestrial Animal Species Compliance Statement – Soventix Phase 3 Pv Project (Second Draft) prepared by Simon Todd of 3 Foxes Biodiversity Solutions dated September 2022.
- Terrestrial Biodiversity Specialist Assessment – Soventix Phase 3 Pv Project prepared by Simon Todd of 3 Foxes Biodiversity Solutions dated September 2022.

Mitigations:

Impact Management Outcome(s):

- Ensure least impact on animal behaviour.
- Ensure the protection of fauna aves and livestock.
- Good waste storage and management.

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Reg: 2006/023163/23

Targets:

- No trapped animals in PV blocks.
- No signs of speeding.
- No vehicle collisions with fauna.
- No poaching incidents.
- Case number.
- Logbook of fauna related incidents.
- No unnecessary physical harm to fauna.
- Natural vegetation preserved where possible.
- Bat monitoring results.
- Bat monitoring systems in working order.
- Excavations are demarcated and not left open.
- Boundary gates in good condition.
- Compensation.
- Lockable waste storage.
- No litter.
- No signs of burning waste.
- Waste storage area.
- Construction outside of breeding season.
- No unnecessarily loud noise.
- Equipment in good condition and operated correctly.
- Compliance with bylaws.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
02	Drilling and/or Ram Piling (for rack foundations and fence poles)	Large antelope can get trapped inside the fenced area and smaller animals such as tortoises	Ensure the protection of fauna aves and livestock	No trapped animals in PV blocks	Ensure large animals are not trapped inside the fenced PV blocks.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		could get trapped along the fence line.						
02	Drilling and/or Ram Piling (for rack foundations and fence poles)	Large antelope can get trapped inside the fenced area and smaller animals such as tortoises could get trapped along the fence line.	Ensure the protection of fauna aves and livestock	No trapped animals in PV blocks	Inspections of boundary fences should be done on a daily basis.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.
02	Construction plant management (including deliveries)	Loss of sedentary or active fauna and aves when driving.	Ensure the protection of fauna aves and livestock	No signs of speeding	Drivers must adhere to the speed limit (30 or 40 km/hr) and slow down when approaching animals. This is to be included in the induction.	Contractor	On-going	Compliance to be verified by ECO and IEA.
02	Construction plant management (including deliveries)	Loss of sedentary or active fauna and aves when driving.	Ensure the protection of fauna aves and livestock	No vehicle collisions with fauna.	Drivers must be vigilant and on the lookout for animals.	Contractor	On-going	Compliance to be verified by ECO and IEA.
02	Employee management (including appointment, conduct and movement)	Poaching	Ensure the protection of fauna aves and livestock	No poaching incidents	Soventix must have a zero-tolerance policy regarding poaching, and make it clear what the punishment and consequences would be.	Holder, Contractor, ECO	On-going	Compliance to be verified by ECO and IEA.
02	Employee management (including	Poaching	Ensure the protection of	Case number	All poaching incidences must be reported to the local police.	Holder, Contractor, ECO	On-going	Compliance to be verified by

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
	appointment, conduct and movement)		fauna aves and livestock					ECO and IEA.
02	Construction plant management (including deliveries)	Roadkill, electrocutions of fauna during construction and post-construction.	Ensure the protection of fauna aves and livestock	Logbook of fauna related incidents	A log should be kept detailing all fauna-related incidences or mortalities that occur on site, including roadkill, electrocutions etc. during construction and operation. These should be reviewed annually and used to inform operational management and mitigation measures.	Contractor	On-going	Compliance to be verified by ECO and IEA.
02	Clearing, grubbing and grading	Direct loss of local sedentary or burrowing fauna and Aves through construction activities on land.	Ensure the protection of fauna aves and livestock	No unnecessary physical harm to fauna	Search and rescue for reptiles and other vulnerable species during construction, before areas of intact vegetation are cleared. Such search and rescue should be conducted by relevant experts with experience in search and rescue of the faunal groups concerned.	Contractor, Specialist	Before clearing, grubbing or grading	Compliance to be verified by ECO and IEA.
02	Clearing, grubbing and grading	Direct loss of local sedentary or burrowing fauna and Aves through construction	Ensure least impact on animal behaviour.	No unnecessary physical harm to fauna	If any sedentary animals or ground nesting birds are found, then these are to be relocated to a suitable distance and habitat by the ECO, and only if it	Contractor, Specialist, ECO	On-going	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		activities on land.			is not possible to relocate the footprint.			
02	Clearing, grubbing and grading	Removal of vegetation and disruption to the watercourse could alter bat behaviour	Ensure the protection of fauna aves and livestock	Natural vegetation preserved where possible	Conserve the natural vegetation around the physical footprints.	Contractor	Construction	Compliance to be verified by ECO and IEA.
02	Clearing, grubbing and grading	Removal of vegetation and disruption to the watercourse could alter bat behaviour	Ensure the protection of fauna aves and livestock	Bat monitoring results	Perform continuous bat monitoring using passive bioacoustic recording systems in line with the South African Good Practice Guidelines for Surveying Bats at WEF's (Sowler and Stoffberg, 2014) and SAGPG for Operational Monitoring (Aronson et al. 2014) for one year pre-construction, during construction and two years post-construction (operation). During the first two years of operation, it is expected that any changes in bat activity and perceived impacts will be most evident.	Contractor, Bat specialist, ECO	Construction	Compliance to be verified by ECO and IEA.
02	Clearing, grubbing and grading	Removal of vegetation and disruption to the watercourse	Ensure the protection of fauna aves and livestock	Bat monitoring systems in working order.	A specialist should maintain these systems and determine the impacts of solar PV facility on bat	Bat specialist ECO	Construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		could alter bat behaviour			populations in relation to landscape changes in both the physical changes with the installation of the solar PV panels, the resulting change in vegetation structure underneath the solar PV panels and the management strategy of the operational facility.			
02	Earthworks	Direct loss of fauna through earthworks during construction activities.	Ensure the protection of fauna aves and livestock	No trapped animals	Check excavations daily for trapped animals and release them.	Contractor	Construction	Compliance to be verified by ECO and IEA.
02	Earthworks	Direct loss of fauna through earthworks during construction activities.	Ensure the protection of fauna aves and livestock	Excavations are demarcated	Demarcate excavations with netting to prevent any persons or animals falling in the excavations.	Contractor	Construction	Compliance to be verified by ECO and IEA.
02	Earthworks	Direct loss of fauna through earthworks during construction activities.	Ensure the protection of fauna aves and livestock	No excavations left open	Fill open excavations as soon as possible after excavation.	Contractor	Construction	Compliance to be verified by ECO and IEA.
03	Construction plant management including deliveries	The construction of a solar electricity generating facility and its	Ensure the protection of fauna aves and livestock	No vehicle collisions with livestock	Livestock must have right of way.	Contractor	On-going	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		associated infrastructure will lead to a change of land use and livelihoods.						
03	Construction plant management including deliveries	The construction of a solar electricity generating facility and its associated infrastructure will lead to a change of land use and livelihoods.	Ensure the protection of fauna aves and livestock	No vehicle collisions with livestock	Construction vehicles must wait for the animals to cross before they continue with their journey.	Contractor	On-going	Compliance to be verified by ECO and IEA.
03	Security	Farm gates being left open, or not being closed properly by construction teams.	Ensure the protection of fauna aves and livestock	Boundary gates in good condition	Inspections of boundary gates should be done on a daily basis in areas where there are activities.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.
03	Security	Farm gates being left open, or not being closed properly by construction teams.	Ensure the protection of fauna aves and livestock	Compensation	Affected landowners must be compensated for their losses if any livestock losses occur.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.
04	Employee management (including appointment,	Animals could gain access to waste receptacles	Good waste storage and management	Lockable waste storage	All laydown areas, construction sites etc with waste disposal bins, should be provided with lockable	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
	conduct and movement)				bins that are tamper proof by baboons, monkeys and other fauna.			
04	General and hazardous waste management	Loss of fauna if inorganic waste is ingested.	Good waste storage and management	No litter	General waste, such as food packaging and cement bags shall be immediately disposed of in the designated receptacles, e.g., scavenger proof bins, and removed from the construction site overnight.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.
04	General and hazardous waste management	Burning of waste as a disposal method increases the risk of veld fires caused by workers during the construction of the facility decreasing grazing capacity and potentially harming wildlife	Good waste storage and management	No signs of burning waste	Burning of waste is prohibited.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.
04	General and hazardous waste management	Cement bags disposed of around the site where fauna could come into	Good waste storage and management	Waste storage area	Designate and contain a temporary waste storage area within the construction camp (e.g., covered skips,	Contractor	Construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		contact with the waste.			scavenger proof bins, etc.)			
05	Construction plant management including deliveries	Disturbance during construction at both sites can cause active mammals to temporarily emigrate from the area.	Ensure least impact on animal behaviour.	Equipment in good condition	Construction plant, machinery and equipment must be regularly serviced and well maintained to reduce noise levels.	Contractor	On-going	Compliance to be verified by ECO and IEA.
05	Construction plant management including deliveries	Disturbance (including of nesting SCC) due to noise such as, machinery movements and maintenance operations during the construction phase the proposed PV solar farm.	Ensure least impact on animal behaviour.	Construction outside of breeding season	Timing construction to May, June, July and August in order to avoid breeding periods of species within the sensitive drainage lines, wetlands and the general region.	Holder, Contractor, ECO	Construction	Compliance to be verified by ECO and IEA.
05	Employee management (including appointment, conduct and movement)	Disturbance during construction can cause active mammals and birds to temporarily evade or	Ensure least impact on animal behaviour.	No unnecessarily loud noise.	Keep noise levels as low as practically possible when working, e.g. no unnecessary shouting, loud music or revving of engines.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		emigrate from the area.						
05	QUARRY (Sourcing materials (aggregate) for roads and concrete)	Disturbance during operation of crushing plant can cause active mammals to temporarily emigrate from the area.	Ensure least impact on animal behaviour.	No unnecessarily loud noise.	Turn off all equipment when not in use.	Contractor	Construction	Compliance to be verified by ECO and IEA.
05	QUARRY (Sourcing materials (aggregate) for roads and concrete)	Disturbance during operation of crushing plant can cause active mammals to temporarily emigrate from the area.	Ensure least impact on animal behaviour.	Equipment in good condition	Ensure that all equipment is kept in good working order.	Contractor	Construction	Compliance to be verified by ECO and IEA.
05	QUARRY (Sourcing materials (aggregate) for roads and concrete)	Disturbance during operation of crushing plant can cause active mammals to temporarily emigrate from the area.	Ensure least impact on animal behaviour.	Equipment is operated correctly.	Operate all equipment within specifications and capacity.	Contractor	Construction	Compliance to be verified by ECO and IEA.
05	QUARRY (Sourcing materials (aggregate)	Disturbance during operation of crushing plant	Ensure least impact on animal behaviour.	Compliance with bylaws.	Adhere to any local bylaws and regulations regarding the generation of noise.	Holder, Contractor	On-going	Compliance to be verified by

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
	for roads and concrete)	can cause active mammals to temporarily emigrate from the area.						ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
02	L	L	M	-I	M	M	1	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
02	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
03	L	L	L	-I	M	M	1	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
03	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE

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Reg: 2006/023163/23

04	L	M	L	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
04	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
05	L	M	L	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
05	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- Sedentary or burrowing fauna (**02**), as well as ground nesting birds, may occupy the development site after their observed absence during the environmental impacts assessment process.
- The residual risk of social impacts (loss of livestock) which thus affects livelihoods (**03**) after mitigation is assumed to be Low.
- The residual risk of loss/disturbance of terrestrial fauna due to poor waste management (**04**) after mitigation is assumed to be Low.
- The residual risk of loss/disturbance of terrestrial fauna due to an increase in noise (**05**) after mitigation is assumed to be Low.

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Reg: 2006/023163/23

Receiving Environment: Terrestrial flora

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Fire management	Wildfires		**Impact:** Risk of veld fires caused by workers during the construction of the facility. **Consequence:** - Runaway fires on neighbouring properties will result in a loss of grazing for livestock and/or wild game, increasing the running costs to provide supplementary feed.	Quantity	06
QUARRY (Sourcing materials (aggregate) for roads and concrete)	New Quarry & Crushing Plant Operation (and maintenance)	Dust generation	**Impact:** Increase in sedimentation/dust covering flora species. **Consequence:** reduced photosynthetic functioning.	Quantity	07
Road Management	Driving new two-track roads	Removal of vegetation and habitat	**Impact:** Direct loss of terrestrial plants from construction activities on land. **Consequence:** - the loss of threatened (Red Data) species may result in a loss of biodiversity and ecosystem resilience to climate change (direct). - the loss of threatened keystone species may alter the functioning of an ecosystem (direct).	Quantity	07
Clearing/Grubbing and Grading	Construction camp (incl. operational area), borrow pit, upgrading existing and new roads, trenches for underground cables and water pipes, holes for racks, fence posts and pylons,	Removal of vegetation	**Impact:** Direct loss of terrestrial plants from construction activities on land. **Consequence:** - the loss of threatened (Red Data) species may result in a loss of biodiversity and ecosystem resilience to climate change (direct). - the loss of threatened keystone species may alter the functioning of an ecosystem (direct).	Quantity	07

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Reg: 2006/023163/23

	foundations for inverters, field transformers and on-site substation, water storage tanks and deionization plant.				
Employee management (including appointment, conduct and movement)	Harvesting muthi plants, collecting firewood and/or poaching	Removal of medicinal plants, dead wood and/or wildlife	**Impact:** Direct loss of terrestrial plants from construction activities on land. **Consequence:** - the loss of threatened (Red Data) species may result in a loss of biodiversity and ecosystem resilience to climate change (direct). - the loss of threatened keystone species may alter the functioning of an ecosystem (direct).	Quantity	07
Construction Plant Management including Deliveries	Driving/Transport	Dust generation	**Impact:** Increase in sedimentation/dust covering flora species. **Consequence:** Reduced photosynthetic functioning.		07
Alien Plant Management	Disturbance to natural areas	Favourable conditions for alien plant/animal recruitment.	**Impact:** Alien invasive plants: Prevent the cleared areas from degrading, as invasive non-native plants will spread into degraded areas. **Consequence:** Loss of biodiversity, invasive species compete with indigenous plant species.	Quantity	08
Linear Infrastructure Crossings	Distribution Line Pylons, Roads and Pipelines	Clearing & Grubbing/Removal of Vegetation/ Sedimentation	**Impact:** Altered surface water flow patterns, e.g., changing sheet flow (natural open system) to concentrated flows leads to erosion. **Consequence:** Increased suspended solids, siltation in watercourses and soil erosion.	Quantity	09
Construction Plant Management including Deliveries	Driving/Transport	Damage to the environment	**Impact:** Removal of vegetation and disruption to the watercourse **Consequence:** (1) Habitat degradation leads to disturbance/alteration of important areas of bat activity such as roosting sites, commuting, foraging and socialising areas.	Quantity	10

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Reg: 2006/023163/23

			(2) Habitat degradation leads to changes in bat community and abundance of bat species. (3) Cumulative deterioration to the landscape and the loss of habitat due to vegetation clearing and roost disturbance/destruction may cause a shift in the species composition and abundance within the bat community to a bias towards more hardy species such as the Egyptian free-tailed bat, T. aegyptiaca.		

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 06 (Fire)

- The De Aar area falls within the Nama Karoo biome. Runaway fires could result in a decrease in grazing capacity.

Impact 07 (Plant species)

- Northern Upper Karoo has not been significantly affected by transformation and is still approximately 96% intact and is classified as Least Threatened.
- Within the study area, the vegetation consists of a mosaic of grassy and more shrubby areas, with shrubs being more prevalent on the stony and shallow soils of the site. No indigenous trees are present within the site and the vegetation consists of low grassland shrubland.
- There are no threated vegetation types or specialised plant communities present within the site.
- No plant species of conservation concern were observed within the site and overall, the site is considered low sensitivity from a Plant Species Theme perspective
- No person may collect firewood or pick, transport or remove an indigenous plant on land of which such person is not the owner without the owner's written permission.

Impact 08 (Alien Invasive Species)

- No large-scale populations of any listed alien invasive species were noted on site. However disturbance and construction activity can result in the recruitment of alien invasive plant species.

Impact 09 (Surface water hydrology)

- The ephemeral drainage line running through the project area is an unnamed tributary to the D62D – 05610 tributary with its confluence just downstream of the Project Area.

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Reg: 2006/023163/23

- Drainage is generally towards the north-west via multiple non-perennial drainage lines towards the ephemeral Brak River, approximately 6,6 km further downstream. (At least) Three small capacity in-stream dams occur within the development area.
- The project area falls within a spring to summer rainfall area (October to April), ranging from 112,4 to 738,9 mm/yr but averaging 320 mm/yr. The Mean Annual Evaporation (2 000 – 2 150 mm/r) exceeds the Mean Annual Precipitation (MAP) by about 85%, so non-perennial streams and rivers will only have water when there are flooding events.

Impact 10 (Animal species)

- Large scale removal of natural vegetation for the installation and operation of solar PV facilities can alter preferred habitats for bats, cause a change in prey availability and thus a change in bat activity in the landscape.

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
06	L	M	L	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

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Reg: 2006/023163/23

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
07	L	M	L	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
08	M	M	M	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
09	L	M	L	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
10	L	M	L	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- National Veld and Forest Fire Act, 1998 (Act No. 101 of 1998)
- Plant Species Compliance Statement – Soventix Phase 3 Pv Project (Second Draft) prepared by Simon Todd of 3 Foxes Biodiversity Solutions dated September 2022.

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Reg: 2006/023163/23

- Chiropteran Specialist Report for Phase 3 of the Proposed Soventix-Solar Africa Solar PV Facility, Hanover, Northern Cape Prepared by: Dawn Cory Toussaint dated July 2022.
- Aquatic Biodiversity Impact Assessment, Section 21(c) & (i) Risk Assessment and Wetland Delineation Verification Report prepared by Dr Andrew Deacon dated August 2022.
- Hydrological Assessment (Version – Final 3) 01 September 2022 GCS Project Number: 22-0076 by Hendrik Botha.
- NCNCA, 2009 (Act No.09 of 2009) section 51(3)
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
    - Alien and Invasive Species Regulations published in GN No. R 1020 in GG 43735 on 25 September 2020
    - Alien and Invasive Species Lists published in GN No.599, amended in GN No. 1003 of GG No. 43726 on 18 September 2020
- Alien and Invasive Species Regulations published in GN No. R 1020 in GG 43735 on 25 September 2020 - Category 1b Listed Invasive Species must be controlled in compliance with sections 75(1), (2) and (3) of the Act and in accordance with any Invasive Species Management Programme that has been developed in terms of section 75(4) of the Act. The Minister may require any person to develop a Category 1b Control Plan for one or more Category 1b species.

Mitigations:

Impact Management Outcome(s):

- Fire management
- Minimize dust generation
- Avoid the unnecessary loss of or harm to terrestrial plants, particularly protected or threatened plants.
- Reduce invasive alien plant recruitment
- Preserve topsoil, control soil erosion.
- Ensure the protection of fauna

Targets:

- Membership of the local Fire Protection Association.
- Maintained firefighting equipment.
- PPE.
- Perimeter firebreak.
- No offloading during windy conditions.
- No disturbance to protected or threatened plants, unless necessary.

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Reg: 2006/023163/23

- Permit, if required.
- Demarcated areas.
- Demarcations are maintained.
- No signs of vehicles in demarcated areas.
- Cleared vegetation stockpiles.
- Rehabilitation and areas are cordoned off.
- No illegal harvesting of plants or plant parts.
- No uncovered vehicles transporting soil.
- No adult or reproductively mature alien invasive plants observed on site.
- No open bare areas.
- Linear infrastructure is planned.
- Construction corridor is not too wide.
- Existing roads used where possible and unused roads rehabilitated.
- No signs of off-road driving.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
06	Fire management	Risk of veld fires caused by workers during the construction of the facility.	Fire management	Membership of the local Fire Protection Association	Join the local Fire Protection Association if there is one and abide by their minimum requirements, as well as any agreements entered into with the Minister or other FPAs to provide mutual assistance in fighting and extinguishing fires.	Holder	On-going	Compliance to be verified by ECO and IEA.
06	Fire management	Risk of veld fires caused by workers during the	Fire management	PPE	Obtain the necessary PPE for firefighting personnel.	Holder	On-going	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		construction of the facility.						
06	Fire management	Risk of veld fires caused by workers during the construction of the facility.	Fire management	Firefighting equipment	Obtain such firefighting equipment as would be reasonably required in the circumstances, that is proportional to the risk.	Holder, Contractor	Construction	Compliance to be verified by ECO and IEA.
06	Fire management	Risk of veld fires caused by workers during the construction of the facility.	Fire management	Maintained firefighting equipment	Firefighting equipment shall be maintained and readily available during construction (and operation) - regularly test and service equipment	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.
06	Fire management	Risk of veld fires caused by workers during the construction of the facility.	Fire management	Perimeter firebreak	Maintain a firebreak around the perimeter of the solar PV facility. Be aware of burning firebreaks under powerlines as dense vertical columns of smoke can conduct electrical charge to the ground posing a danger to personnel and wildlife or livestock.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.
07	QUARRY (Sourcing materials (aggregate)	Increase in sedimentation/dust covering flora species.	Minimize dust generation	No offloading during windy conditions	Offloading of dispersive materials should be avoided	Contractor	Ongoing	Compliance to be verified by

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
	for roads and concrete)				during windy conditions.			ECO and IEA
07	Road management	Direct loss of terrestrial plants from construction activities on land.	Avoid the unnecessary loss of or harm to terrestrial plants, particularly protected or threatened plants.	No disturbance to protected or threatened plants, unless necessary.	Perform a search for any threatened or protected flora in those areas that will be disturbed.	ECO	Prior to commencement of clearing and grubbing.	Compliance to be verified by ECO and IEA.
07	Road management	Direct loss of terrestrial plants from construction activities on land.	Avoid the unnecessary loss of or harm to terrestrial plants, particularly protected or threatened plants.	Permit, if required	Only apply for permit(s) and/or a license to "pick" a threatened or protected plant if it is not possible to relocate the two-track road.	Holder, Contractor	Prior to commencement of clearing and grubbing.	Compliance to be verified by ECO and IEA.
07	Clearing and grubbing	Direct loss of terrestrial plants from construction activities on land.	Avoid the unnecessary loss of or harm to terrestrial plants, particularly protected or threatened plants.	Demarcated areas	Suitable demarcation must be erected around the construction area, including the servitude, areas where material is stored and the actual footprint of the development to prevent access to sensitive areas.	Contractor, ECO	Prior to commencement of clearing and grubbing.	Compliance to be verified by ECO and IEA.
07	Clearing and grubbing	Direct loss of terrestrial plants from construction activities on land.	Avoid the unnecessary loss of or harm to terrestrial	Demarcations are maintained	Site demarcations should be maintained until the cessation of all	Contractor	Construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
			plants, particularly protected or threatened plants.		construction activities.			
07	Clearing and grubbing	Direct loss of terrestrial plants from construction activities on land.	Avoid the unnecessary loss of or harm to terrestrial plants, particularly protected or threatened plants.	No signs of vehicles in demarcated areas	Vehicular or pedestrian access is prohibited in natural areas beyond the demarcated boundary of the construction site.	Contractor, ECO	Construction	Compliance to be verified by ECO and IEA.
07	Clearing and grubbing	Direct loss of terrestrial plants from construction activities on land.	Avoid the unnecessary loss of or harm to terrestrial plants, particularly protected or threatened plants.	Cleared vegetation stockpiles	Cleared vegetation from the construction camp, laydown area and other footprints shall be stockpiled separately within the construction camp for use during rehabilitation.	Contractor, ECO	Construction	Compliance to be verified by ECO and IEA.
07	Clearing and grubbing	Direct loss of terrestrial plants from construction activities on land.	Avoid the unnecessary loss of or harm to terrestrial plants, particularly protected or threatened plants.	Rehabilitation	Conduct active rehabilitation during the construction activities according to a rehabilitation plan and/or implement the Bare Patch Restoration Protocol (Appendix C) that will restore the natural vegetation to what it	Contractor, ECO	Construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					was prior to construction so that the long-term impact could be negligible.			
07	Clearing and grubbing	Direct loss of terrestrial plants from construction activities on land.	Avoid the unnecessary loss of or harm to terrestrial plants, particularly protected or threatened plants.	Rehabbed areas are cordoned off	Cordon off areas under rehabilitation as “no-go areas” to prevent vehicular, pedestrian and livestock access.	Contractor, ECO	Construction	Compliance to be verified by ECO and IEA.
07	Employee management	Direct loss of terrestrial plants from construction activities on land	Avoid the unnecessary loss of or harm to terrestrial plants, particularly protected or threatened plants	No illegal harvesting of plants or plant parts, e.g., debarked trees or dug-up tubers, used for muthi.	Harvesting of any plant or plant part is prohibited.	Contractor	Ongoing	Compliance to be verified by ECO and IEA.
07	Construction plant management including deliveries	Increase in sedimentation/dust covering flora species.	Avoid the unnecessary loss of or harm to terrestrial plants, particularly protected or threatened plants	No uncovered vehicles transporting soil	Vehicles transporting dispersive materials shall be covered.	Contractor, ECO	Construction	Compliance to be verified by ECO and IEA.
08	Alien plant management	Alien invasive plants: Prevent the cleared areas from degrading, as invasive non-	Reduce invasive alien plant recruitment	No adult or reproductively mature alien invasive plants	Clearing of invasive alien plants must take place coupled with the sowing of seeds of indigenous	Holder, Contractor.	On-going	Compliance to be verified by

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		native plants will spread into degraded areas.		observed on site.	species to stabilise disturbed habitats.			ECO and IEA.
08	Alien plant management	Alien invasive plants: Prevent the cleared areas from degrading, as invasive non-native plants will spread into degraded areas.	Reduce invasive alien plant recruitment	Re-vegetation	Re-vegetation with appropriate indigenous species (to prevent dust and erosion, as well as establishment of alien species).	Holder, Contractor.	On-going	Compliance to be verified by ECO and IEA.
08	Alien plant management	Alien invasive plants: Prevent the cleared areas from degrading, as invasive non-native plants will spread into degraded areas.	Reduce invasive alien plant recruitment	No open bare areas.	Compacted bare ground should be loosened and pitted and covered with branches or stones. This will improve the ability of the surfaces to trap seeds and to absorb rainwater, thereby hastening vegetation recovery.	Holder, Contractor.	On-going	Compliance to be verified by ECO and IEA.
09	Linear infrastructure crossings	Altered surface water flow patterns, e.g., changing sheet flow (natural open system) to concentrated flows leads to erosion.	Preserve topsoil, control soil erosion.	Linear infrastructure is planned.	Slight deviations of alignment are permitted, so as to avoid significant vegetation specimens and communities, natural features and sites of cultural and historical significance. These deviations must be	Holder, Contractor, ECO	Construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					approved by the ECO.			
09	Linear infrastructure crossings	Altered surface water flow patterns, e.g., changing sheet flow (natural open system) to concentrated flows leads to erosion.	Preserve topsoil, control soil erosion.	Construction corridor is not too wide	The width of the construction corridor should be kept to a minimum.	Contractor, ECO	Construction	Compliance to be verified by ECO and IEA.
09	Linear infrastructure crossings	Altered surface water flow patterns, e.g., changing sheet flow (natural open system) to concentrated flows leads to erosion.	Preserve topsoil, control soil erosion.	Existing roads used where possible and unused roads rehabilitated	Where new roads need to be constructed, the existing road infrastructure should be rationalised, and any unnecessary roads decommissioned and rehabilitated to reduce the disturbance of the area in the riverbeds.	Contractor, ECO	Construction	Compliance to be verified by ECO and IEA.
10	Construction plant management	Removal of vegetation and disruption to the watercourse can impact bat behaviour.	Ensure the protection of fauna	No signs of off-road driving	Driving through natural vegetation must be discouraged where construction activities are not taking place.	Holder, Contractor	Construction	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
06	L	M	L	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
06	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
07	L	M	L	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
07	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
08	L	M	L	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
08	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
09	L	M	L	-I	M	L	0	L	L	0

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
09	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
10	L	M	L	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
10	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- The residual risk of loss of grazing material from fire (**06**) after mitigation is assumed to be Low.
- The residual risk of loss/damage to plant species (**07**) particularly during clearing and site establishment of the laydown area, site selection and site area) after mitigation is assumed to be Low.
- The residual risk of alien invasive species recruitment (**08**) after mitigation is assumed to be Low.
- The residual risk of erosion caused by altered surface water hydrology (**09**) after mitigation is assumed to be Low.
- The residual risk of altered behaviour to bat species due to disturbance (driving) in natural vegetated areas (**10**) after mitigation is assumed to be Low.

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Reg: 2006/023163/23

Receiving Environment: Aquatic fauna

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Linear Infrastructure Crossings	Distribution Line Pylons, Roads, Pipelines, and cables	Clearing & Grubbing/Removal of Vegetation/ Sedimentation	**Impact:** A direct loss of aquatic macro and microfauna by construction activities in a watercourse. **Consequence:** - The loss of threatened (Red Data) species may result in a loss of biodiversity and ecosystem resilience to climate change (direct). - The loss of a threatened keystone species may alter the functioning of the aquatic ecosystem	Quantity	11

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 11 (General)

- The aquatic macro-invertebrates were sampled at the project pools. The shallow water level, brief presence of surface water and the lack of flows, reflected in the macro-invertebrate scores resulted in “Fair” SASS scores and low number of families (5). The assemblage of taxa, mostly air-breathers, had a low sensitivity. Furthermore, no fish species are able to inhabit and survive in the system due to its ephemeral nature, the lack of flows and absence of surface water. Even during the short-lived surface flows, the distance from permanent water and brief inundation of the system, rules out the presence of these assemblages.
- However, these ephemeral ecosystems have been found to provide aquatic habitat to a diverse array of faunal species that depend on brief periods of inundation for hatching, mating, feeding and refuge. For instance, many frogs of the Karoo region breed in temporary pools associated with watercourses and wetlands, this includes the Karoo Toad Vandijkophrynus gariepensis and Karoo Dainty Frog Cacosternum Karooicum.

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant

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Reg: 2006/023163/23

M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
11	L	L	L	neutral	L	L	0	L	L	0
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- Construction of linear infrastructure across parts of the ephemeral drainage system, should be restricted to the dry winter months (e.g., May to September), that is commence with such activities as clearing or grading, excavating and importing material at the end of the wet season/beginning of the dry season whilst the soil is still moist and as far as is practical, be completed in, the dry winter months.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Aquatic Biodiversity Impact Assessment, Section 21(c) and (i) Risk Assessment and Wetland Delineation Verification by Dr Andrew Deacon August 2022.

Mitigations:

Impact Management Outcome(s):

- Ensure the protection of aquatic fauna.

Targets:

- Construction during dry winter months.
- No unnecessary physical harm to aquatic fauna.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
11	Linear Infrastructure crossings	A direct loss of aquatic macro and microfauna by construction activities in a watercourse.	Ensure the protection of aquatic fauna	Construction during dry winter months	The construction of linear infrastructure across parts of the ephemeral drainage system, should be restricted to the dry winter months (e.g., May to September), that is commence with such activities as clearing or grading, excavating and importing material at the end of the wet season/beginning of the dry season whilst the soil is still moist and as far as is practical, be completed in, the dry winter months.	Holder, Contractor	Construction	Compliance to be verified by ECO and IEA.
11	Linear Infrastructure crossings	A direct loss of aquatic macro and microfauna by construction activities in a watercourse.	Ensure the protection of aquatic fauna	No unnecessary physical harm to aquatic fauna	The ECO shall undertake a cursory inspection of the physical footprint prior to clearing and when grading or excavating in the ephemeral drainage system for signs of frogs, and if found, relocate them to a suitable habitat out of harms way.	ECO	Prior to clearing, grubbing or grading	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

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Reg: 2006/023163/23

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
11	L	L	L	neutral	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
11	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- Although the drainage lines are ephemeral, amphibians may be present in localised low-lying depressions that collect rainwater in the rainy season.
- The residual risk of loss of aquatic fauna (**11**) after mitigation is assumed to be Low.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Receiving Environment: Aquatic flora

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Linear Infrastructure Crossings	Distribution Line Pylons, Roads, Pipelines, and cables	Clearing & Grubbing/Removal of Vegetation/ Sedimentation	**Impact:** A direct loss of local aquatic plants by construction activities in a watercourse. Loss of riparian systems and disturbance of the alluvial water courses. **Consequences**: - The loss of threatened (Red Data) species may result in a loss of biodiversity and ecosystem resilience to climate change (direct). - The loss of a threatened keystone species may alter the functioning of the aquatic ecosystem (direct).	Quantity	12

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 12 (General)

- Apart from linear infrastructure crossings, the solar PV facility is planned to remain outside of sensitive ecological areas, including watercourses and wetlands.
- The study area is not within an area identified in terms of an international convention, such as a RAMSAR site.
- The delineated ephemeral drainage line in the project area has been identified as having the conservation importance relating to the Freshwater Ecosystem Protected Areas (FEPA) category. The entire sub-quaternary catchment indicates that the surrounding land and smaller stream network need to be managed in a way that maintains the good condition (A or B ecological category) of the river reach.

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
12	L	L	L	-I	L	L	0	L	L	0
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Aquatic Biodiversity Impact Assessment, Section 21(c) & (i) Risk Assessment and Wetland Delineation Verification Report prepared by Dr Andrew Deacon dated August 2022.

Mitigations:

Impact Management Outcome(s):

- Avoid the unnecessary loss of or harm to aquatic plants, particularly protected or threatened plants.

Targets:

- No unnecessary loss of or harm to aquatic plants.
- Grass sods stockpiled.
- Grass sods removed during winter and replanted in spring.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
12	Linear infrastructure crossings	Loss of local aquatic plants.	Avoid the unnecessary loss of or harm to aquatic plants, particularly protected or threatened plants.	No unnecessary loss of or harm to aquatic plants	Perform a search for any threatened or protected flora in those areas that will be disturbed by construction activities, including but not limited to the physical footprint of linear infrastructure across a watercourse.	ECO	Prior to clearing, grubbing or grading	Compliance to be verified by ECO and IEA.
12	Linear infrastructure crossings	Loss of local aquatic plants.	Avoid the unnecessary loss of or harm to aquatic plants, particularly protected or threatened plants.	Grass sods stockpiled	Vegetation cover can be removed as sods (for rehabilitation) and stored within transformed vegetation (alien invasive vegetation must be removed prior to storing the grassland sods).	Contractor, ECO	Construction	Compliance to be verified by ECO and IEA.
12	Linear infrastructure crossings	Loss of local aquatic plants.	Avoid the unnecessary loss of or harm to aquatic plants, particularly protected or threatened plants.	Grass sods removed during winter and replanted in spring	The sods must preferably be removed during the winter months and be replanted by latest springtime. The sods should not be stacked on top of each other.	Contractor, ECO	Construction	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

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Reg: 2006/023163/23

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
12	L	L	L	-I	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
12	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- Aquatic flora, such as reeds or grasses, may be harvested by staff.
- The residual risk of loss of threatened aquatic plants (**12**) after mitigation is assumed to be Low.

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Reg: 2006/023163/23

Receiving Environment: Soil and Rock

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Construction Plant Management including Deliveries	Operating equipment Parking	Causing spills	**Impact:** Spills from machinery can contaminate the topsoil. **Consequences:** - sterile habitat for fauna and flora (direct).	Quality	13
Construction Plant Management including Deliveries	Maintenance	Land contamination	**Impact:** (1) Vehicles in poor condition are more prone to breakdowns and/or leaks (Risk). (2) Spills from vehicles undergoing maintenance can contaminate the topsoil. **Consequence:** - sterile habitat for fauna and flora (indirect).	Quality	13
Construction Plant Management including Deliveries	Washing plant	Land contamination	**Impact:** Washing cement slurry can contaminate the topsoil and create hard layer: **Consequence:** - sterile habitat for fauna and flora (indirect).	Quality	13
General and Hazardous Waste Management	Handling and Collection (incl. chemical toilets)	Land contamination	**Impact:** Spillage could result in microbiological pollutants to soil. **Consequence:** loss of microorganisms in the soil and groundwater	Quality	13
General and Hazardous Waste Management	Reuse	Health and safety	**Impact:** Hydrocarbon spills can contaminate topsoil. **Consequence:** Loss of a valuable resource.	Quality	13
Handling Hazardous Substances	Fuel Storage	Land contamination	**Impact:** contaminated rainwater may be released from the bund into the environment. **Consequence:** sterile habitat for fauna and flora.	Quality	13

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Reg: 2006/023163/23

Handling Hazardous Substances	Refuelling	Causing spills	**Impact:** Spills from mobile fuel bowser can contaminate the topsoil. **Consequences:** - sterile habitat for fauna and flora (direct).	Quality	13
Handling Hazardous Substances	Mixing concrete on site	Effluent (cement slurry) discharges and land contamination	**Impacts:** Concrete slurry from the batching plant can contaminate the topsoil and form a hardpan layer: **Consequences:** sterile habitat for fauna and flora.	Quality	13
Handling Hazardous Substances	Importing Ready mix/Cleaning the cement trucks	Land contamination	**Impact:** Cleaning residual ready-mixed concrete (RMC) from truck mixers can create hardpan layers. **Consequence:** effectively sterilising patches of ground (and contaminate water resources).	Quality	13
Handling Hazardous Substances	Importing Ready mix/Cleaning the cement trucks	Waste arisings (cement slurry)	**Impact:** Mixing concrete on exposed ground can create a hardpan layer. **Consequence:** sterile habitat for fauna and flora.	Quality	13
Handling Hazardous Substances	Transporting concrete	Land contamination	**Impact:** Concrete slurry from the vehicle and spills can contaminate the topsoil and form a hardpan layer: **Consequence:** sterile habitat for fauna and flora (indirect).	Quality	13
Handling Hazardous Substances	Lubricating, Oil Storage and Disposal	Land contamination	**Impact:** Contamination of soil with hydrocarbons. **Consequence:** - sterile habitat for fauna and flora.	Quality	13
Stockpiling and Storing (Laydown)	Topsoil	Viability of stockpiled material	**Impacts:** Stockpiled topsoil left for extended period. **Consequences:** seed bank becoming depleted and increased growth/dispersal of alien plants.	Quality	13

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Reg: 2006/023163/23

Quarry (Sourcing materials (aggregate) for roads and concrete)	New Quarry & Crushing Plant Operation (and maintenance)	Soil contamination (hydrocarbon spills)	**Impact:** Spills from crushing plant can contaminate the topsoil. **Consequences:** - sterile habitat for fauna and flora (direct).	Quality	13
Installing panel arrays and associated infrastructure (from racks to field transformers) including within 100 m of a watercourse or 500 m of a wetland/pan	Field transformers		**Impact:** Spills from damaged and leaking oil-filled field transformers will contaminate the topsoil (Risk). **Consequences:** - sterile habitat for fauna and flora (direct).	Quality	13
Construction Plant Management including Deliveries	Parking	Damage to the environment	**Impact:** Parking of vehicles will compact the ground **Consequence:** Increasing surface water run-off and erosion.	Quantity	14
Stormwater Management and Erosion Control			**Impact:** There is a potential for erosion and sedimentation of the surroundings or ephemeral drainage lines from, e.g., excavations associated with the borrow pits for road building material, if storm events take place and insufficient vegetation cover is present. **Consequence:** Loss of topsoil, disturbance to the vadose zone, and sedimentation of a watercourse.	Quantity	14
Stormwater Management and Erosion Control			**Impact:** Construction activities could result in increased soil erosion due to vegetation clearing. **Consequence:** Loss of topsoil and soil erosion	Quantity	14

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Reg: 2006/023163/23

Linear Infrastructure Crossings	Distribution Line Pylons	Clearing & Grubbing/Removal of Vegetation/ Sedimentation	**Impact:** Areas cleared or disturbed around the pylon site might be affected by erosion of topsoil. **Consequence:** Disturbing topsoil around the pylon site might result in increased suspended solids, as well as siltation in watercourses.	Quantity	14
Linear Infrastructure Crossings Road Management Earthworks	Distribution Line Pylons, Roads, Pipelines and Cable routes	Importing material/ Excavating/Diversion Works/Sedimentation /Erosion	**Impact:** Supplying services via trenches and constructing roads and culverts in dispersive soils can cause tunnel erosion. **Consequence:** Trenches may be used to supply services such as water and electricity, however in dispersive soils, the increased porosity of repacked spoil within the trench can lead to tunnel erosion and damage to pipes and cables. Any degradation of the soil-terrain complex that undermines its capacity to function - from storing water and recycling nutrients to resisting erosion - will lead to a decline in primary production and diminish energy flow to higher trophic levels. Primary production is an ecosystem supporting service that maintains other ecosystem services, so its harm can lead to ecosystem collapse.	Quantity	14
Clearing/Grubbing and Grading	Construction camp (incl. operational area), borrow pit, upgrading existing and new roads, trenches for underground cables and water pipes, holes for racks, fence posts and pylons, foundations for	Creating bare surfaces susceptible to erosion	**Impact:** Areas cleared or disturbed around site might be affected by erosion of topsoil. **Consequence:** Increased turbidity and siltation in watercourses.	Quantity	14

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Reg: 2006/023163/23

	inverters, field transformers and on-site substation, water storage tanks and deionization plant.				
Drilling and/or Ram Piling (for rack foundations and fence poles)	Drilling Rig on land and in a watercourse (perimeter fence)	Mixing soil horizons	**Impact:** Disturbing vadose zone during excavations activities, contractor laydown areas. **Consequence:** Loss of suitable topsoil for rehabilitation.	Quality	14
Installing panel arrays and associated infrastructure (from racks to field transformers) including within 100 m of a watercourse or 500 m of a wetland/pan	Panels	Dripline	**Impact:** Run-off from solar PV arrays in dispersive soils can cause erosion. **Consequence:** Storm water and runoff from hard surfaces such as solar PV panels, need to be managed to prevent initiation of erosion. Any degradation of the soil-terrain complex that undermines its capacity to function - from storing water and recycling nutrients to resisting erosion - will lead to a decline in primary production and diminish energy flow to higher trophic levels. Primary production is an ecosystem supporting service that maintains other ecosystem services, so its harm can lead to ecosystem collapse.	Quantity	14
Stockpiling and Storing (Laydown)	Topsoil	Viability of stockpiled material	**Impact:** Stockpiled topsoil left for extended period resulting in compaction **Consequence:** Loss of topsoil	Quantity	14

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

- During the rainy season terrain mobility on high clay soils in low lying areas with drainage lines will be difficult and might increase soil erosion when drainage lines are disturbed.
- Construction plant normally stays on site for cost, road impact and time saving reasons.

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Reg: 2006/023163/23

- There will be no machinery service/wash bay areas on site.

Impact 13 (Soil quality –contamination)

- The study area is part of the Beaufort Group of the Karoo Supergroup of geology in South Africa and consist mainly of sandstones and shales dominated by the Mispah soil form. Sub dominant soil forms are Swartland and Oakleaf forms. Dolerite koppies also form a small but conspicuous part of the landscape.
- Construction equipment (risk of leaking/spills of hydrocarbons) will include at least: Water tankers; Graders; Tipper trucks; Drilling rigs (down to 2m); Mobile pile ramming machines (down to 3m at the most); Rock crushing plant; Excavators; TLBs; Concrete mixers; Compaction equipment; Light delivery vehicles; and Heavy delivery vehicles (for the transformers).

Impact 14 (Soil quantity – erosion, loss of topsoil)

- The entire site has very thin soils and either bedrock sub-outcrop at less than 0,5 metres depth below ground surface or bedrock outcrop/dispersed outcrop. The thickest soils of 1,0 to 1,2 metres thickness over minor parts occur in areas of either gully wash material, alluvial deposits or pediplain positions (at low landscape localities). These soils are generally of a silty sand to clayey sand nature.
- Most of the soils are very shallow with an average depth of less than 30cm. Clay content ranges from sandy loam to very clayey. Calcareous soils are covering relatively small areas. Soils are unsuitable for most types of agriculture.
- No severe donga erosion has been observed in the study areas. Minor to moderate plate erosion is present. Severe donga and sheet erosion have been observed on flood plains outside the study areas.
- The only area of concern is potential enhanced soil erosion. Some infrastructure e.g., substations will have weatherproof surfaces and will cover in general relatively small areas with very little influence on soil erosion. Most of the areas will be covered by PV solar panels.
- Erosion and sedimentation are only likely to take place during severe storm events (e.g., 1:2 to 1:100y events). Incidental rainfall will likely not cause sedimentation.
- It is not envisaged that the proposed development will result in major soil erosion or any other degradation of the soils of the focus areas if there is proper runoff management from roads and other bare areas.

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant

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Reg: 2006/023163/23

L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
13	H	L	H	-I	H	M	1	M	L	0
Reversibility	L	**Irreplaceability**	M	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
14	H	L	M	-I	H	M	1	H	M	1
Reversibility	M	**Irreplaceability**	M	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- Proper runoff management from roads and other bare areas is to be implemented.
- The civil construction phase should be restricted to the dry winter months (e.g., April/May to September), that is commence with such activities as clearing or grading, excavating and importing material at the end of the wet season/beginning of the dry season whilst the soil is still moist to reduce dust and as far as is practical, be completed in, the dry winter months with a decreased probability of storm events.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Hydrological Assessment (Version – Final 3) 01 September 2022 GCS Project Number: 22-0076 by Hendrik Botha.
- Soil Mapping Report prepared by Hennie van den Burg of Iris International and Francois Botha of Eco Soil dated June 2022.
- Geotechnical Assessment Study prepared by FDJ Stapelberg of the Council for Geoscience dated 11 May 2022 (CO2017-5806 (Phase 80)).
- Aquatic Biodiversity Impact Assessment, Section 21(c) & (i) Risk Assessment and Wetland Delineation Verification Report prepared by Dr Andrew Deacon dated August 2022.
- Plant Species Compliance Statement – Soventix Phase 3 Pv Project prepared by Simon Todd of 3 Foxes Biodiversity Solutions dated September 2022.

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Reg: 2006/023163/23

- Hardie M. (2009), "Dispersive Soils and their Management, Technical Reference Manual." Department of Primary Industries and Water, State of Tasmania, Australia (ISBN 978-0-7246-6774-1)

Mitigations:

Impact Management Outcome(s):

- Avoid contamination of soil from leaking machinery
- Reduce contamination of soil through proper waste management
- Avoid contamination of soil from washing machinery
- Avoid contamination of soil from ablutions
- Avoid contamination of soil from fuel tanks
- Avoid contamination of soil when refuelling
- Avoid contamination of soil from concrete
- Avoid contamination of soil from servicing
- Minimise the disturbance and contamination of topsoil
- Avoid contamination of soil from transformers
- Good quality soil for reinstatement
- Minimise the risk of erosion on dispersive soils
- Minimize loss of topsoil

Targets:

- No leaking machinery on site
- Drip trays and no vehicles parked overnight except in the construction camp
- Spill response kit
- Low incidence of waste induced ground contamination with a trend indicating constant improvement over time
- No signs of washing or servicing of construction vehicles/equipment on site
- Use of chemical toilets
- No leaks or spills
- Waybill(s) from service provider

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Reg: 2006/023163/23

- Contaminated soil is treated on site
- Waste storage of contaminated soil is intact and away from the watercourse
- Fuel tanks are covered and bunded area located within construction camp
- Refuelling at construction camp only with drip trays
- No observed hard pan layers of concrete and hardened cement has been removed (by recycling/re-use)
- No residual RMC dumped on site and residual RMC stored in a temporary waste storage facility at the workshop area
- A designated and contained, impervious waste storage area
- Compliance with conditions of the GA for S21(g) in GN 665 of 06 September 2013
- Waste temporarily stored has been removed (by recycling/re-use)
- Residual water is re-used
- Transformers are in a bund and have oil/water separation system
- Inspection sheets
- Sensitive areas are avoided
- No signs of activity outside of demarcated areas
- Compacted surfaces on site have been ripped
- Minimal vegetation clearance for powerline
- Construction period minimised
- Soil erosion management plan
- No signs of stormwater runoff or soil erosion
- Topsoil is preserved.
- Large timber mats used.
- No exposed soils and cover stockpiles
- Swales installed
- No unnecessary clearing of vegetation
- Rehabilitation/Re-vegetation
- Topsoil removed and stockpiled
- Vegetation under panels is cut short but not cleared and cuttings are left under the panels
- No signs of disturbance to topsoil stockpiles

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
13	Construction plant management including deliveries	Spills from machinery can contaminate the topsoil.	Avoid contamination of soil from leaking machinery	No leaking machinery on site	Any construction plant, machinery, and equipment which leaks shall not be permitted on site. Undertake visual inspections for any leakages that may emanate from any vehicle accessing the site - all vehicles must be in good working order when entering the site.	Contractor	Construction	Compliance to be verified by ECO and IEA
13	Construction plant management including deliveries	Spills from machinery can contaminate the topsoil.	Avoid contamination of soil from leaking machinery	Drip trays and no vehicles parked overnight except in the construction camp	All vehicles must be parked with drip trays in designated areas outside ecological buffer areas and if overnight, then preferably in the construction camp	Contractor	Construction	Compliance to be verified by ECO and IEA
13	Construction plant management including deliveries	Spills from machinery can contaminate the topsoil.	Avoid contamination of soil from leaking machinery	Drip trays	Enough drip trays must be available for all construction plant.	Contractor	Construction	Compliance to be verified by ECO and IEA
13	Construction plant management including deliveries	Spills from machinery can contaminate the topsoil.	Avoid contamination of soil from leaking machinery	Spill response kit	Provide accidental spill response equipment at the construction camp.	Holder, Contractor	Ongoing	Compliance to be verified by ECO and IEA
13	Construction plant	Spills from machinery can	Reduce contamination of	Low incidence of waste induced	In event of a spill, immediately remove	Contractor	Ongoing	Compliance to be

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
	management including deliveries	contaminate the topsoil.	soil through proper waste management	ground contamination with a trend indicating constant improvement over time. Waybills	the contaminated soil to the depth of penetration and temporarily store in a sealed container within the designated waste storage area for on-site bioremediation or disposal at a licensed hazardous waste landfill.			verified by ECO and IEA
13	Construction plant management including deliveries	Vehicles in poor condition are more prone to breakdowns and/or leaks which could cause soil contamination	Avoid contamination of soil from leaking machinery	No signs of servicing on site.	Any planned maintenance or servicing of construction plant, machinery and equipment is not permitted on site, including the construction camp.	Contractor	Construction	Compliance to be verified by ECO and IEA
13	Construction plant management including deliveries	Vehicles in poor condition are more prone to breakdowns and/or leaks which could cause soil contamination	Avoid contamination of soil from leaking machinery	Drip trays	Any emergency repairs on site shall be undertaken with drip trays.	Holder, Contractor	Ongoing	Compliance to be verified by ECO and IEA
13	Construction plant management including deliveries	Washing cement slurry can contaminate the topsoil and	Avoid contamination of soil from washing machinery	No signs of washing construction vehicles on site	Any washing of construction vehicles and other equipment is not permitted on site,	Contractor	Construction	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		create hard layer			including the construction camp.			
13	General and Hazardous Waste Management	Spillage could result in microbiological pollutants to soil.	Avoid contamination of soil from ablutions	Use of chemical toilets	Chemical toilets (1 toilet for 20 or less staff) shall be provided in the construction camp.	Contractor	Construction	Compliance to be verified by ECO and IEA
13	General and Hazardous Waste Management	Spillage could result in microbiological pollutants to soil.	Avoid contamination of soil from ablutions	No leaks or spills.	Chemical toilets are to be contained.	Contractor	Construction	Compliance to be verified by ECO and IEA
13	General and Hazardous Waste Management	Spillage could result in microbiological pollutants to soil.	Avoid contamination of soil from ablutions	Waybill(s) from service provider.	Chemical toilets shall be regularly emptied by the appointed service provider for appropriate disposal.	Contractor	Construction	Compliance to be verified by ECO and IEA
13	General and Hazardous Waste Management	Hydrocarbon spills can contaminate topsoil.	Avoid contamination of soil through proper waste management	Contaminated soil is treated on site	Soil contaminated with hydrocarbons should as far as is possible be treated on site by bioremediation so that it can be reused for rehabilitation.	Contractor	Construction	Compliance to be verified by ECO and IEA
13	General and Hazardous Waste Management	Hydrocarbon spills can contaminate topsoil.	Avoid contamination of soil through proper waste management	Waste storage of contaminated soil is intact and away from the watercourse	The storage and bioremediation of contaminated soil should take place in intact, impervious, not corroded receptacles within the designated	Contractor	Construction	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					waste storage area of the construction camp at least 100 m away from the outer edge of the ecological buffer.			
13	Handling of hazardous substances	Contaminated rainwater may be released from the bund into the environment.	Avoid contamination of soil from fuel tanks	Fuel tanks are covered	Cover the fuel tank(s) and bund to prevent the ingress of rain.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA
13	Handling of hazardous substances	Spills from mobile fuel bowser can contaminate the topsoil.	Avoid contamination of soil when refuelling	Bunded area located within construction camp.	Any mobile fuel bowser shall be parked in a suitably bunded area within the construction camp.	Contractor	Construction	Compliance to be verified by ECO and IEA
13	Handling of hazardous substances	Spills from mobile fuel bowser can contaminate the topsoil.	Avoid contamination of soil when refuelling	Refuelling at construction camp only with drip trays	Always use a drip tray when refuelling with a mobile fuel bowser.	Contractor	Construction	Compliance to be verified by ECO and IEA
13	Handling of hazardous substances	Concrete slurry from the batching plant can contaminate the topsoil and form a hardpan layer	Avoid contamination of soil from concrete	No observed hard pan layers of concrete.	Mix concrete on a mixing tray and not on open ground.	Contractor	Construction	Compliance to be verified by ECO and IEA
13	Handling of hazardous substances	Cleaning residual ready-mixed concrete (RMC) from truck mixers can	Avoid contamination of soil from concrete	No residual RMC dumped on site	Mixer trucks should return any residual RMC to their batching plant after the delivery.	Contractor	Construction	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		create hardpan layers.						
13	Handling of hazardous substances	Cleaning residual ready-mixed concrete (RMC) from truck mixers can create hardpan layers.	Avoid contamination of soil from concrete	Residual RMC stored in a temporary waste storage facility at the workshop area	If it is not possible for mixer trucks to return the residual RMC to their batching plant after the delivery, then the residual RMC within the truck mixers shall be disposed in a temporary waste storage facility designated for this purpose at the construction camp. Temporary storage means a once off storage of waste for a period not exceeding 90 days.	Contractor	Construction	Compliance to be verified by ECO and IEA
13	Handling of hazardous substances	Cleaning residual ready-mixed concrete (RMC) from truck mixers can create hardpan layers.	Avoid contamination of soil from concrete	A designated and contained, impervious waste storage area	Designated RMC waste storage facilities shall be covered and contained, that is impervious, and shall not detrimentally impact on a water resource (surface and groundwater).	Contractor	Construction	Compliance to be verified by ECO and IEA
13	Handling of hazardous substances	Cleaning residual ready-mixed concrete	Avoid contamination of	Compliance with conditions of the GA for S21(g) in	The temporary storage of residual RMC for re-use (or	Contractor	Construction	Compliance to be verified by

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		(RMC) from truck mixers can create hardpan layers.	soil from concrete	GN 665 of 06 September 2013	disposal) must comply with the limits and conditions of the GA for S21(g) in GN 665 of 06 September 2013, particularly those provisions relating to the location of the wastewater storage facility and incidence reporting.			ECO and IEA
13	Handling of hazardous substances	Cleaning residual ready-mixed concrete (RMC) from truck mixers can create hardpan layers.	Avoid contamination of soil from concrete	Waste temporarily stored has been removed (by recycling/re-use)	Temporarily stored waste shall be re-used, recycled, and/or disposed of within a period not exceeding 90 days.	Contractor	Construction	Compliance to be verified by ECO and IEA
13	Handling of hazardous substances	Cleaning residual ready-mixed concrete (RMC) from truck mixers can create hardpan layers.	Avoid contamination of soil from concrete	Residual water is re-used	Any residual water in the RMC waste can be re-used by replacing domestic water for making new mortar or concrete. It is estimated that a replacement of up to 50% should be used to achieve the greatest gains in strength in relation to either 100% domestic water or	Contractor	Construction	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					100% residual water.			
13	Handling of hazardous substances	Cleaning residual ready-mixed concrete (RMC) from truck mixers can create hardpan layers.	Avoid contamination of soil from concrete	Hardened cement has been removed (by recycling/re-use)	Once hardened, solid waste arising from the concrete mixer truck washing can also be recycled or reused as fill material and/or disposed at the De Aar licensed landfill site.	Contractor	Construction	Compliance to be verified by ECO and IEA
13	Handling Hazardous Substances	Contamination of soil with hydrocarbons.	Avoid contamination of soil from servicing	Waybill(s) from registered collector.	Any waste oil shall be collected by a registered collector for recycling and reuse or appropriate disposal.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA
13	Handling Hazardous Substances Stockpiling and Storing (Laydown)	Stockpiled topsoil left for extended period resulting in the seed bank becoming depleted and increased growth/dispersal of alien plants	Minimise the disturbance and contamination of topsoil	No alien plant growth on stockpiles	Immediately control any alien invasive plant in its entirety (including roots and propagating material) upon being identified on site, using preferably mechanical control methods as opposed to chemical spraying.	Contractor	Construction	Compliance to be verified by ECO and IEA
13	Installing panel arrays and associated	Spills from damaged and leaking oil-filled field	Avoid contamination of soil from transformers	Transformers are in a bund and have oil/water	Field transformers shall be located in/on a transformer contaminant bund	Holder, Contractor	Construction	Compliance to be verified by

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
	infrastructure (from racks to field transformers) including within 100 m of a watercourse or 500 m of a wetland/pan	transformers will contaminate the topsoil		separation system	designed with an oil/water separation system, such as but not limited to a valve with an oil/water capture filter that allows water to pass through but trap oil.			ECO and IEA
13	Installing panel arrays and associated infrastructure (from racks to field transformers) including within 100 m of a watercourse or 500 m of a wetland/pan	Spills from damaged and leaking oil-filled field transformers will contaminate the topsoil	Avoid contamination of soil from transformers	Inspection sheets	Regular inspections (monthly) and maintenance of field transformers.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA
14	Construction plant management including deliveries	Parking of vehicles will compact the ground	Good quality soil for reinstatement.	Sensitive areas are avoided	Identify and avoid no-go areas or areas sensitive to compaction on the site plan	Holder, Contractor	Construction	Compliance to be verified by ECO and IEA
14	Construction plant management including deliveries	Parking of vehicles will compact the ground	Good quality soil for reinstatement.	No signs of activity outside of demarcated areas	All activities remain strictly within demarcated routes and areas.	Contractor	Construction	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
14	Construction plant management including deliveries	Parking of vehicles will compact the ground	Good quality soil for reinstatement.	Compacted surfaces on site have been ripped.	Once the intervention has been completed, break the crust on bare compacted areas to enhance vegetation establishment.	Contractor	Construction	Compliance to be verified by ECO and IEA
14	Linear infrastructure crossings	Areas cleared or disturbed around the pylon site might be affected by erosion of topsoil.	Minimize soil erosion	Minimal vegetation clearance for powerline	Vegetation should be removed only where essential for the continuation of the powerline. Any disturbance to the adjoining natural vegetation cover or soils should not be allowed.	Contractor	Construction	Compliance to be verified by ECO and IEA
14	Linear infrastructure crossings	Areas cleared or disturbed around the pylon site might be affected by erosion of topsoil.	Minimize soil erosion	Construction period minimised	The duration of construction activities at each pylon site should be minimised as far as is practical.	Contractor	Construction	Compliance to be verified by ECO and IEA
14	Stormwater management and erosion control	There is a potential for erosion and sedimentation of the surroundings or ephemeral drainage lines from, e.g., excavations associated with	Minimize soil erosion	Soil erosion management plan	Develop a soil erosion management plan	Holder	Pre-Construction	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		the borrow pits for road building material, if storm events take place and insufficient vegetation cover is present.						
14	Stormwater management and erosion control	There is a potential for erosion and sedimentation of the surroundings or ephemeral drainage lines from, e.g., excavations associated with the borrow pits for road building material, if storm events take place and insufficient vegetation cover is present.	Minimize soil erosion	No signs of stormwater runoff	It is recommended that sandbags and temporary berms be used, to manage stormwater runoff and control erosion.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA
14	Stormwater management and erosion control	There is a potential for erosion and sedimentation of the surroundings or ephemeral	Minimize soil erosion	No exposed soils	Exposed soils to be protected using a suitable covering, e.g., mulch.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

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		drainage lines from, e.g., excavations associated with the borrow pits for road building material, if storm events take place and insufficient vegetation cover is present.						
14	Stormwater management and erosion control	There is a potential for erosion and sedimentation of the surroundings or ephemeral drainage lines from, e.g., excavations associated with the borrow pits for road building material, if storm events take place and insufficient vegetation cover is present.	Minimize soil erosion	Cover stockpiles	Where required, cover soil stockpiles with a temporary liner to prevent erosion and contamination.	Contractor	Construction	Compliance to be verified by ECO and IEA
14	Stormwater management	There is a potential for erosion and	Minimize soil erosion	Revegetated areas	Re-vegetate areas where erosion is noted or where	Holder, Contractor	On-going	Compliance to be verified by

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
	and erosion control	sedimentation of the surroundings or ephemeral drainage lines from, e.g., excavations associated with the borrow pits for road building material, if storm events take place and insufficient vegetation cover is present.			vegetation is required to reduce stormwater peak flows.			ECO and IEA
14	Stormwater management and erosion control	There is a potential for erosion and sedimentation of the surroundings or ephemeral drainage lines from, e.g., excavations associated with the borrow pits for road building material, if storm events take place and insufficient vegetation	Minimize soil erosion	Swales installed	Install swales as per the CSWMP (Appendix E) if free drainage back to the environment shows evidence of accelerated erosion and sedimentation.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		cover is present.						
14	Linear infrastructure crossings and Earthworks	Supplying services via trenches in dispersive soils can cause tunnel erosion.	Minimise the risk of erosion in dispersive soils.	No signs of tunnel erosion	If trenching is to be undertaken in potentially dispersive soils (e.g., bare patches) then implement the 'Trenching in Dispersive Soils Protocol' (Appendix B1)	Contractor	Construction	Compliance to be verified by ECO and IEA
14	Linear infrastructure crossings and Earthworks	Supplying services via trenches in dispersive soils can cause tunnel erosion.	Minimise the risk of erosion in dispersive soils.	Topsoil is preserved	The method of pipeline construction used in wetlands depends on the stability of the soils. Overall, topsoil is first removed and stored separately from the subsoil. Where wetland soils are saturated, segregating topsoil is not possible.	Contractor	Construction	Compliance to be verified by ECO and IEA
14	Linear infrastructure crossings and Earthworks	Supplying services via trenches in dispersive soils can cause tunnel erosion.	Minimise the risk of erosion in dispersive soils.	Large timber mats used.	Large timber mats placed ahead of the construction equipment can provide a stable working platform and protect wetland soils by spreading the weight of the construction	Contractor	Construction	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					equipment over a broad area.			
14	Linear infrastructure crossings and Road Management	Constructing roads and culverts in dispersive soils can cause erosion.	Minimise the risk of erosion on dispersive soils	No signs of soil erosion	If roads and culverts are to be constructed in potentially dispersive soils (e.g., bare patches) then implement the 'Roads & Culverts in Dispersive Soils Protocol' (Appendix B2)	Contractor	Construction	Compliance to be verified by ECO and IEA
14	Linear infrastructure crossings and Road Management	Constructing roads and culverts in dispersive soils can cause erosion.	Minimise the risk of erosion on dispersive soils	No signs of soil erosion	Implement appropriate stormwater management around the excavation areas to prevent the ingress of run-off into the excavation trenches.	Contractor	Construction	Compliance to be verified by ECO and IEA
14	Linear infrastructure crossings and Road Management	Constructing roads and culverts in dispersive soils can cause erosion.	Minimise the risk of erosion on dispersive soils	No signs of soil erosion	Implement source-directed erosion controls.	Contractor	Construction	Compliance to be verified by ECO and IEA
14	Linear infrastructure crossings and Road Management	Constructing roads and culverts in dispersive soils can cause erosion.	Minimise the risk of erosion on dispersive soils	No signs of soil erosion	Maintain buffer zones to trap sediments.	Contractor	Construction	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
14	Clearing, grubbing and grading	Areas cleared or disturbed around site might be affected by erosion of topsoil.	Minimize loss of topsoil	No unnecessary clearing of vegetation	Vegetation and soil should be retained in position for as long as possible and should only be removed immediately ahead of construction / earthworks in any specific area so that cleared areas are not unnecessarily exposed to erosion for extended periods prior to working in those areas.	Contractor	Construction	Compliance to be verified by ECO and IEA
14	Clearing, grubbing and grading	Areas cleared or disturbed around site might be affected by erosion of topsoil.	Minimize loss of topsoil	Rehabilitation/Re-vegetation	In areas where construction activities have been completed and no further disturbance is anticipated, rehabilitation and re-vegetation should commence as soon as possible.	Contractor	Construction	Compliance to be verified by ECO and IEA
14	Clearing, grubbing and grading	Areas cleared or disturbed around site might be affected by erosion of topsoil.	Minimize loss of topsoil	No signs of erosion channels developing	Any erosion channels developing during or after the construction period should be appropriately backfilled (and	Contractor	Construction	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

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					compacted where relevant) and the areas restored to a condition similar to the condition before the erosion occurred.			
14	Clearing, grubbing and grading	Areas cleared or disturbed around site might be affected by erosion of topsoil.	Minimize loss of topsoil	Topsoil removed and stockpiled	Topsoil must be removed from the construction camp footprint to a depth of 150 to 200mm and stockpiled within the construction camp.	Contractor, ECO	Construction	Compliance to be verified by ECO and IEA
14	Installing panel arrays and associated infrastructure (from racks to field transformers) including within 100 m of a watercourse or 500 m of a wetland/pan	Run-off from solar PV arrays in dispersive soils can cause erosion.	Minimise the risk of erosion on dispersive soils.	Vegetation under panels is cut short but not cleared	Sheep will help control the height of the underlying vegetation. However, given that they are highly selective grazers and the unlikelihood of all karoo 'bossies' immediately to the east and west of each solar module being browsed below 300 mm, indigenous vegetation may where required be cropped/cut by staff to a height of 100 mm below the solar	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					module at maximum tilt, but not cleared.			
14	Installing panel arrays and associated infrastructure (from racks to field transformers) including within 100 m of a watercourse or 500 m of a wetland/pan	Run-off from solar PV arrays in dispersive soils can cause erosion.	Minimise the risk of erosion on dispersive soils.	Cut vegetation is left under the panels	Cut vegetation shall be left on the ground beneath and around the trimmed plants to protect the soil and provide shelter for seedlings.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA
14	Installing panel arrays and associated infrastructure (from racks to field transformers) including within 100 m of a watercourse or 500 m of a wetland/pan	Run-off from solar PV arrays in dispersive soils can cause erosion.	Minimise the risk of erosion on dispersive soils.	No signs of erosion under the panels	If solar arrays are to be installed on potentially dispersive soils (e.g., bare patches) then implement the 'Solar Arrays on Dispersive Soils Protocol' (Appendix B3).	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA
14	Stockpiling and Storing (Laydown)	Stockpiled topsoil left for extended period resulting in compaction	Minimize loss of topsoil	No signs of disturbance to topsoil stockpiles	No driving, parking, or storing of construction plant is permitted on topsoil stockpiles.	Contractor	Construction	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
13	L	L	L	-I	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
13	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
14	L	L	L	-I	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
14	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

- The residual risk of soil contamination from spills etc. (**13**) after mitigation is assumed to be Low.
- The residual risk of the loss of topsoil and soil erosion (14) after mitigation is assumed to be Low.

Receiving Environment: Ground and Surface Water

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.

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Reg: 2006/023163/23

Construction Plant Management including Deliveries	Parking	Causing spills	**Impact:** Hydrocarbon (fuel or oil) spills from construction vehicles or plant, and transformers will contaminate the soil, surface water run-off and possibly seepage, reducing the quality of the surface and groundwater resources. **Consequence:** (1) Alter feeding and breeding behaviour (lowering vigour and reproductivity), species composition and aquatic ecosystem functioning. (2) Poor quality seepage from oil/fuel spills during the construction phase, at any point in the project area, may impact the shallow groundwater table. Groundwater boreholes are generally situated within and downstream of the development areas, hence are potential receptors to pollution. (3) Sterile habitat for fauna and flora.	Quality	15
Construction Plant Management including Deliveries	Maintenance	Watercourse contamination	**Impact:** (1) Vehicles in poor condition are more prone to breakdowns and/or leaks (Risk). (2) Spills from vehicles undergoing maintenance can contaminate the surface water. **Consequence:** - sterile habitat for fauna and flora	Quality	15
Stockpiling and Storing (Laydown)	Mulch, topsoil, aggregate, spoil and infrastructure	Sedimentation of watercourse	**Impacts:** Erosion and sedimentation of watercourses due to unforeseen circumstances (i.e., bad weather). **Consequences**: loss of soil	Quality	15
Water management (abstraction, storage and use)	Monitoring		**Impact:** It is anticipated that soils downstream of the proposed development, and the non-perennial streams (feeding into temporary livestock watering dams) are the receivers of any sediment runoff or poor-quality runoff from the site. Suspended sediment (or turbidity) during construction in the watercourse can influence water quality. **Consequences:** - making it unfit for agricultural use (irrigation), affecting crop yield by photosynthetic activity reducing films, reducing infiltration rate and/or seedling emergence because of a soil surface crust being deposited by suspended solids, clogging of drip irrigation systems as well as accelerated wear and tear of sprinkler irrigation nozzles (indirect).	Quality	15

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Reg: 2006/023163/23

			- making it unfit for domestic water use, by having aesthetics effects (appearance, taste, and odour), and affecting human health (indirect).		
Water management (abstraction, storage and use)	Dust suppression	Surface water run-off	**Impact:** Dust suppression with chemical additives or treated effluent may contaminate a watercourse. **Consequences:** - loss or disturbance of aquatic fauna/flora	Quality	15
General and Hazardous Waste Management	Handling and Collection (incl. chemical toilets)	Land contamination	**Impact:** Disturbance, including pollution, of vadose zone during excavations activities, contractor laydown areas. **Consequence:** Interrupted pathway for groundwater recharge. Pollution of groundwater.	Quality	15
General and Hazardous Waste Management	Reuse	Health and safety	**Impact:** Concrete slurry can contaminate surface water run-off. **Consequence:** Contamination of terrestrial and aquatic ecosystems. **Addressed under "Receiving Environment: Soil and Rock"**	Quality	15
Linear Infrastructure Crossings	Distribution Line Pylons and Roads	Clearing & Grubbing/Removal of Vegetation/ Sedimentation	**Impacts:** Installation of pylons for transmission lines may cause temporary sedimentation after storm events. **Consequence:** Sedimentation of watercourse **Addressed under "Receiving Environment: Soil and Rock"**	Quality	15
Stormwater management and erosion control			**Impact:** Sedimentation in wetlands and watercourses. **Consequence:** Loss of riparian habitat.	Quality	16
Stormwater management and erosion control			**Impact:** Altered surface water flow patterns, e.g., changing sheet flow (natural open system) to concentrated flows leads to erosion. **Consequence:** Increased suspended solids, siltation in watercourses and soil erosion.	Behaviour	16

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Reg: 2006/023163/23

Linear infrastructure crossings	Distribution Line Pylons, Roads, underground pipelines and cables	Importing material/ Excavating/Diversion Works/Sedimentation /Erosion	**Impact:** Construction of linear infrastructure across the ephemeral drainage system may involve temporary diversion works, changing the surface water hydrology or flow patterns. **Consequence:** - Altered flow patterns can slow down the stream flow, causing deposition of sediment or increase the velocity and turbulence of the water, causing erosion (direct).	Behaviour	16
Linear Infrastructure Crossings	Distribution Line Pylons, Roads, Underground pipelines and cables	Importing material/ Excavating/Diversion Works/Sedimentation /Erosion	**Impact:** Construction of linear infrastructure across the ephemeral drainage system will reshape the bed and banks of the watercourse. **Consequence:** -The excavation, removal or moving of sand could change the surface water flow patterns of the river causing sedimentation along sand bars and/or erosion of riverbanks (indirect).	Behaviour	16
Road Management	Use including gravel District Road, Transnet Service Road and internal roads	Development of corrugations, potholes and puddles	**Impact:** Altered surface water flow patterns, e.g., changing sheet flow (natural open system) to concentrated flows leads to erosion. **Consequence:** Increased suspended solids, siltation in watercourses and loss of topsoil.	Behaviour	16
Earthworks Stockpiling and Storing (Laydown) Road Management	Excavating and Trenching	Alter surface water hydrology	**Impact:** Construction activities may alter the physical characteristics of the terrain. **Consequence:** - Altered surface stormwater run-off patterns, e.g., from sheet flow to channelled flow, can cause erosion (direct).	Behaviour	16
Stockpiling and Storing (Laydown)	Mulch, topsoil, aggregate, spoil and infrastructure	Impede river flow or surface water run-off	**Impact:** Stockpiles and overburden left in the river or floodplain can alter channel hydraulics during high flows, e.g., stockpiles left in the river channel can also deflect water to the other side of the river bank. **Consequence:** Excessive bank erosion, undercutting of property and loss of riparian vegetation on one side of the river (direct).	Behaviour	16

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Reg: 2006/023163/23

Water management (abstraction, storage and use)	Monitoring		**Impact:** Natural Resource depletion (groundwater reserve) - Construction will require the abstraction of water from boreholes for dust suppression, mixing concrete and potable usage. Declining groundwater abstraction yields as a result of no water quality and quantity monitoring plan. **Consequence:** Depletion of groundwater reserve, particularly under future climate change scenarios. Less water in the underground aquifer means less water for other water users, including for reasonable domestic use and livestock watering (direct).	Quantity	17
Water management (abstraction, storage and use)	Pumping from a borehole	Use of natural resources	**Impact:** Natural Resource depletion (groundwater reserve) - Construction will require the abstraction of water from boreholes for dust suppression, mixing concrete and potable usage. Declining groundwater abstraction yields as a result of no water quality and quantity monitoring plan. **Consequence:** Depletion of groundwater reserve, particularly under future climate change scenarios. Less water in the underground aquifer means less water for other water users, including for reasonable domestic use and livestock watering (direct).	Quantity	17
Water management (abstraction, storage and use)	Dust suppression	Use of natural resources	**Impact:** Natural Resource depletion - Construction will require the abstraction of water from boreholes for dust suppression, mixing concrete and potable usage. **Consequence:** - Less water in an underground aquifer means less water for other water users, including for reasonable domestic use and livestock watering.	Quantity	17
Alien Plant Management	Disturbance to natural areas	Favourable conditions for alien plant/animal recruitment.	**Impact:** Disturbance of aquatic or terrestrial habitat can favour the recruitment of alien invasive plants. **Consequence:** - threat to local and national water security (indirect). **Addressed under "Receiving Environment: Soil and Rock"**	Quantity	17

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 15 (Water Quality - Sedimentation)

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Reg: 2006/023163/23

- Considering the District Municipality's Climate Change Response Plan highlighted the risk of reduced deterioration in (surface) water quality due to increased salt concentrations in dams, wetlands and soil/plant systems from enhanced evaporation rates, and the farmer has 'always' supplied his livestock with groundwater via boreholes, it is assumed that no further treatment is required for livestock production.
- Groundwater is vulnerable to pollution (DHS Redbook, Section J)
- Almost a third of the households in Ward 6 get their water from a borehole.
- Erosion and sedimentation are only likely to take place during severe storm events (e.g., 1:2 to 1:100y events). Incidental rainfall will likely not cause sedimentation.
- Most of the soils are very shallow with an average depth of less than 30cm. Clay content ranges from sandy loam to very clayey. Calcareous soils are covering relatively small areas. Soils are unsuitable for most types of agriculture.
- No severe donga erosion has been observed in the study areas. Minor to moderate plate erosion is present.
- Groundwater boreholes are generally situated within and downstream of the development areas, hence are potential receptors to pollution.
- It is also advised that groundwater boreholes be monitored for the decline in water levels/yields, as well as water quality as the boreholes are used as the main water supply for livestock / domestic use.

Impact 16 (Surface Water Hydrology)

- The drainage systems are predominantly ephemeral, which means that the stream flows briefly in direct response to precipitation in the immediate vicinity, and the channel is at all times above the ground-water reservoir. These systems have a far less predictable flow regime compared to perennial or seasonal rivers and are frequently dry for long periods in arid regions. These ephemeral drainage lines are tributaries of the Brak River and considered to be in a largely natural ecological state.
- Available rainfall data suggest a MAP ranging from 112.4 (30th percentile) to 738.9 (90th percentile) mm/yr, based on a historical record of 69 years (e.g., 1920 to 1989). The average rainfall is in the order of 320 mm/yr.
- The site falls within evaporation zone 17A, of which Mean Annual Evaporation (MAE) ranges from 2 000 to 2 150 mm/yr. The MAE far exceeds the MAP for the site, which implies greater evaporative losses when compared to incident rainfall. Due to evaporation being about 85% more than local rainfall, non-perennial streams and rivers will only have water when there are flooding events (e.g., 1:2, 1:5, 1:50 and 1:100 year flood events). Lowest average rainfall (mm) is from May to September and lowest estimated monthly run-off (mm) is from May to November.
- The project area is located within a Strategic Water Source Area (Screening Report). Strategic Water Source Areas (SWSAs) are defined as areas of land that (a) supply a disproportionate (e.g., relatively large) quantity of mean annual surface water runoff in relation to their size and so are considered nationally important; and/or (b) have high groundwater recharge and where the groundwater forms a nationally important resource. **The protection and restoration of strategic water source areas is of direct benefit to all downstream users.** This dependence needs to be considered in decisions relating to these primary headwater catchments. **The protection of both water quantity (flows) and quality must be addressed. Any failure to address impacts on water quality or quantity will have impacts on the water security of all**

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Reg: 2006/023163/23

those depending on that water downstream. Groundwater is the main or only source of water for numerous towns and settlements across the country so protecting the capture zone, specifically for municipal supply well-fields, the recharge area, and the integrity of the aquifers is important as well.

- The project area falls within quaternary catchment D62D and the Orange Water Management Area. (Hydrology Assessment)
- The project area contains 3 Hydrological Response Units (HRU). Ninety-six percent (96%) of the project area falls within HRU2. The average slope of HRU2 (21,738 km^2) is 0,56%. Sixteen percent (16,51%) of HRU2 has a 3-10% slope, which is mostly restricted to the western and eastern corners of the project area. Consequently, the topography of the study area is generally flat with elevations on the site typically ranging from 1 335 to 1 370 m above mean sea level. (Hydrology Assessment)
- Drainage is generally towards the north-west via multiple non-perennial drainage lines towards the ephemeral Brak River, approximately 6,6 km further downstream. However, the drainage channels or flow paths are not clearly defined. Sheet flow occurs from micro sub-catchments towards lower topographical areas or isolated depressions forming temporarily flooded areas. Irregular occurrences of ponded water were visible across the project area, even in areas with no defined drainage lines or stream channels. (Hydrology Assessment)
- In the absence of clearly defined drainage channels or streams the area is prone to exhibit ponded flood occurrence zones. Micro sub-catchment sheet flow towards lower-lying areas within the non-perennial river flood plains is likely to dominate flood propagation, and isolated flooded areas are predicted to occur. (Hydrology Assessment)
- Considering run-off is directly related to rainfall intensity, and longer precipitation events, both monthly rainfall and run-off, peak from January to April. The run-off during these peak months, ranges from 0,3 to 1,1 mm/yr over the surface area of quaternary catchment D62D. The annual run-off from natural (unmodified) catchments in D62D is approximately 0,9% of the MAP. (Hydrology Assessment)
- Accounting for changes in soil type, slope angle and rainfall intensity, ground cover beneath solar arrays was found to have the most significant impact on run-off rates. So, if vegetation cover beneath the solar arrays is maintained, no significant increase in surface water run-off (run-off volumes, peak rates, or time to peak rates) is anticipated compared to greenfield run-off rates. (Hydrology Assessment)

Impact 17 (Water Quantity)

- A Geohydrological Assessment was commissioned to determine if there is enough groundwater to support demand during construction and operation under normal conditions and under drought years/climate change scenarios, as well as investigate the feasibility of drilling an additional borehole should it be required.
- A geophysical investigation aimed to identify likely dolerite contact zones, as these are known preferential flow paths for groundwater movement, revealed two high-feasibility drilling positions which can be considered for future water supply: T1 and T2 located in the southwestern corner of Phase 3.
- If the combined sustainable abstraction yield for both boreholes (336.67 m^3/day for 8 hours of pumping) is used as the Proposed Use in the water balance calculation for the HRU2 sub-catchment (Phase 3), there will be a surplus amount of 54 824.94 m3/yr (or 150.21 m3/day) available

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

after the allocation of existing uses, basic human needs, base flow (to surface water streams) and PU (refer to Table 5-4 of the Geohydrological Assessment Report).

- However, if the PU is substituted for the estimated demand during construction (including the period when construction and operation overlap), that is 216 m3/day, there will be a greater surplus of 98 869,79 m3/yr (or 270,87 m3/day)
- It is therefore estimated that there is enough groundwater available on a sub-catchment level to sustain the proposed 8-hour abstraction from the designated boreholes and the sub- catchments they fall in. Provided the surplus estimates are not exceeded, the impact on the groundwater reserve will likely be minimum.
- The base case water balance will be different under the forecasted climate change scenario for 2050. If the combined sustainable abstraction yield for both boreholes (336.67 m^3/day for 8 hours of pumping) is used as the Proposed Use (PU) in the water balance calculation under the climate change scenario (lower rainfall and effective recharge to the aquifer), there will be a deficit amount of -29 954.96 m3/yr (or -82.07 m3/day) available after the allocation of existing uses, basic human needs, base flow (to surface water streams) and PU (refer to Table 5-4 of the Geohydrological Assessment Report). Based on the climate change predictions, HRU2 will therefore not be able to meet the demand for water uses by 2050. Water abstraction rates, or specifically the PU, would need to be considerably decreased nearing the 2050 mark. The potential deficit must be avoided by reducing water usage during operation and substituting the PU with the estimated demand during operation, that is 150 m3/day, in which case there will be a surplus of 38 180 m3/yr (or 140,60 m3/day).
- Although forecasted production rates (to support the development and operation of the Solar PV facility) under current and future climate change scenarios, are/can be sustainable, groundwater is a very important resource for locals in the area, so care should be taken not to overproduce from boreholes chosen for this project, and to ensure that there is a limited impact on existing livestock/domestic watering already implemented.
- Almost a third of the households in Ward 6 get their water from a borehole, a much higher proportion than on local, district or provincial level, while just over 60% get their water from a regional or local water scheme (much lower than on local, district or provincial level).
- The project area overlies a moderate to high yielding aquifer (median yields of 0,5 to 2 L/sec), on average 6,9 m below ground level, and generally in bedding planes in shale or interbedded sandstone of the Beaufort Group and jointed and fractured contact zones between sedimentary rocks and dolerite dykes.
- However, the landowner, Willem Retief has indicated that each windmill pump yields approximately 1 200l/hr from both (two) boreholes in the project area for Phase 3. This is equivalent to 0,33 L/s, which falls at the bottom of the range (0.5 to 2 L/s – Class D3 Intergranular & Fractured Aquifer System) that is considered the median aquifer yield of the project area (Meyer, P.S., Chetty, & T., Jonk, F., 2002). Furthermore, Willem observed the water table dropped by at least 3 ms over the last few years during the drought.
- The electrical conductivity (EC) for the underlying aquifers generally ranges from 70 to 300 mS/m and the pH ranges from 6 to 8. Consequently, groundwater can generally be used for domestic and recreational use.
- Water scarcity in the arid Pixley Ka Seme District Municipality is expected to be exacerbated by climate change, specifically drought. Most of the province receives minimal summer rainfall ranging from 50 mm to 400 mm depending on the location. Under a low climate change mitigation

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

scenario (Climate Change Adaptation Response Strategy for the Northern Cape, 2016), model simulations indicated an average temperature increase by 2.3 °C, an increase of 16.1 in the total number of heat waves experienced and a decrease in rainfall to 17 mm - 74.3 mm annually.

- Where a series of boreholes are drilled in the same contact, and close to each other (< 500 m), borehole interference may likely occur as the fractures are simultaneously dewatered. Over-production may lead to fracture failures which will lead to borehole collapse. However, due to the degree of fracturing being unknown, the anticipated impact cannot be pre-determined.
- As a good practice, it is advised that all new boreholes drilled in the project area be pump tested, and interference (if any) be evaluated by long-duration pump tests. In terms of the development, limited impacts are anticipated due to the foreseeable low volumes required.
- Currently, no groundwater (GW) monitoring is taking place. It is proposed that a proper monitoring programme be implemented to monitor both the water quality and quantity at the site.
- It is advised that all groundwater boreholes (4 identified within proximity of the solar farm) be monitored for the decline in water levels/yields, as well as water quality. It is known that the boreholes are used as the main water supply for livestock / domestic use.
- It is advised that water be pumped to dedicated storage tanks from the boreholes to build up a reserve, whereafter the boreholes are only used to top up the storage tanks. Allowing boreholes to rest and recover between pumping cycles will help to decrease the impact on the aquifer reserve.
- He (Willem Retief, Landowner) also mentioned that the water table dropped by at least 3 metres over the last few years, due to the drought. So the question is how effective are the windmills, for if the water table drops below the intake pump the mill will spin, but no water will be abstracted?" (pers. comm. Henri Botha, Hydrologist).
- The abstraction of water for dust suppression will likely be very high.
- The water demand will depend on the frequency of spraying events for dust suppression. It is recommended that environmentally safe binding liquids be considered to decrease water use volumes. If dust suppression and operational water use volumes taken from groundwater resources in the sub-catchments are within the surplus estimates, the impact on the groundwater reserve will likely be minimum.
- Dust Suppression - Assuming four litres of water on every square meter, the access road from the N10 to the main entrance of the facility (a road roughly 18,5 km long and 6 m wide) would require the use of roughly 444 m3 of water for dust suppression or control.
- Total permissible abstraction for the project area, that is both properties combined is 109 +107 = 216 m3 per day.

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
15	H	M	M	-I	H	M	1	H	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
16	M	L	M	-I	M	M	1	M	M	1
Reversibility	M	**Irreplaceability**	M	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
17	H	M	M	-I	H	M	1	H	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

Abstraction may not exceed the sustainable abstraction yield at the recommended pumping rate of 8 hrs per day for each borehole, that is 6,58 l/s @ 8hrs (or 189,5 m3/8hr day) for BH4 and 5,11 l/s @ 8 hrs (or 147,17 m3/8hr day) for BH5.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Hydrological Assessment (Version – Final 2) 11 April 2022 GCS Project Number: 22-0076 by Hendrik Botha

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

- Geohydrological Assessment Report (Final Rev 3) prepared by GCS Water and Environmental Consultants dated 10th August 2022 (GCS Project Number: 22-0401).
- Aquatic Biodiversity Impact Assessment, Section 21(c) and (i) Risk Assessment and Wetland Delineation Verification by Dr Andrew Deacon August 2022.
- Social Impact Assessment Report prepared by Ilse Aucamp of Equispectives Research & Consulting Services dated August 2022.

Mitigations:

Impact Management Outcome(s):

- Reduce deterioration in water quality
- Avoidance of water pollution
- Minimal sedimentation of watercourses
- Preserve topsoil, control soil erosion
- Preserve hydrological patterns
- Minimise water usage during construction (and operation) to avoid depleting the underground aquifer.

Targets:

- No signs of hydrocarbon spills
- Compliance with general standards
- Treated effluent sample data
- Soil binders used are environmentally friendly
- Watercourse has no sediment build up
- Preserved hydrological pattern
- In-stream diversion
- No erosion of banks or bars
- No signs of sand mining
- Fill roads of gravel/crushed rock
- Shaped to natural forms during operations.
- Roads in good condition
- No signs of soil erosion
- Stockpiles are outside of the ephemeral drainage system buffer

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

- Abstraction records and pump tests and water level monitoring results
- Water wise technologies are installed
- Reduce the quantity of water used for each spray (e.g., 1 000 ml per sqm) and the frequency of spraying (e.g., less frequent than daily).

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
15	Construction Plant Management including Deliveries	Hydrocarbon (fuel or oil) spills from construction vehicles or plant, and transformers will contaminate the soil, surface water run-off and possibly seepage, reducing the quality of the surface and groundwater resources.	Reduce deterioration in water quality	No signs of hydrocarbon spills	Implement the Surface and Groundwater Monitoring Protocol during construction and operation (Appendix D).	Holder, Contractor	Ongoing	Compliance to verified by ECO and IEA.
15	Water management (abstraction, storage and use)	Dust suppression with chemical additives or treated effluent may contaminate a watercourse.	Avoidance of water pollution	Compliance with general standards	Effluent shall be treated to General Standards	Holder, Contractor	Ongoing	Compliance to verified by ECO and IEA.
15	Water management (abstraction, storage and use)	Dust suppression with chemical additives or treated effluent may	Avoidance of water pollution	Treated effluent sample data	Treated effluent must be sampled and monitored at the points of ingress to the effluent plants and at the points of reuse or discharge	Holder, Contractor	Ongoing	Compliance to verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		contaminate a watercourse.						
15	Water management (abstraction, storage and use)	Dust suppression with chemical additives or treated effluent may contaminate a watercourse.	Avoidance of water pollution	Soil binders used are environmentally friendly	Soil binding agents used for dust suppression shall be biodegradable, environmentally friendly, non-phototoxic and must not harm flora or fauna (e.g., local wildlife and livestock).	Holder, Contractor	Ongoing	Compliance to verified by ECO and IEA.
16	Stormwater management and erosion control	Sedimentation in wetlands and watercourses.	Minimal sedimentation of watercourses	Watercourse has no sediment build up	Any sediment build-up should be removed immediately.	Holder, Contractor	Ongoing	Compliance to verified by ECO and IEA.
16	Stormwater management and erosion control	Sedimentation in wetlands and watercourses.	Minimal sedimentation of watercourses	Preserved hydrological pattern.	Disturbance of the natural topography and vegetation cover should be minimised. The natural contours should be preserved as far as is practical in order to preserve the existing site drainage patterns as far as possible.	Contractor	Construction	Compliance to verified by ECO and IEA.
16	Stormwater management and erosion control	Sedimentation in wetlands and watercourses.	Minimal sedimentation of watercourses	Preserved hydrological pattern.	Natural, dispersed, drainage should be encouraged, by maintaining the natural drainage	Contractor	Construction	Compliance to verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					characteristics of the land as far as possible, thereby minimising the concentration of flows and consequently the risk of erosion.			
16	Stormwater management and erosion control	Altered surface water flow patterns, e.g., changing sheet flow (natural open system) to concentrated flows leads to erosion.	Preserve topsoil, control soil erosion.	No signs of soil erosion	Storm water runoff off all roads must be spread as much as possible, to avoid concentration of flows off compacted or hardened surfaces.	Holder, Contractor	On-going	Compliance to verified by ECO and IEA.
16	Stormwater management and erosion control	Altered surface water flow patterns, e.g., changing sheet flow (natural open system) to concentrated flows leads to erosion.	Preserve topsoil, control soil erosion.	No signs of soil erosion	Maintain all access routes and roads adequately to minimise erosion and undue surface damage. Repair rutting and potholing and maintain stormwater control mechanisms.	Holder, Contractor	On-going	Compliance to verified by ECO and IEA.
16	Linear infrastructure crossings	Construction of linear infrastructure across the ephemeral drainage system may involve	Preserve in-stream hydrological pattern	In-stream diversion.	Any river diversion works must remain inside the active channel, e.g., the works may not extend into the active channel bank. The location	Engineer, Contractor, ECO	Before clearing and grubbing operations	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		temporary diversion works, changing the surface water hydrology or flow patterns.			of the active channel bank must be verified by the ECO.			
16	Linear infrastructure crossings	Construction of linear infrastructure across the ephemeral drainage system may involve temporary diversion works, changing the surface water hydrology or flow patterns.	Preserve in-stream hydrological pattern	No erosion of banks or bars.	Any river diversion works, and their outlets must be designed in such a way so as not to cause scouring of any bank or mid-channel bar. The works must be monitored regularly by the SEO for signs of scouring.	Engineer, Contractor, SEO	On-going	Compliance to be verified by ECO and IEA.
16	Linear infrastructure crossings	Construction of linear infrastructure across the ephemeral drainage system may involve temporary diversion works, changing the surface water hydrology or flow patterns.	Preserve in-stream hydrological pattern	No erosion of banks or bars.	Any signs of scouring caused by the river diversion works must be immediately rectified and remediated.	Engineer, Contractor, SEO	On-going	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
16	Linear infrastructure crossings	Construction of linear infrastructure across the ephemeral drainage system will reshape the bed and banks of the watercourse.	Preserve in-stream hydrological pattern	No signs of sand mining	Sand mining in the ephemeral drainage system is prohibited.	Engineer, Contractor.	Ongoing	Compliance to be verified by ECO and IEA.
16	Linear infrastructure crossings	Construction of linear infrastructure across the ephemeral drainage system will reshape the bed and banks of the watercourse.	Preserve in-stream hydrological pattern	Fill roads of gravel/crushed rock.	Limit or restrict the construction of fill roads. All fill roads must use a permeable fill material (such as gravel or crushed rock) for at least the first layer of fill in order to maintain the natural flow regimes of subsurface water.	Engineer, Contractor.	Ongoing	Compliance to be verified by ECO and IEA.
16	Linear infrastructure crossings	Construction of linear infrastructure across the ephemeral drainage system will reshape the bed and banks of the watercourse.	Preserve in-stream hydrological pattern	Shaped to natural forms during operations.	Re-instatement of the original landscape levels must be done concurrent with construction activities.	Engineer, Contractor.	Ongoing	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
16	Linear infrastructure crossings	Construction of linear infrastructure across the ephemeral drainage system will reshape the bed and banks of the watercourse.	Preserve in-stream hydrological pattern	Shaped to natural forms during operations.	The final grading of the crossing area should not significantly alter the flow characteristics of the ephemeral drainage system during periods of high flows, e.g., shaped to natural forms that blend in with pre-construction topography.	Engineer, Contractor.	Ongoing	Compliance to be verified by ECO and IEA.
16	Road Management	Altered surface water flow patterns, e.g., changing sheet flow (natural open system) to concentrated flows leads to erosion.	Preserve topsoil, control soil erosion.	Roads in good condition	Maintain all access routes and roads adequately in order to minimise erosion and undue surface damage. Repair rutting and potholing and maintain stormwater control mechanisms.	Holder, Contractor.	Ongoing	Compliance to be verified by ECO and IEA.
16	Road Management	Altered surface water flow patterns, e.g., changing sheet flow (natural open system) to concentrated flows leads to erosion.	Preserve topsoil, control soil erosion.	Roads in good condition	Ensure that all access roads utilised during construction (which are not earmarked for closure and rehabilitation) are returned to a usable state and / or a state no worse than	Holder, Contractor.	Ongoing	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					prior to construction.			
16	Road Management	Altered surface water flow patterns, e.g., changing sheet flow (natural open system) to concentrated flows leads to erosion.	Preserve topsoil, control soil erosion	No signs of soil erosion	Any erosion problems observed to be associated with the project infrastructure should be rectified as soon as possible and monitored thereafter to ensure that it does not re-occur.	Holder, Contractor.	Ongoing	Compliance to be verified by ECO and IEA.
16	Earthworks Stockpiling and Storing (Laydown) Road Management	Construction activities may alter the physical characteristics of the terrain.	Preserve topsoil, control soil erosion	No signs of rills/gullies	Monitor for signs of channelled surface water run-off, e.g., rills and gullies, caused by construction activities, and if observed, take actions necessary to immediately re-instate the original ground level and sheet flow across the affected site.	Holder, Contractor.	Ongoing	Compliance to be verified by ECO and IEA.
16	Stockpiling and storing (Laydown)	Stockpiles and overburden left in the river or floodplain can alter channel hydraulics during high flows, e.g., stockpiles left in	Preserve hydrological patterns	Stockpiles are outside of the ephemeral drainage system buffer	Stockpiling and laydown areas must be outside the 20 m ecological buffer of the ephemeral drainage system.	Contractor	Construction	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		the river channel can also deflect water to the other side of the riverbank.						
17	Water management (abstraction, storage and use)	Natural Resource depletion (groundwater reserve) - Construction will require the abstraction of water from boreholes for dust suppression, mixing concrete and potable usage. Declining groundwater abstraction yields as a result of no water quality and quantity monitoring plan.	Minimise water usage during construction (and operation) to avoid depleting the underground aquifer.	Abstraction records	The abstraction of groundwater from both properties combined (but limited to sub-catchment HRU2 of Quaternary Catchment D62D), including all boreholes contained thereon, shall not exceed 216 m3/ day (or 78 840,43 m3/ yr) during the construction period (including when it overlaps with operation), and 150 m3/day (or 54 750,3 m3/ yr) during operation.	Holder, Contractor.	Ongoing	Compliance to be verified by ECO and IEA.
17	Water management (abstraction, storage and use)	Natural Resource depletion (groundwater reserve) - Construction will require the	Minimise water usage during construction (and operation) to avoid depleting the underground aquifer.	Abstraction records	Abstraction may not exceed the sustainable abstraction yield at the recommended pumping rate of 8 hrs per day for each	Holder, Contractor.	Ongoing	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		abstraction of water from boreholes for dust suppression, mixing concrete and potable usage. Declining groundwater abstraction yields as a result of no water quality and quantity monitoring plan.			borehole, that is 6,58 l/s @ 8hrs (or 189,5 m3/8hr day) for BH4 and 5,11 l/s @ 8 hrs (or 147,17 m3/8hr day) for BH5.			
17	Water management (abstraction, storage and use)	Natural Resource depletion (groundwater reserve) - Construction will require the abstraction of water from boreholes for dust suppression, mixing concrete and potable usage. Declining groundwater abstraction yields as a result of no	Minimise water usage during construction (and operation) to avoid depleting the underground aquifer.	Water level monitoring results	Undertake water level monitoring of boreholes within a 1.5 km radius of the pumping borehole. If a decline in water levels is noted in all boreholes, because of pumping, the abstraction rate should be lowered to prevent aquifer depletion.	Holder	Ongoing	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		water quality and quantity monitoring plan.						
17	Water management (abstraction, storage and use)	Natural Resource depletion (groundwater reserve) - Construction will require the abstraction of water from boreholes for dust suppression, mixing concrete and potable usage. Declining groundwater abstraction yields as a result of no water quality and quantity monitoring plan.	Minimise water usage during construction (and operation) to avoid depleting the underground aquifer.	Pump tests	All new boreholes drilled in the project area (such as T1 or T2) must be pump tested, and interference (if any) with other existing boreholes (closer than 500 m) be evaluated by long-duration pump tests.	Holder, Engineer, Contractor.	When new boreholes are drilled.	Compliance to be verified by ECO and IEA.
17	Water management (abstraction, storage and use)	Natural Resource depletion (groundwater reserve) - Construction will require the abstraction of water from boreholes for	Minimise water usage during construction (and operation) to avoid depleting the underground aquifer.	Water level logbook	Conduct multi borehole water level logging, to ensure that no cumulative dewatering impacts are taking place for boreholes which may be in the same contact zones.	Holder, Contractor.	Ongoing	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		dust suppression, mixing concrete and potable usage. Declining groundwater abstraction yields as a result of no water quality and quantity monitoring plan.						
17	Water management (abstraction, storage and use)	Natural Resource depletion (groundwater reserve) - Construction will require the abstraction of water from boreholes for dust suppression, mixing concrete and potable usage. Declining groundwater abstraction yields as a result of no water quality and quantity monitoring plan.	Minimise water usage during construction (and operation) to avoid depleting the underground aquifer.	Water wise technologies are installed	Continually investigate and implement water-saving strategies and technologies or alternatives, including designs.	Holder, Engineer, Contractor.	Ongoing	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
17	Water management (abstraction, storage and use)	Natural Resource depletion - Construction will require the abstraction of water from boreholes for dust suppression, mixing concrete and potable usage.	Minimize the impact of borehole abstraction on the groundwater reserve.	Reduce the quantity of water used for each spray (e.g., 1 000 ml per sqm) and the frequency of spraying (e.g., less frequent than daily).	Reduce the quantity of groundwater and frequency of applications required for dust suppression on gravel access roads by adding environmentally safe/friendly soil binding agents.	Holder, Contractor.	Ongoing	Compliance to be verified by ECO and IEA.
17	Water management (abstraction, storage and use)	Natural Resource depletion - Construction will require the abstraction of water from boreholes for dust suppression, mixing concrete and potable usage.	Minimize the impact of borehole abstraction on the groundwater reserve.	Reduce the quantity of water used for each spray (e.g., 1 000 ml per sqm) and the frequency of spraying (e.g., less frequent than daily).	Monitor the amount of water used for suppressing dust on gravel roads.	Holder, Contractor.	Ongoing	Compliance to be verified by ECO and IEA.
17	Water management (abstraction, storage and use)	Natural Resource depletion - Construction will require the abstraction of water from boreholes for dust suppression,	Minimize the impact of borehole abstraction on the groundwater reserve.	Reduce the quantity of water used for each spray (e.g., 1 000 ml per sqm) and the frequency of spraying (e.g., less frequent than daily).	Regular, light watering of gravel roads is better than infrequent, heavy watering.	Holder, Contractor.	Ongoing	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		mixing concrete and potable usage.						

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
15	L	L	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
15	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
16	L	L	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
16	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
17	L	L	M	-I	M	L	0	L	L	0

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Reg: 2006/023163/23

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
17	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- The residual risk of surface and water pollution (**15**) after mitigation is assumed to be Low.
- The residual risk of erosion caused by changed surface water flow patterns (**16**) after mitigation is assumed to be Low.
- The residual risk of a reduction in the water quantity through abstraction of groundwater for construction activities such as dust suppression (**17**) after mitigation is assumed to be Low.

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Reg: 2006/023163/23

Receiving Environment: Atmosphere

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Clearing/Grubbing and Grading	Construction camp (incl. operational area), borrow pit, upgrading existing and new roads, trenches for underground cables and water pipes, holes for racks, fence posts and pylons, foundations for inverters, field transformers and on-site substation, water storage tanks and deionization plant.	Removal of vegetation	**Impact:** The PV ""heat island"" (PVHI) effect would be the result of a detectable increase in sensible heat flux (atmospheric warming). This may be compounded by the forecasted increase in temperatures linked to climate change. **Consequences:** - Warming surrounding areas could potentially influence wildlife habitat, ecosystem function and human health. (indirect)	Quality	18
General and Hazardous Waste Management	Disposal	Land contamination	**Impact:** Burning of waste as a disposal method increases the risk of veld fires caused by workers during the construction of the facility. **Consequence:** - increase emissions to air reducing air quality (direct) **Addressed under "Receiving Environment: Terrestrial Fauna"**	Quality	19
Employee management (including appointment,	Keeping warm or cooking	Starting fires	**Impacts:** Staff starting fires for warm/cooking could result in uncontrolled runaway fires. **Consequences:** affects air quality/damage to property.	Quality	19

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Reg: 2006/023163/23

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
conduct and movement)			**Addressed under "Receiving Environment: Terrestrial Fauna"**		
Quarry (Sourcing materials (aggregate) for roads and concrete)	New Quarry & Crushing Plant Operation (and maintenance)	Dust generation	**Impact:** Excessive dust from rock crushing plant **Consequence:** - Dust settling on and smothering plants will reduce photosynthetic capacity and plant vigour, making them less resistant to diseases and pest infestations. - Dust settling on and smothering any already installed solar panels will reduce their efficiency, causing a decline in electrical power output, lost income for the operator and increase the payback period Disturbance.	Quality	19
Road Management	Use including gravel District Road, Transnet Service Road and internal roads	Dust generation	**Impact:** Air pollution or reduced air quality. Assumption: **Consequence:** - Airborne dust from gravel roads (a type of PM10) can cause eyes, nose and throat irritations (direct). - Dust settling on and smothering plants will reduce photosynthetic capacity and plant vigour, making them less resistant to diseases and pest infestations (indirect). - Dust settling on and smothering solar panels will reduce their efficiency, causing a decline in electrical power output, lost income for the operator and increase the payback period (indirect).	Quality	19
Road Management	Use including gravel District Road, Transnet Service Road and internal roads	Dust generation	**Impact:** Dust pollution caused by increased traffic. **Consequence:** Reduced photosynthetic functioning, nuisance.	Quality	19
Blasting		Noise generation	**Impact:** Vibrations/noise from blasting. **Consequence:** disturbance.	Quality	20
Construction Plant	Driving/Transport	Generating noise	**Impact:** Noise pollution due to traffic.	Quality	20

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Reg: 2006/023163/23

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Management including Deliveries			**Consequence:** Decrease in sense of place due to noise generated by traffic.		

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 18 (Heat Island Effect)

- The study area is not within an Air Quality Priority Area.
- Incoming solar energy is typically either reflected to the atmosphere or absorbed, stored and later reradiated in the form of latent or sensible heat. (Barron-Gafford G.A., et al 2016)
- Within natural ecosystems, vegetation reduces heat gain (or capture) and storage in soils by creating surface shading. Energy absorbed by vegetation and surface soils can be released as latent heat in the transition of liquid water to water vapour to the atmosphere through evapotranspiration (the combined water loss from soils and vegetation). (Barron-Gafford G.A., et al 2016)
- In PV farms, the reduced albedo (reflectance) of the dark panels combined with the greater amount of exposed ground surfaces compared to natural systems absorbs a larger proportion of high energy, shortwave solar radiation during the day. Combined with minimal rates of heat-dissipating transpiration from vegetation, a proportionately higher amount of stored energy is reradiated as longwave radiation during the night in the form of sensible heat. (Barron-Gafford G.A., et al 2016)
- The PHVI effect occurs across all seasons with the greatest influence on ambient temperature at night (by as much as 3 to 4 degrees Celcius), possibly due to heat trapping of reradiated sensible heat flux under PV arrays at night and delayed cooling. (Barron-Gafford G.A., et al 2016)
- The maintenance of vegetation and ecosystem regulating services will reduce, but not avoid the potential PV "heat island" effect.
- A wind blows year-round and should alleviate heat trapping at night. Heat trapping can be further alleviated through adequate spacing between solar arrays.
- The decreased albedo due to a PV power plant and their associated warming from the PVHI is at least offset by the carbon dioxide emission reductions associated with PV power plant and more so when ecosystem regulating services, such as carbon sequestration, are maintained through sound ecological management.
- A risk averse approach to counter increased climatic uncertainty is through climate change mitigation, specifically the need to halt and reverse existing degradation primarily from extensive livestock production and adopt the most effective management practices.
- The lateral and vertical extent of the PHVI effect cannot be known.

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Reg: 2006/023163/23

Impact 19 (Dust Generation)

- For the PV scope (excluding the MTS and DX works) we have projected the following number of delivery trucks per 100MW sub-phase of the project: Panels - 273 trucks, Mounting Structure - 300 trucks, Inverters - 13 trucks, Field Transformers - 12 trucks, Cable & BOS - 120 trucks *(pers. comm Bruce Conné, General Manager, Soventix).*
- Although still to be finalised it is projected that staff will be transported in mini-bus taxis or small busses daily. Assuming mini-bus taxis one could work on 15 people per taxi which would result in an estimated average of 20 taxis per day X 2 for morning and afternoon trips. Using busses will reduce the number of vehicle-trips *(pers. comm Bruce Conné, General Manager, Soventix).*

Impact 20 (Noise)

- Blasting may be required for shallow dolerite areas. *"Yes, the dolerite is the hardest rock on site. However, it wears to rounded cobbles and boulders with cobbles, gravel and sand in between. In parts the weathering may be to such an advanced stage that boulders in the rock mass are small enough to enable be moving them with an excavator. However, since the largest part of the dolerite rock is below ground level (e.g., covered by soil) one cannot really judge as to how much of the dolerite rock mass is moveable by excavator. Certainly, in the vicinity of locality P28B very large dolerite boulders which are only slightly weathered occur. Additionally, in many parts, good quality sandstone and siltstone rock mass occurs at shallow depth below ground level and will also require blasting for laying of the three cabling routes." (pers. comm. Frederik Stapelberg).*
- For the PV scope (excluding the MTS and DX works) we have projected the following number of delivery trucks per 100MW sub-phase of the project: Panels - 273 trucks, Mounting Structure - 300 trucks, Inverters - 13 trucks, Field Transformers - 12 trucks, Cable & BOS - 120 trucks (pers. comm Bruce Conné, General Manager, Soventix).
- Although still to be finalised it is projected that staff will be transported in mini-bus taxis or small busses daily. Assuming mini-bus taxis one could work on 15 people per taxi which would result in an estimated average of 20 taxis per day X 2 for morning and afternoon trips. Using busses will reduce the number of vehicle-trips (pers. comm Bruce Conné, General Manager, Soventix).

<u>Assessment without mitigation:</u>

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant

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Reg: 2006/023163/23

L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
18	M	M	M	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
19	M	M	M	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
20	M	M	M	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Barron-Gafford G.A., et al (2016) "The Photovoltaic Heat Island Effect: Larger solar power plants increase local temperatures" www.nature.com/scientificreports.

- Traffic Impact Assessment prepared by Annebet Krige of Sturgeon Consulting (Pty) Ltd dated September 2022 (Project No.: STUR0352).

Mitigations:

Impact Management Outcome(s):

- Increased ecosystem resilience to atmospheric warming.
- Minimise dust generation.
- Minimal noise generated by blasting and traffic.

Targets:

- Reduce the potential PVHI: Restored bare patches.
- Compliance with National Dust Control Regulations.
- Dust monitoring unit is installed.
- No excessive dust at the rock crushing plant.
- No signs of speeding.
- Good road drainage.
- No unnecessary staff or delivery trips.
- Use of minimum magnitude and amount of 'explosive' material.
- Blast mat in use.
- No blasting after hours or on weekends.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
18	Clearing, grubbing and grading	The PV ""heat island"" (PVHI) effect would be the result of a detectable increase in sensible heat flux	Increased ecosystem resilience to atmospheric warming.	Reduce the potential PVHI: Restored bare patches.	Minimise vegetation clearance.	Contractor	Continuous	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		(atmospheric warming). This may be compounded by the forecasted increase in temperatures linked to climate change.						
18	Clearing, grubbing and grading	The PV ""heat island"" (PVHI) effect would be the result of a detectable increase in sensible heat flux (atmospheric warming). This may be compounded by the forecasted increase in temperatures linked to climate change.	Increased ecosystem resilience to atmospheric warming.	Reduce the potential PVHI: Restored bare patches.	Once construction has been completed in an area, immediately reinstate and maintain the vegetation underneath the solar PV modules to retain its cooling effect through transpiration	Contractor	Continuous	Compliance to be verified by ECO and IEA.
18	Clearing, grubbing and grading	The PV ""heat island"" (PVHI) effect would be the result of a detectable increase in sensible heat flux (atmospheric warming). This may be	Increased ecosystem resilience to atmospheric warming.	Reduce the potential PVHI: Restored bare patches.	Restore all bare patches of soil with vegetation.	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		compounded by the forecasted increase in temperatures linked to climate change.						
19	Quarry (Sourcing materials (aggregate) for roads and concrete)	Excessive dust from rock crushing plant	Minimise dust generation	Compliance with National Dust Control Regulations	Effective implementation of the National Dust Control Regulations.	Contractor	Construction	Compliance to be verified by ECO and IEA.
19	Quarry (Sourcing materials (aggregate) for roads and concrete)	Excessive dust from rock crushing plant	Minimise dust generation	Dust monitoring unit is installed	Dust Monitoring Unit is recommended to be installed.	Holder, Contractor	Construction	Compliance to be verified by ECO and IEA.
19	Quarry (Sourcing materials (aggregate) for roads and concrete)	Excessive dust from rock crushing plant	Minimise dust generation	No excessive dust at the rock crushing plant	Operating/offloading of the crusher plant shall be avoided during windy conditions, unless additional dust suppression methods will ensure that the dust fallout does not exceed the acceptable limits. We suggest that the contractor take into consideration predicted wind speeds from the local weather station when planning construction-related activities with a high risk of generating dust.	Contractor	Construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
19	Quarry (Sourcing materials (aggregate) for roads and concrete)	Excessive dust from rock crushing plant	Minimise dust generation	No excessive dust at the rock crushing plant	Dust suppressant must be prioritised for the operation of the crusher plant.	Holder, Contractor	Construction	Compliance to be verified by ECO and IEA.
19	Road Management	Reduced air quality due to dust from driving on dirt roads.	Minimise dust generation.	No signs of speeding	Reduce speed limit to 30 or 40 km/hr for deliveries and contractors.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.
19	Road Management	Reduced air quality due to dust from driving on dirt roads.	Minimise dust generation.	No signs of speeding	Enforce speed control through speed limit road signage and fines.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.
19	Road Management	Reduced air quality due to dust from driving on dirt roads.	Minimise dust generation.	Good road drainage	Implement and maintain good drainage.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.
19	Road Management	Reduced air quality due to dust from driving on dirt roads.	Minimise dust generation.	No unnecessary staff trips	As far as possible, reduce the number of vehicle trips by transporting staff in busses instead of 15-seater taxis.	Contractor	Construction	Compliance to be verified by ECO and IEA.
20	Blasting	Vibrations/noise from blasting.	Minimal noise generated by blasting	Use of minimum magnitude and amount of 'explosive' material.	The contractor carrying out the blasting work shall apply the absolute minimum magnitude and amount of 'explosive' material.	Contractor	Construction	Compliance to be verified by ECO and IEA.
20	Blasting	Vibrations/noise from blasting.	Minimal noise generated by blasting	Blast mat in use	The contractor carrying out the blasting work shall use a blast mat (not soil) to reduce noise/fly rock.	Contractor	Construction	Compliance to be verified by

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
								ECO and IEA.
20	Blasting	Vibrations/noise from blasting.	Minimal noise generated by blasting	No blasting after hours or on weekends	Blasting should be done during work hours and during weekdays only.	Contractor	Construction	Compliance to be verified by ECO and IEA.
20	Construction plant management including deliveries	Noise pollution due to traffic	Minimal noise generated by traffic.	No unnecessary delivery trips	Stagger delivery trips.	Contractor	Construction	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
18	L	M	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
18	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
19	L	M	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
19	L	L	L	neutral	L	L	0	L	L	0

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Reg: 2006/023163/23

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
20	L	M	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
20	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- The residual risk of the solar PV facility on increased atmospheric warming (**18**) after (a) the maintenance and sound ecological management of ecosystem regulating services, such as carbon sequestration, (b) fragmentation of the facility, and (c) spacing of the arrays is assumed to be "Low", particularly when considered in combination with the carbon dioxide emission reductions associated with a PV power plant.
- The residual risk of the solar PV facility on increased dust generation (**19**) with mitigation measures is assumed to be Low.
- The residual risk of the generation of noise to the atmosphere from blasting and traffic (**20**) with mitigation is assumed to be Low.

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Reg: 2006/023163/23

Receiving Environment: Terrestrial and Avian Ecosystem

Description of potential impacts:

Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Construction Plant Management including Deliveries	Driving/Transport	Damage to the environment	**Impact:** Altered surface water flow patterns, e.g., changing sheet flow (natural open system) to concentrated flows leads to erosion. **Consequence:** Increased suspended solids, siltation in watercourses and soil erosion.	Transformation	21
Installing panel arrays and associated infrastructure (from racks to field transformers) including within 100 m of a watercourse or 500 m of a wetland/pan	Panels	Dripline	**Impact:** Erosion and sediment transport may be exacerbated by the concentrated rainfall volumes off the solar PV panels. Efforts should be made in managing run-off from the PV panels and arrays onto the soils, and then managing the distribution of the accumulated water back to the environment. **Consequences:** - Erosion can result in a degraded or dysfunctional terrestrial ecosystem (direct) and loss of ecosystem services (indirect).	Transformation	21
Stormwater Management and Erosion Control			**Impact:** (1) Flooding in the predicted "ponded flood occurrence zones" (Hydrology Assessment Report) combined with solar PV panels and arrays could alter surface water flow patterns in these areas, causing erosion. (2) The largest risk is potential run-off and stormwater discharge from the site into the surrounding causing soil erosion. **Consequences:** - Erosion can result in a degraded or dysfunctional ecosystem (direct) and loss of ecosystem services (indirect)	Transformation	21
Road Management	Grading existing and new roads	Creating bare surfaces susceptible to erosion	**Impact:** (1) Roads, including the two-track service roads between the solar panel arrays, will increase surface water run-off, causing erosion and sedimentation of watercourses (Hydrology Assessment Report). **Consequences:**	Transformation	21

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Reg: 2006/023163/23

Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
			- Erosion can result in a degraded or dysfunctional terrestrial ecosystem (direct) and loss of ecosystem services (indirect)		
Clearing/Grubbing and Grading	Construction camp (incl. operational area), borrow pit, upgrading existing and new roads, trenches for underground cables and water pipes, holes for racks, fence posts and pylons, foundations for inverters, field transformers and on-site substation, water storage tanks and deionization plant.	Removal of vegetation	**Impact:** (1) Bare areas created by vegetation removal will increase surface water run-off, causing erosion and sedimentation of watercourses. (2) Erosion and sediment transport will likely take place from the concentrated rainfall volumes off the solar PV panels. Efforts should be made in managing run-off from the PV panels and arrays onto the soils, and then managing the distribution of the accumulated water back to the environment. **Consequences:** - Erosion can result in a degraded or dysfunctional terrestrial ecosystem (direct) and loss of ecosystem services (indirect) - Sedimentation can increase turbidity and Total Suspended Solids (TSS). Turbid waters reduce light penetration, decreasing photosynthesis and primary production, reducing food availability for aquatic organisms higher up the food chain. Suspended solids may interfere with the feeding mechanisms of filter-feeding organisms such as certain macroinvertebrates, and the gill functioning, foraging efficiency (due to visual disturbances) and growth of fish, leading to changes in invertebrate and fish assemblages. Suspended solids that settle out may cover spawning grounds (places to lay eggs), smother or abrade benthic plants and animals, resulting in changes to the nature of the substratum where invertebrates live, causing either change in the structure of the biotic community by the replacement of these organisms with organisms that burrow in soft sediments, or massive declines in fish populations. Sensitive species may be permanently eliminated if the source of the suspended solids is not removed. The recovery of a stream from sediment deposition is dependent on the elimination of the sediment source and the potential for the deposited material to be flushed out by stream flow (indirect).	Transformation	21

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Reg: 2006/023163/23

Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Road Management	Use including gravel District Road, Transnet Service Road and internal roads	Development of corrugations, potholes and puddles	**Impacts:** Damage to environment when driving through veld to avoid potholes or puddles. **Consequences:** - Loss of flora and fauna - erosion, ecosystem degradation and dysfunction.	Transformation	22
Clearing/Grubbing and Grading	Construction camp (incl. operational area), borrow pit, upgrading existing and new roads, trenches for underground cables and water pipes, holes for racks, fence posts and pylons, foundations for inverters, field transformers and on-site substation, water storage tanks and deionization plant.	Removal of vegetation	**Impact:** The physical footprint of solar PV facility will result in a loss of local terrestrial habitat. **Consequence:** - reduced habitat for terrestrial fauna and Aves (direct). - reduced productivity and carrying capacity (direct). **Addressed under "Receiving Environment: Terrestrial Fauna"**	Quantity	22
Construction Plant Management including Deliveries	Washing plant	Land contamination	**Impact:** Hydrocarbon spills in a watercourse **Consequences**: Altered aquatic ecosystem structure and function. **Addressed under "Receiving Environment: Soil and Rock"**	Transformation	23
General and Hazardous Waste Management	Storage	Land contamination	**Impact:** Unsanitary conditions surrounding infrastructure promoting the establishment of alien plants and/or invasive rodents.	Transformation	23

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Reg: 2006/023163/23

Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
			Consequence: Disturbance to ecosystems		
General and Hazardous Waste Management	Transport	Land contamination	**Impact:** Windblown litter from transporting waste can contaminate the environment. **Consequence:** Disturbance to ecosystems	Transformation	23
General and Hazardous Waste Management	Disposal	Land contamination	**Impact:** Pollution from waste material. **Consequence:** Visual aesthetic are reduced. Fauna may ingest waste.	Transformation	23
Handling Hazardous Substances	Lubricating, Oil Storage and Disposal	Watercourse contamination	**Impact:** Chemical pollution of the water resources. **Consequence:** Altered ecological functioning. **Addressed under "Receiving Environment: Soil and Rock"**	Transformation	23
Alien Plant Management	Disturbance to natural areas	Favourable conditions for alien plant/animal recruitment.	**Impact:** Herbicides can introduce toxic chemicals into the food chain. **Consequence:** Disruption of trophic levels and disturbance to terrestrial ecosystems	Transformation	23
Earthworks	Excavating and Trenching	Waste arisings (spoil)	**Impact:** Chemical pollution of the water resources. **Consequence:** Alter ecological functioning.	Transformation	23

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 21 (Surface Water Hydrology)

- The flood lines suggest low flooding risk associated with the project area, as no clearly defined drainage lines occur. In the absence of clearly defined drainage channels or streams the area is prone to exhibit ponded flood occurrence zones. Micro sub-catchment sheet flow towards lower-lying areas within the non-perennial river flood plains is likely to dominate flood propagation, and isolated flooded areas are predicted to occur. The flood line determination suggests a low flooding risk as no clearly defined drainage lines occur. As such, no clearly defined exclusion

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

zones or protection buffer areas could be mapped or recommended. However, care should be taken in areas where development does take place within the likely flooding zones (local flooding/ponding due to many topographical depressions).

- The largest risk is potential run-off and stormwater discharge from the site into the surrounding causing soil erosion and should be managed according to the CSWMP and Monitoring Plan (for the Storm Water Management System and ground and surface water resources.
- Considering run-off is directly related to rainfall intensity, and longer precipitation events, both monthly rainfall and run-off, peak from January to April. The run-off during these peak months ranges from 0,3 to 1,1 mm/yr over the surface area of quaternary catchment D62D. The annual run-off from natural (unmodified) catchments in D62D is approximately 0,9% of the MAP. (Hydrology Assessment)
- The solar panels are going to have an impact on rainfall runoff, especially along the dripline of the panels, and that will probably be an area of ongoing management, as well as channelling from the “two-spoor” roads in-between the panel arrays and along the perimeter fence, necessary for inspection and cleaning. As the panels need to be largely north facing (although they will be single-axis tracking units), at face value, the orientation of the panels and associated service roads will lie largely on the contour, which will be important for minimising runoff down the slope.
- Accounting for changes in soil type, slope angle and rainfall intensity, ground cover beneath solar arrays was found to have the most significant impact on run-off rates. It is therefore anticipated, that maintaining natural vegetation cover will assist in preventing increases in peak flow to the non-perennial streams/rivers. Hence, a marginal impact in terms of post-development peak flows on a sub-catchment scale is anticipated. It is predicted that there may only be an impact on the sub-catchment flood peak flows, if severe erosion and vegetation clearing activities take place, with inadequate stormwater management. So, if vegetation cover beneath the solar arrays is maintained, no significant increase in surface water run-off (run-off volumes, peak rates or time to peak rates) is anticipated compared to greenfield run-off rates.
- There is a risk of channelling from the “two-spoor” roads in-between the panel arrays and along the perimeter fence, necessary for inspection and cleaning. However, as the panels need to be largely north facing (although they will be single-axis tracking units), at face value, the orientation of the panels and associated service roads will lie largely on the contour, which will be important for minimising runoff down the slope *(pers. comm. Justin Bowers).*

Impact 22 (Terrestrial Biodiversity)

- Although there are no CBAs within the affected area, the whole of the Soventix Phase 3 site falls within an extensive ESA. According to the reasons layer that accompanies the CBA map, the ESA is based on the selection of the area as Northern Upper Karoo, the Platberg - Karoo Conservancy Important Bird Area, the presence of natural wetlands, rivers, and wetland FEPAs. However, the aquatic features listed above have been excluded from the development footprint, with the result that the impact of the development on these features would be minimal.
- There are no impacts associated with the development of the Soventix Phase 3 site on terrestrial biodiversity that cannot be mitigated to an acceptable level.
- Northern Upper Karoo is one of the most extensive vegetation types in the country and occupies over 40 000km2 of the interior Karoo. The vegetation consists of shrubland dominated by dwarf Karoo shrubs, grasses and Acacia mellifera subsp. detinens, and other low trees particularly

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

on the sandy soils. Four plant species are known to be endemic to the vegetation type, Lithops hookeriana, Stomatium pluridens, Galenia exigua and Manulea deserticola. Northern Upper Karoo has not been significantly affected by transformation and is still approximately 96% intact and is classified as Least Threatened.

Impact 23 (Pollution including alien invasive plants, waste material, contaminated soil)

- Imported material (aggregate) is a potential source of contaminant (seed of alien invasive plants).
- It is anticipated that both general and hazardous waste types will be generated during construction. Except for domestic wastewater (13 m3/day), volumes cannot be known.
- Construction equipment (risk of leaking/spills of hydrocarbons) will include at least: Water tankers; Graders; Tipper trucks; Drilling rigs (down to 2m); Mobile pile ramming machines (down to 3m at the most); Rock crushing plant; Excavators; TLBs; Concrete mixers; Compaction equipment; Light delivery vehicles; and Heavy delivery vehicles (for the transformers).

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	**Intensity**	**Spatial**	**Duration**	**Status**	**Nature**	**Prob.**	**MAGNITUDE**	**Accept.**	**Prob.**	**IMPORTANCE**
21	H	L	M	-I	H	H	1	H	H	1
Reversibility		M		**Irreplaceability**		H		**Mitigatory Potential**		H

Alternative Site No. 1 (preferred)

Impact	**Intensity**	**Spatial**	**Duration**	**Status**	**Nature**	**Prob.**	**MAGNITUDE**	**Accept.**	**Prob.**	**IMPORTANCE**

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

22	M	L	M	-I	M	H	1	M	H	1
Reversibility	M	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	**Intensity**	**Spatial**	**Duration**	**Status**	**Nature**	**Prob.**	**MAGNITUDE**	**Accept.**	**Prob.**	**IMPORTANCE**
23	H	L	M	-I	H	M	1	H	M	1
Reversibility	M	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Aquatic Biodiversity Impact Assessment, Section 21(c) & (i) Risk Assessment and Wetland Delineation Verification Report prepared by Dr Andrew Deacon dated August 2022.
- Hydrological Assessment (Version – Final 3) 01 September 2022 GCS Project Number: 22-0076 by Hendrik Botha.
- Soil Mapping Report prepared by Hennie van den Burg of Iris International and Francois Botha of Eco Soil dated June 2022.
- Terrestrial Biodiversity Specialist Assessment – Soventix Phase 3 Pv Project (Final) prepared by Simon Todd of 3 Foxes Biodiversity Solutions dated September 2022.

Mitigations:

Impact Management Outcome(s):

- Preserve topsoil, control soil erosion.
- Minimise the risk of erosion on dispersive soils.
- Ensure the protection of undisturbed or sensitive vegetation units.
- Sanitary conditions and good waste management.
- Good waste management.
- Adopt an integrated pest management (IPM) approach to avoid the use of chemical pesticides and minimize risks to human health and the environment while maintaining economically viable management.

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Reg: 2006/023163/23

- No incidents of chemical pollution of watercourses.

Targets:

- Limited construction activity after rainfall.
- No signs of off-road driving in wet conditions.
- No bare soil beneath or between solar panels or in the ecological buffer.
- No signs of rivulets, sheet or rill erosion.
- No signs of flooding on site as a result of poor stormwater management.
- Natural vegetation is retained between structures and infrastructure.
- No signs of unsanitary conditions or of increased rodent populations.
- Covered trucks.
- No signs of dumping or litter.
- Waybills.
- Integrated Weed Management (IWM) plan.
- FSC Pesticides Policy adopted.
- Best practise is used when undertaking alien plant control.
- No surplus spoil stockpiled on site.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
21	Construction plant management including deliveries	Altered surface water flow patterns, e.g., changing sheet flow (natural open system) to concentrated flows leads to erosion.	Preserve topsoil, control soil erosion.	Limited construction activity after rainfall	There should be reduced activity at the site after rainfall events when the soils are wet. No driving off from hardened roads should occur immediately following large rainfall events until soils had	Contractor	Construction	Compliance to be monitored by the SEO and verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					dried out and the risk of bogging down has decreased.			
21	Construction plant management including deliveries	Altered surface water flow patterns, e.g., changing sheet flow (natural open system) to concentrated flows leads to erosion.	Preserve topsoil, control soil erosion.	No signs of off-road driving in wet conditions	No off-road driving in wet conditions, and for two weeks afterwards. In particular, no driving in veld should take place on clay or fine-textured soils following rain.	Contractor	Construction	Compliance to be monitored by the SEO and verified by ECO and IEA.
21	Installing panel arrays and associated infrastructure (from racks to field transformers) including within 100 m of a watercourse or 500 m of a wetland/pan	Erosion and sediment transport may be exacerbated by the concentrated rainfall volumes off the solar PV panels. Efforts should be made in managing run-off from the PV panels and arrays onto the soils, and then managing the distribution of the accumulated water back to the environment	Minimise the risk of erosion on dispersive soils.	No bare soil beneath or between solar panels	With the exception of two-track roads, restore and maintain vegetation cover underneath and between the solar panel arrays.	Holder, Contractor	On-going	Compliance to be monitored by the SEO and verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
21	Installing panel arrays and associated infrastructure (from racks to field transformers) including within 100 m of a watercourse or 500 m of a wetland/pan	Erosion and sediment transport may be exacerbated by the concentrated rainfall volumes off the solar PV panels. Efforts should be made in managing run-off from the PV panels and arrays onto the soils, and then managing the distribution of the accumulated water back to the environment	Minimise the risk of erosion on dispersive soils.	No bare soil beneath or between solar panels	Restore bare patches of soil using the Bare Patch Restoration Protocol (Appendix C) with native species of vegetation in the area.	Holder, Contractor	On-going	Compliance to be monitored by the SEO and verified by ECO and IEA.
21	Installing panel arrays and associated infrastructure (from racks to field transformers) including within 100 m of a watercourse or 500 m of a wetland/pan	Erosion and sediment transport may be exacerbated by the concentrated rainfall volumes off the solar PV panels. Efforts should be made in managing run-off from the PV panels and arrays onto the soils, and then managing the distribution of the accumulated water back to the environment	Minimise the risk of erosion on dispersive soils.	No bare soil in the ecological buffer.	Maintain vegetation cover within the designated ecological buffer zone alongside the delineated watercourses.	Holder, Contractor	On-going	Compliance to be monitored by the SEO and verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
21	Installing panel arrays and associated infrastructure (from racks to field transformers) including within 100 m of a watercourse or 500 m of a wetland/pan	Erosion and sediment transport may be exacerbated by the concentrated rainfall volumes off the solar PV panels. Efforts should be made in managing run-off from the PV panels and arrays onto the soils, and then managing the distribution of the accumulated water back to the environment	Minimise the risk of erosion on dispersive soils.	No signs of rivulets	Conduct regular inspections and maintenance of the site to ensure that vegetation cover is adequate, and no rivulets are generated.	Holder, Contractor	On-going	Compliance to be monitored by the SEO and verified by ECO and IEA.
21	Installing panel arrays and associated infrastructure (from racks to field transformers) including within 100 m of a watercourse or 500 m of a wetland/pan	Erosion and sediment transport may be exacerbated by the concentrated rainfall volumes off the solar PV panels. Efforts should be made in managing run-off from the PV panels and arrays onto the soils, and then managing the distribution of the accumulated water back to the environment	Minimise the risk of erosion on dispersive soils.	No signs of sheet or rill erosion	Monitor for signs of sheet or rill erosion beneath the drip line of the solar panel arrays after rainfall events and remedy any signs of erosion using measures appropriate to the severity and scale of erosion, and that will prevent a recurrence.	Holder, Contractor	On-going	Compliance to be monitored by the SEO and verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
21	Installing panel arrays and associated infrastructure (from racks to field transformers) including within 100 m of a watercourse or 500 m of a wetland/pan	Erosion and sediment transport may be exacerbated by the concentrated rainfall volumes off the solar PV panels. Efforts should be made in managing run-off from the PV panels and arrays onto the soils, and then managing the distribution of the accumulated water back to the environment	Minimise the risk of erosion on dispersive soils.	No signs of sheet or rill erosion	Sandbags shall be used to construct temporary berms and manage stormwater run-off across cleared or bare areas.	Holder, Contractor	On-going	Compliance to be monitored by the SEO and verified by ECO and IEA.
21	Stormwater management and erosion control	Flooding in the predicted "ponded flood occurrence zones combined with solar PV panels and arrays and stormwater discharge from the site could alter surface water flow patterns in these areas, causing erosion.	Minimise the risk of erosion on dispersive soils.	No signs of flooding on site as a result of poor stormwater management	Implement where applicable, prescribed flooding protocols (e.g., drainage and stormwater systems to minimize flooding potential) and erosion prevention measures in the predicted "ponded flood occurrence zones".	Holder, Contractor	On-going	Compliance to be monitored by the SEO and verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
21	Stormwater management and erosion control	Flooding in the predicted "ponded flood occurrence zones combined with solar PV panels and arrays and stormwater discharge from the site could alter surface water flow patterns in these areas, causing erosion.	Minimise the risk of erosion on dispersive soils.	No signs of flooding on site as a result of poor stormwater management	Stormwater run-off and discharge from the site shall be managed according to the CSWMP (Appendix E) and the Surface and Groundwater Monitoring Protocol (Appendix D).	Holder, Contractor	On-going	Compliance to be monitored by the SEO and verified by ECO and IEA.
21	Road Management	Roads, including the two-track service roads between the solar panel arrays, will increase surface water run-off, causing erosion and sedimentation of watercourses.	Minimise the risk of erosion on dispersive soils.	No signs of erosion on the service roads	Install berms & mitre drains only where absolutely necessary at strategic points along the two-track service roads between the solar panel arrays (and other roads) as a mechanism to dissipate runoff.	Holder, Contractor	On-going	Compliance to be monitored by the SEO and verified by ECO and IEA.
22	Road Management	Damage to environment when driving through veld to avoid potholes or puddles.	Ensure the protection of undisturbed or sensitive vegetation units.	Natural vegetation is retained between structures and infrastructure.	Driving offroad is prohibited.	Holder, Contractor	On-going	Compliance to be monitored by the SEO and verified by ECO and IEA.
23	General and hazardous	Unsanitary conditions	Sanitary conditions and	No signs of unsanitary	Waste management	Holder, Contractor	On-going	Compliance to be

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
	waste management	surrounding infrastructure promoting the establishment of alien plants and/or invasive rodents.	good waste management.	conditions or of increased rodent populations	must be a priority and all waste must be collected and stored adequately. It is recommended that all waste be removed from site on a weekly basis to prevent rodents and pests entering the site.			monitored by the SEO and verified by ECO and IEA.
23	General and hazardous waste management	Windblown litter from transporting waste can contaminate the environment.	Sanitary conditions and good waste management.	Covered trucks	Trucks transporting waste must be covered.	Holder, Contractor	On-going	Compliance to be monitored by the SEO and verified by ECO and IEA.
23	General and hazardous waste management	Pollution of waste material	Good waste management	No signs of dumping	No illegal dumping of waste.	Holder, Contractor	On-going	Compliance to be monitored by the SEO and verified by ECO and IEA.
23	General and hazardous waste management	Pollution of waste material	Good waste management	No litter	No littering.	Holder, Contractor	On-going	Compliance to be monitored by the SEO and verified by ECO and IEA.
23	General and hazardous	Pollution of waste material	Good waste management	Waybills	General Waste shall be disposed	Holder, Contractor	On-going	Compliance to be

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
	waste management				of at a licensed municipal landfill, whereas hazardous waste will be disposed of at a licensed hazardous waste disposal facility.			monitored by the SEO and verified by ECO and IEA.
23	Alien Plant Management	Herbicides can introduce toxic chemicals into the food chain.	Adopt an integrated pest management (IPM) approach to avoid the use of chemical pesticides and minimize risks to human health and the environment while maintaining economically viable management.	Integrated Weed Management (IWM) plan.	Develop an integrated approach to weed management, combining all appropriate weed control options into an integrated weed management (IWM) plan. Methods of control include herbicide application, mechanical removal, mulch or weed mat, shading, fire, flame guns, biological control agents, manual control, slashing, ring barking, and controlled grazing.	Holder	Pre-construction and Construction	Compliance to be monitored by the SEO and verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
23	Alien Plant Management	Herbicides can introduce toxic chemicals into the food chain.	Adopt an integrated pest management (IPM) approach to avoid the use of chemical pesticides and minimize risks to human health and the environment while maintaining economically viable management.	FSC Pesticides Policy adopted	Adopt the FSC Pesticides Policy (FSC-POL-30-001 V3-0 EN) to regulate the use of chemical pesticides, if after having considered all available pest management strategies, the use of chemical pesticides may be identified as the most suitable control.	Holder, Contractor	On-going	Compliance to be monitored by the SEO and verified by ECO and IEA.
23	Alien Plant Management	Herbicides can introduce toxic chemicals into the food chain.	Adopt an integrated pest management (IPM) approach to avoid the use of chemical pesticides and minimize risks to human health and the environment while maintaining economically viable management.	Best practise is used when undertaking alien plant control	Give preference, as a matter of principle, to: (a) non-chemical methods over chemical pesticides, (b) chemical pesticides not listed in the FSC lists of Highly Hazardous Pesticides (HHPs) over those listed in the FSC lists of HHPs, and (c) FSC restricted HHPs over FSC	Holder, Contractor	On-going	Compliance to be monitored by the SEO and verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					highly restricted HHPs.			
23	Earthworks	Chemical pollution of the water resources.	No incidents of chemical pollution of watercourses.	No surplus spoil stockpiled on site	All surplus spoil material from the foundation excavations (e.g., not used as backfill) should be removed from the site as soon as is practically possible.	Contractor	Construction	Compliance to be monitored by the SEO and verified by ECO and IEA.
23	Earthworks	Chemical pollution of the water resources.	No incidents of chemical pollution of watercourses.	Waybills	Waste material should be removed to a licensed waste disposal facility, if it cannot be re-used or recycled.	Holder, Contractor	On-going	Compliance to be monitored by the SEO and verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
21	L	L	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
21	H	L	H	-I	H	M	1	M	M	1

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
22	L	L	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
22	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
23	L	L	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
23	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

- The residual risk of lost biodiversity from erosion and altered surface water hydrology (**21**) after mitigation is assumed to be Low.
- The residual risk of losing terrestrial ecosystems, including through fragmentation (**22**) after mitigation is assumed to be Low.
- The residual risk of pollution such as contaminated soil, alien invasive plants, general and hazardous waste etc. (**23**) after mitigation is assumed to be Low.

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Reg: 2006/023163/23

Receiving Environment: Aquatic Ecosystem

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Construction Plant Management including Deliveries	Operating equipment	Causing spills	**Impact:** Poorly maintained vehicles can result in hydrocarbon and other pollution. Hydrocarbon spills, during construction in the watercourse may temporarily reduce the quality of the water. **Consequence:** - Alter feeding and breeding behaviour (lowering vigour and reproductivity), species composition and aquatic ecosystem functioning (indirect). **Addressed under: "Receiving Environment: Soil and Rock"**	Transformation	24
Construction Plant Management including Deliveries	Washing plant	Watercourse contamination	**Impact:** Hydrocarbon spills in a watercourse **Consequences:** Altered aquatic ecosystem structure and function. **Addressed under: "Receiving Environment: Soil and Rock"**	Transformation	24
General and Hazardous Waste Management	Storage	Watercourse contamination	**Impacts:** Altered aquatic ecosystem structure and function. **Consequences:** pollution of watercourse Mitigations: The designated temporary waste storage area must be contained (e.g., covered skips and scavenger proof bins, fenced) to prevent rainfall accumulation/wind-blown litter. **Addressed under: "Receiving Environment: Soil and Rock"**	Transformation	24
General and Hazardous Waste Management	Transport	Watercourse contamination	**Impact:** Windblown litter from transporting waste can contaminate the environment. **Consequence:** pollution of watercourse. **Addressed under "Receiving Environment: Terrestrial and Avian Ecosystem"**	Transformation	24
General and Hazardous Waste Management	Disposal	Watercourse contamination	**Impact:** Chemical pollution of the water resources. **Consequence:** Altered ecosystem functioning**.** **Addressed under "Receiving Environment: Terrestrial and Avian Ecosystem"**	Transformation	24

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Handling Hazardous Substances	Refuelling	Causing spills	**Impact:** Chemical pollution of the water resources. **Consequence:** Loss of aquatic flora and fauna	Transformation	24
Handling Hazardous Substances	Mixing concrete on site	Effluent (cement slurry) discharges and watercourse contamination	**Impact:** Chemical pollution of the water resources. **Consequence:** Loss of aquatic fauna and flora.	Transformation	24
Alien Plant Management	Disturbance to natural areas	Favourable conditions for alien plant/animal recruitment.	**Impact:** Alien invasive plants: Prevent the cleared areas from degrading, as invasive non-native plants will spread into degraded areas. **Consequence:** Loss of biodiversity, invasive species compete with indigenous plant species.	Transformation	24
Alien Plant Management	Disturbance to natural areas	Favourable conditions for alien plant/animal recruitment.	**Impact:** Water and soil pollution by chemicals Herbicides can enter waterbodies either directly through spray or spray drift, or they can move into waterbodies via surface water run-off or leaching and sub-surface draining. **Consequence**: disturbance to aquatic ecosystems.	Transformation	24
Quarry (Sourcing materials (aggregate) for roads and concrete)	New Quarry & Crushing Plant Operation (and maintenance)	Dust generation	**Impact:** The generation of excessive wind-blown dust could 'choke' the ecologically sensitive ephemeral drainage line system. **Consequence:** Turbid waters reduce light penetration, decreasing photosynthesis and primary production, reducing food availability for aquatic organisms higher up the food chain. Alter feeding and breeding behaviour (lowering vigour and reproductivity) of certain macroinvertebrates, species abundance and/or composition and aquatic ecosystem functioning (indirect). Sensitive species may be permanently eliminated if the source of the suspended solids is not removed.	Transformation	24
Linear Infrastructure Crossings	Distribution Line Pylons, Roads, pipelines and cable routes	Clearing & Grubbing/Removal of Vegetation/ Sedimentation	**Impacts:** The crossing alignments will result in the loss of aquatic or river habitat equivalent to the size of the development footprint or in the case of construction creep, greater. **Consequence:** - reduced habitat for aquatic fauna and Aves (direct) - reduced productivity and carrying capacity (direct)	Quantity	24
Linear Infrastructure Crossings	Distribution Line Pylons, Roads,	Importing material/ Excavating/Diversion	**Impact:** River diversion works may result in sedimentation and increased turbidity of the ephemeral drainage system. **Consequence:** Turbid waters reduce light penetration, decreasing photosynthesis	Transformation	24

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Reg: 2006/023163/23

	pipelines and cable routes	Works/Sedimentation /Erosion	and primary production, reducing food availability for aquatic organisms higher up the food chain. Alter feeding and breeding behaviour (lowering vigour and reproductivity) of certain macroinvertebrates, species abundance and/or composition and aquatic ecosystem functioning (indirect). Sensitive species may be permanently eliminated if the source of the suspended solids is not removed.		
Linear Infrastructure Crossings	Distribution Line Pylons, Roads, pipelines and cables	Installing pylons, culverts, pipelines and cable trenches/Watercourse contamination	**Impact:** Operation of heavy equipment in a channel bed can directly destroy spawning habitat for fish and macro-invertebrate habitat, and produce increased turbidity (lower dissolved oxygen) and increased suspended sediment downstream. **Consequence:** Alter aquatic ecosystem structure and function (indirect).	Transformation	24
Linear Infrastructure Crossings	Distribution Line Pylons, Roads, pipelines and cables	Installing pylons, culverts, pipelines and cable trenches/Watercourse contamination	**Impact:** Poorly maintained vehicles can result in hydrocarbon and other pollution. Hydrocarbon spills, during construction in the watercourse may contaminate the watercourse/reduce the quality of the water. **Consequence:** Sterile habitat for fauna and flora (direct). Alter feeding and breeding behaviour (lowering vigour and reproductivity), species composition and aquatic ecosystem functioning (indirect). **Addressed under: "Receiving Environment: Soil and Rock"**	Transformation	24
Road Management	Use including gravel District Road, Transnet Service Road and internal roads	Development of corrugations, potholes and puddles	**Impacts:** Roads concentrate surface water run-off, increasing its velocity and potential to erode river or stream banks at crossings. **Consequences:** - erosion of banks, ecosystem degradation and dysfunction. - sedimentation of a watercourse.	Transformation	25
Clearing/Grubbing and Grading	Construction camp (incl. operational area), borrow pit, upgrading existing and new roads, trenches for underground cables and water pipes, holes for	Creating bare surfaces susceptible to erosion	**Impact:** Clearing of vegetation for the construction of access roads, solar panel installations, substations and other infrastructure can cause sediment load in the water courses before the cleared areas can be stabilized. **Consequence:** Erosion and sedimentation of a watercourse.	Transformation	25

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Reg: 2006/023163/23

	racks, fence posts and pylons, foundations for inverters, field transformers and on-site substation, water storage tanks and deionization plant.				
Earthworks	Excavating and Trenching	Alter surface water hydrology	**Impact:** Alteration of natural drainage lines may lead to ponding or increased runoff patterns. **Consequence:** Ponding and increased erosion	Transformation	25
Stockpiling and Storing (Laydown)	Mulch, topsoil, aggregate, spoil and infrastructure	Sedimentation of watercourse	**Impact:** Altered aquatic ecosystem structure and function. **Consequence:** sedimentation of watercourse	Transformation	25
Linear Infrastructure Crossings	Distribution Line Pylons	Clearing & Grubbing/Removal of Vegetation/ Sedimentation	**Impact:** Areas cleared or disturbed around the pylon site might be affected by erosion of topsoil. **Consequence:** Disturbing topsoil around the pylon site might result in increased suspended solids, as well as siltation in watercourses.	Transformation	25
Stormwater Management and Erosion Control			**Impact:** The largest risk is potential run-off and stormwater discharge from the site into the surrounding causing soil erosion. **Consequences:** - Erosion can result in a degraded or dysfunctional ecosystem (direct) and loss of ecosystem services (indirect) **Addressed under "Receiving Environment: Terrestrial and Avian Ecosystem"**	Transformation	25
Stormwater Management and Erosion Control			**Impact:** Disturbing topsoil might result in increased turbidity, as well as siltation in watercourses. **Consequence:** Increased turbidity and siltation in watercourses.	Transformation	25

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Reg: 2006/023163/23

Water management (abstraction, storage and use)	Storage in tanks	Overflow and surface water run-off	**Impact:** Water storage tanks can topple over, leak or overflow. **Consequences:** - Overflowing water storage tanks may cause erosion or degradation of the receiving environment.	Transformation	25
Construction Plant Management including Deliveries	Driving/Transport	Damage to the environment	**Impact:** Altered surface water flow patterns, e.g., changing sheet flow (natural open system) to concentrated flows leads to erosion. **Consequence:** Increased suspended solids, siltation in watercourses and soil erosion. **Addressed under: "Receiving Environment: Terrestrial and Avian Ecosystem"**	Transformation	25

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 24 (Aquatic Biodiversity)

- An Aquatic Biodiversity Impact Assessment was commissioned to inter alia Identify, describe, delineate, and demarcate ecological buffers around watercourses, including wetlands.
- The drainage systems are predominantly classified as ephemeral, which means that the stream flows briefly in direct response to precipitation in the immediate vicinity, and the channel is at all times above the ground-water reservoir. These ephemeral tributaries of the Brak River and considered to be in a largely natural ecological state. These systems have a far less predictable flow regime compared to perennial or seasonal rivers, and are frequently dry for long periods in arid regions. The ephemeral drainage system consists of one major ephemeral drainage channel which are fed by upstream catchment areas beyond the project area fence line. Three smaller tributaries are feeding into the main drainage line in the project area. The ecological importance and sensitivity category (EISC) of the ephemeral drainage system and associated alluvial floodplains is classified as "High" and therefore considered as a "no-go area" for all infrastructure apart from access roads, pipelines, cables and pylons. The no-go area includes the ecological buffer.
- The delineated ephemeral drainage system is of conservation importance as it is considered a Freshwater Ecosystem Protected Area (FEPA) category. The entire sub-quaternary catchment indicates that the surrounding land and smaller stream network need to be managed in a way that maintains the good condition (A or B ecological category) of the river reach.
- A buffer of 20 m wide on both sides of the drainage line delineation is required during the construction and operational phases to protect the Phase 3 PV facility in its current condition from any degradation. This buffer width is obtained whenever the following mitigation measures are applied to the model: (a) the management of surface water runoff, (b) erosion monitoring, and (c) constraints regarding the clearing of vegetation within these areas.

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Reg: 2006/023163/23

- The generation of excessive wind-blown dust could 'choke' the ecologically sensitive ephemeral drainage line system (pers. comm. Sam Laurence). The recovery of a stream from sediment deposition is dependent on the elimination of the sediment source and the potential for the deposited material to be flushed out by stream flow.
- In terms of the regional vegetation and aquatic habitat composition, there is very little discernible riparian vegetation, which consists of a relatively dense low shrubby system, often visible by the formation of smaller washes and dense encroachment by spiny shrubs. Nonetheless, the vegetation integrity score is 93.9% which represents an Ecological Class A (90-100%), which is considered an “Unmodified, natural.” status.
- The only aquatic habitat present to sample, was a series of isolated pools in the system, filled with rainwater but not flowing. These pools are certainly very temporary and the habitats available were overhanging grass and a sandy pool bottom with loose pebbles and stones. The Integrated Habitat Assessment System (IHAS) and Habitat Quality Index (HQI) scores were mostly “Poor” due to the shallow water level, brief presence of surface water and the lack of flow.

Impact 25 (Surface Water Hydrology)

- The project area is located within a Strategic Water Source Area (Screening Report). Strategic Water Source Areas (SWSAs) are defined as areas of land that (a) supply a disproportionate (e.g., relatively large) quantity of mean annual surface water runoff in relation to their size and so are considered nationally important; and/or (b) have high groundwater recharge and where the groundwater forms a nationally important resource. **The protection and restoration of strategic water source areas is of direct benefit to all downstream users.** This dependence needs to be considered in decisions relating to these primary headwater catchments. The protection of both water quantity (flows) and quality must be addressed. Any failure to address impacts on water quality or quantity will have impacts on the water security of all those depending on that water downstream. Groundwater is the main or only source of water for numerous towns and settlements across the country **so protecting the capture zone, specifically for municipal supply well-fields, the recharge area, and the integrity of the aquifers is important as well**.
- The project area falls within quaternary catchment D62D and the Orange Water Management Area. (Hydrology Assessment)
- The project area contains 3 Hydrological Response Units (HRU). Ninety-six percent (96%) of the project area falls within HRU2. The average slope of HRU2 (21,738 km2) is 0,56%. Sixteen percent (16,51%) of HRU2 has a 3-10% slope, which is mostly restricted to the western and eastern corners of the project area. Consequently, the topography of the study area is generally flat with elevations on the site typically ranging from 1 335 to 1 370 m above mean sea level. (Hydrology Assessment)
- Drainage is generally towards the north-west via multiple non-perennial drainage lines towards the ephemeral Brak River, approximately 6,6 km further downstream. (At least) Three small capacity in-stream dams occur within the development area. (Hydrology Assessment)
- The rivers are ephemeral and only have water shortly after storm events. (Hydrology Assessment) – **Construction of watercourse crossings during the dry winter months will minimise the risk of sedimentation and increased TSS or turbidity.**

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Reg: 2006/023163/23

- It is anticipated that soils downstream of the proposed development, and the non-perennial streams (feeding into temporary livestock watering dams) are the receivers of any sediment runoff or poor-quality runoff from the site. (Hydrology Assessment)
- The largest risk is potential run-off and stormwater discharge from the site into the surrounding causing soil erosion and should be managed according to the CSWMP and Monitoring Plan for the Storm Water Management System and ground and surface water resources.

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
24	M	L	M	-I	M	M	1	H	M	1
Reversibility	M	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
25	M	L	M	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

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Reg: 2006/023163/23

- The civil construction phase should be restricted to the dry winter months (e.g., April/May to September), that is commence with such activities as clearing or grading, excavating and importing material at the end of the wet season/beginning of the dry season whilst the soil is still moist to reduce dust and as far as is practical, be completed in, the dry winter months with a decreased probability of storm events.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Hydrological Assessment (Version – Final 3) 01 September 2022 GCS Project Number: 22-0076 by Hendrik Botha
- Aquatic Biodiversity Impact Assessment, Section 21(c) and (i) Risk Assessment and Wetland Delineation Verification by Dr Andrew Deacon August 2022.
- Soil Mapping Report prepared by Hennie van den Burg of Iris International and Francois Botha of Eco Soil dated June 2022.
- Avifauna Specialist Assessment (Final) prepared by Enviro-Insight CC (Sam Laurence and A.E. van Wyk) dated October 2022.
- The National Water Act, 1998 (Act No. 36 of 1998) requirements with regards to *inter alia* classification of water resources and Resource Quality Objectives (RQO's) must be adhered to.
- The White Paper on a National Water Policy for South Africa (1997), states that effective resource protection requires two separate sets of measures. The first are resource-directed measures, which set clear objectives for the desired level of protection for each resource. The second are source-directed controls which aim to control what is done to the water resource by way of registration of sources of impact, standards for waste discharges, best management practices, permits, Water Use Authorisations, impact assessments and environmental management plans - so that the resource protection objectives are achieved.

Mitigations:

Impact Management Outcome(s):

- No incidents of chemical pollution of watercourses
- Reduce invasive alien plant recruitment
- Avoid spillage onto soil or into water while mixing or using chemicals.
- Prevent loss of biodiversity and non-targeted plant species (damage to indigenous trees).
- Prevent contamination of ecologically sensitive environments.
- Minimise dust generation.
- Contain construction and avoid the unnecessary loss of aquatic habitat.
- Preserve aquatic ecosystem structure and function, as well as riparian habitat.
- Preserve topsoil.
- Reduce sedimentation of watercourses
- Avoid erosion from water storage tanks.

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Reg: 2006/023163/23

Targets:

- No signs of refuelling or concrete batching in sensitive areas.
- Weed and alien invasive species control plan
- No signs of alien plants or bare patches on site
- No signs of excessive use of herbicides
- Chemical spraying is undertaken as per guidelines
- No signs of quarry mining outside of the wet summer season
- Demarcated areas
- Pipeline corridors are no wider than 10m through ephemeral drainage line
- No dilapidated/broken demarcations
- No signs of vehicles in natural areas
- No unnecessary vegetation clearance
- No bare surfaces
- Rehabbed areas are protected
- No construction creep
- Aggregate is protected from any flowing water
- No dispersive soils used
- No spoil stockpiled on site
- No signs of vehicles in sensitive areas and buffers except in working servitude areas
- Limited equipment within the ephemeral drainage line
- Pylon site is rehabilitated
- Underground cables are below subsurface flows and rehabilitated once complete
- Roads do not impeded surface or subsurface flows
- No clearing done during rainfall periods
- Limit transformation of aquatic ecosystem
- Zero interruption to flow.
- Stockpiles are outside of sensitive areas
- No signs of stormwater or soil erosion
- Gypsum applied
- Silt traps

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Reg: 2006/023163/23

- Water storage tanks are on a solid foundation, platform or stand and fastened to the platform or stand
- Water pipes are visibly secured and the design includes an overflow pipe to a soakaway
- No signs of erosion around water storage tanks

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
24	Handling hazardous substances	Chemical pollution of the water resources.	No incidents of chemical pollution of watercourses	No signs of refuelling in sensitive areas.	Refuelling with a mobile fuel bowser shall take place 100 m away from the ecological buffer, as well as any boreholes and soakaways.	Contractor	Construction	Compliance to be verified by ECO and IEA
24	Handling hazardous substances	Chemical pollution of the water resources.	No incidents of chemical pollution of watercourses.	No signs of concrete batching in sensitive areas.	No concrete batching shall take place within the delineated riparian zone or within the ecological buffer of the watercourse.	Contractor	Construction	Compliance to be verified by ECO and IEA
24	Alien plant management	Alien invasive plants: Prevent the cleared areas from degrading, as invasive non-native plants will spread into degraded areas	Reduce invasive alien plant recruitment	Weed and alien invasive species control plan	A weed and alien invasive species control plan should be implemented during the contract period.	Contractor	Construction	Compliance to be verified by ECO and IEA
24	Alien plant management	Alien invasive plants: Prevent the cleared areas from degrading, as invasive non-	Reduce invasive alien plant recruitment	No signs of alien plants on site	Control involves killing the plants present, killing the seedlings which emerge, and establishing and	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		native plants will spread into degraded areas			managing an alternative plant cover to limit re-growth and re-invasion.			
24	Alien plant management	Alien invasive plants: Prevent the cleared areas from degrading, as invasive non-native plants will spread into degraded areas	Reduce invasive alien plant recruitment	No signs of alien plants on site	Any materials brought into construction sites should be from sources free of invasive alien species.	Contractor	Construction	Compliance to be verified by ECO and IEA
24	Alien plant management	Alien invasive plants: Prevent the cleared areas from degrading, as invasive non-native plants will spread into degraded areas	Reduce invasive alien plant recruitment	No signs of alien plants or bare patches on site	Clearing of invasive alien plants must take place coupled with the sowing of seeds of indigenous species to stabilise disturbed habitats.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA
24	Alien plant management	Water and soil pollution by chemicals Herbicides can enter waterbodies either directly through spray or spray drift, or they can move into waterbodies via surface water run-off or	Avoid spillage onto soil or into water while mixing or using chemicals. Prevent contamination of ecologically sensitive environments. Prevent loss of biodiversity and non-targeted	No signs of excessive use of herbicides	Minimise the use of herbicides near waterways by considering other techniques that can be alternatives to, or complementary with, herbicides.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		leaching and sub-surface draining.	plant species (damage to indigenous trees).					
24	Alien plant management	Water and soil pollution by chemicals Herbicides can enter waterbodies either directly through spray or spray drift, or they can move into waterbodies via surface water run-off or leaching and sub-surface draining.	Avoid spillage onto soil or into water while mixing or using chemicals. Prevent contamination of ecologically sensitive environments. Prevent loss of biodiversity and non-targeted plant species (damage to indigenous trees).	Chemical spraying is undertaken as per guidelines	If chemical spraying is adopted: (a) use only approved herbicides prescribed by the Working for Water guidelines. (b) Staff using chemicals are trained and aware of the risks of using chemicals. (c) Chemicals are mixed on impermeable and level surfaces as per the manufacturer's instructions. (d) All waste material and containers are safely and properly removed after use. (e) Chemicals are stored, mixed and used in demarcated areas. (f) Do not apply foliar hand spray chemical applications under	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					conditions where chemical drift may impact non-targeted species (as indicated on the manufacturer's directions for use on the herbicide label).			
24	Quarry (Sourcing materials (aggregate) for roads and concrete)	The generation of excessive wind-blown dust could 'choke' the ecologically sensitive ephemeral drainage line system.	Minimise dust generation.	No signs of quarry mining outside of the wet summer season	Mining of suitable material from a quarry for road construction and associated rock crushing should as far as is practical take place during the wet summer season prior to the commencement of the civil construction phase.	Contractor	Construction	Compliance to be verified by ECO and IEA.
24	Linear Infrastructure Crossings	The crossing alignments will result in the loss of aquatic or river habitat equivalent to the size of the development footprint or in the case of construction creep, greater.	Contain construction and avoid the unnecessary loss of aquatic habitat.	Demarcated areas	Suitable demarcation must be erected around the construction area, including the servitude, areas where material is stored and the actual footprint of the development to prevent access to sensitive areas.	Contractor	Construction	Compliance to be verified by ECO and IEA.
24	Linear Infrastructure Crossings	The crossing alignments will result in the loss	Contain construction and avoid the	Pipeline corridors are no wider than 10m through	All Pipelines corridors (affected areas) should be	Contractor, SEO	Construction	Compliance to be verified by

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		of aquatic or river habitat equivalent to the size of the development footprint or in the case of construction creep, greater.	unnecessary loss of aquatic habitat.	ephemeral drainage line	implemented to a maximum 10 metres wide through wetlands during construction.			ECO and IEA.
24	Linear Infrastructure Crossings	The crossing alignments will result in the loss of aquatic or river habitat equivalent to the size of the development footprint or in the case of construction creep, greater.	Contain construction and avoid the unnecessary loss of aquatic habitat.	Underground cables are below subsurface flows and rehabilitated once complete	All underground cables bisecting sensitive habitats must be placed below the subsurface flow of the ephemeral wetlands with the linear construction pits subjected to full rehabilitation in order to maintain normal subsurface slow.	Engineer, Contractor	Construction	Compliance to be verified by ECO and IEA.
24	Linear Infrastructure Crossings	The crossing alignments will result in the loss of aquatic or river habitat equivalent to the size of the development footprint or in the case of construction creep, greater.	Contain construction and avoid the unnecessary loss of aquatic habitat.	Zero interruption to flow.	Horizontal directional drilling is preferred for the crossing of wetlands. A hole is dug below the stream crossing and pulling a prefabricated section of pipe through the hole.	Engineer, Contractor	Construction	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
24	Linear Infrastructure Crossings	The crossing alignments will result in the loss of aquatic or river habitat equivalent to the size of the development footprint or in the case of construction creep, greater.	Contain construction and avoid the unnecessary loss of aquatic habitat.	Zero interruption to flow.	Should horizontal directional drilling not be possible, open-cut crossings can be used. This involves cutting a trench across the waterbody while water flows through the trenching area. Where the water is shallow enough, it may be diverted by flumes and pumps. A flume pipe may be placed to divert the water around the trenching area. Pumps in combination with dams may also be used to divert the water during open-cut trenching.	Engineer, Contractor	Construction	Compliance to be verified by ECO and IEA.
24	Linear Infrastructure Crossings	The crossing alignments will result in the loss of aquatic or river habitat equivalent to the size of the development footprint or in the case of construction creep, greater.	Contain construction and avoid the unnecessary loss of aquatic habitat.	Zero interruption to flow.	Where possible, pipelines can be installed using the push-pull technique-- stringing and welding the pipeline outside of the wetland and excavating and backfilling the trench using a backhoe supported	Engineer, Contractor	Construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					by equipment mats or timber riprap. The prefabricated pipeline is installed in the wetland by pushing or pulling it across the trench. After the pipeline is floated into place, the floats are removed and the pipeline sinks into place.			
24	Linear Infrastructure Crossings	The crossing alignments will result in the loss of aquatic or river habitat equivalent to the size of the development footprint or in the case of construction creep, greater.	Contain construction and avoid the unnecessary loss of aquatic habitat.	Zero interruption to flow.	Avoid or minimise any restriction to subsurface water flow by constructing road crossings at or above (not below) natural ground level (NGL) and, where applicable, retaining the in-situ topsoil with vegetation root mass (or mat). In the case of building road crossings above NGL, and if the natural vegetation is cleared, then ensure that the grader does not penetrate the abovementioned root mat and	Engineer, Contractor	Construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					maintains a flat surface. Topsoil removed from other infrastructure placement sites can be added below the road surface to protect the vegetative binding below.			
24	Linear Infrastructure Crossings	The crossing alignments will result in the loss of aquatic or river habitat equivalent to the size of the development footprint or in the case of construction creep, greater.	Contain construction and avoid the unnecessary loss of aquatic habitat.	Limit transformation of aquatic ecosystem	The trench is backfilled to the proper grade to maintain wetland hydrology and grades are restored to the original elevation. If topsoil is segregated from subsoil, then subsoil is backfilled first.	Engineer, Contractor	Construction	Compliance to be verified by ECO and IEA.
24	Linear Infrastructure Crossings	The crossing alignments will result in the loss of aquatic or river habitat equivalent to the size of the development footprint or in the case of construction creep, greater.	Contain construction and avoid the unnecessary loss of aquatic habitat.	Roads do not impeded surface or subsurface flows	All roads and crossings must be engineered not to impede surface or subsurface flow in any way.	Engineer, Contractor	Construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
24	Linear Infrastructure Crossings	The crossing alignments will result in the loss of aquatic or river habitat equivalent to the size of the development footprint or in the case of construction creep, greater.	Contain construction and avoid the unnecessary loss of aquatic habitat.	Roads do not impede surface or subsurface flows	A temporary road in a wetland needs to provide adequate crossroad drainage at all natural drainageways. Temporary drainage structures include culverts, bridges, and porous material.	Engineer, Contractor	Construction	Compliance to be verified by ECO and IEA.
24	Linear Infrastructure Crossings	The crossing alignments will result in the loss of aquatic or river habitat equivalent to the size of the development footprint or in the case of construction creep, greater.	Contain construction and avoid the unnecessary loss of aquatic habitat.	Roads do not impede surface or subsurface flows	It is preferable to eliminate fill roads and utilise raised bridges and culverts with adequate sizing and spacing of water crossing structures, proper choice of the type of crossing structure, and installation of drainage structures at a depth adequate to pass subsurface flow.	Engineer, Contractor	Construction	Compliance to be verified by ECO and IEA.
24	Linear Infrastructure Crossings	The crossing alignments will result in the loss of aquatic or river habitat equivalent to the size of the development footprint or in the	Contain construction and avoid the unnecessary loss of aquatic habitat.	No dilapidated/broken demarcations	Site demarcations should be maintained until the cessation of all construction activities.	Contractor	Construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		case of construction creep, greater.						
24	Linear Infrastructure Crossings	The crossing alignments will result in the loss of aquatic or river habitat equivalent to the size of the development footprint or in the case of construction creep, greater.	Contain construction and avoid the unnecessary loss of aquatic habitat.	No signs of vehicles in natural areas	Vehicular or pedestrian access is prohibited in natural areas beyond the demarcated boundary of the construction site, including working servitudes across the ephemeral drainage system.	Contractor	Construction	Compliance to be verified by ECO and IEA.
24	Linear Infrastructure Crossings	The crossing alignments will result in the loss of aquatic or river habitat equivalent to the size of the development footprint or in the case of construction creep, greater.	Contain construction and avoid the unnecessary loss of aquatic habitat.	Limited equipment within the ephemeral drainage line	Construction equipment used while working in wetlands is limited to only those pieces that are essential and non-essential equipment is allowed to travel through wetlands only once during deployment and once during extraction.	Contractor	Construction	Compliance to be verified by ECO and IEA.
24	Linear Infrastructure Crossings	The crossing alignments will result in the loss of aquatic or river habitat equivalent to the size of the	Contain construction and avoid the unnecessary loss of aquatic habitat.	No unnecessary vegetation clearance	Limit vegetation clearing to the physical footprint and if no bare patches are available in the vicinity, then	Contractor	Construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		development footprint or in the case of construction creep, greater.			temporary stockpiles of excavated material.			
24	Linear Infrastructure Crossings	The crossing alignments will result in the loss of aquatic or river habitat equivalent to the size of the development footprint or in the case of construction creep, greater.	Contain construction and avoid the unnecessary loss of aquatic habitat.	No unnecessary vegetation clearance	Vegetation and soil should be retained in position for as long as possible, and should only be removed immediately ahead of construction / earthworks in any specific area so that cleared areas are not unnecessarily exposed to erosion for extended periods prior to working in those areas.	Contractor	Construction	Compliance to be verified by ECO and IEA.
24	Linear Infrastructure Crossings	The crossing alignments will result in the loss of aquatic or river habitat equivalent to the size of the development footprint or in the case of construction creep, greater.	Contain construction and avoid the unnecessary loss of aquatic habitat.	No bare surfaces	Conduct active rehabilitation during the construction activities according to a rehabilitation plan or implement the Bare Patch Restoration Protocol (Appendix C) that will restore the natural vegetation to what it was prior to the construction of the	Contractor	Construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					pylons, roads etc, so that the long-term impact could be negligible.			
24	Linear Infrastructure Crossings	The crossing alignments will result in the loss of aquatic or river habitat equivalent to the size of the development footprint or in the case of construction creep, greater.	Contain construction and avoid the unnecessary loss of aquatic habitat.	Rehabbed areas are protected	Cordon off areas under rehabilitation as “no-go areas” to prevent vehicular, pedestrian and livestock access	Contractor	Construction	Compliance to be verified by ECO and IEA.
24	Linear Infrastructure Crossings	River diversion works may result in sedimentation and increased turbidity of the ephemeral drainage system.	Preserve aquatic ecosystem structure and function, as well as riparian habitat.	No construction creep.	If it is practical to do so, construct river diversion works on the perimeter of the working servitude before clearing the in-situ material.	Contractor	Construction	Compliance to be verified by ECO and IEA.
24	Linear Infrastructure Crossings	River diversion works may result in sedimentation and increased turbidity of the ephemeral drainage system.	Preserve aquatic ecosystem structure and function, as well as riparian habitat.	Aggregate is protected from any flowing water	Aggregate used in the construction of river diversion works shall not be in direct contact with flowing water, by using for example, plastic sheets, sandbags, culverts, or pipes.	Contractor	Construction	Compliance to be verified by ECO and IEA.
24	Linear Infrastructure Crossings	River diversion works may result in sedimentation	Preserve aquatic ecosystem structure and	No dispersive soils used	Aggregate used in the construction of river diversion	Contractor	Construction	Compliance to be verified by

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		and increased turbidity of the ephemeral drainage system.	function, as well as riparian habitat.		works shall not include dispersive soils.			ECO and IEA.
24	Linear Infrastructure Crossings	River diversion works may result in sedimentation and increased turbidity of the ephemeral drainage system.	Preserve aquatic ecosystem structure and function, as well as riparian habitat.	No spoil stockpiled on site	All surplus spoil material from the foundation excavations (e.g., not used as backfill) should be removed from the site as soon as is practically possible.	Contractor	Construction	Compliance to be verified by ECO and IEA.
24	Linear Infrastructure Crossings	Operation of heavy equipment in a channel bed can directly destroy spawning habitat for fish and macro-invertebrate habitat and produce increased turbidity (lower dissolved oxygen) and increased suspended sediment downstream.	Preserve aquatic ecosystem structure and function, as well as riparian habitat.	No signs of vehicles in sensitive areas and buffers except in working servitude areas	Vehicles and other machinery are prohibited from accessing the ecologically sensitive ephemeral drainage system and its ecological buffer unless confined to the demarcated construction servitudes associated with the construction of linear infrastructure crossings.	Contractor	Construction	Compliance to be verified by ECO and IEA.
25	Linear Infrastructure Crossings	Areas cleared or disturbed around the pylon site	Preserve topsoil.	Pylon site is rehabilitated	Once construction at a pylon site is complete, the site	Contractor	Once construction	Compliance to be verified by

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		might be affected by erosion of topsoil.			should be rehabilitated immediately by removing all waste material.		at a pylon site is complete	ECO and IEA.
25	Road Management	Roads concentrate surface water run-off, increasing its velocity and potential to erode river or stream banks at crossings.	Preserve aquatic ecosystem structure and function, as well as riparian habitat.	No signs of erosion	The applicant shall in response to bank erosion at road crossings either maintain existing or implement new storm water control measures as soon as is reasonably practical (e.g., within 5 working days of being noticed).	Holder Contractor	On-going	Compliance to be verified by ECO and IEA.
25	Road Management	Roads concentrate surface water run-off, increasing its velocity and potential to erode river or stream banks at crossings.	Preserve aquatic ecosystem structure and function, as well as riparian habitat.	No signs of erosion	The applicant shall rehabilitate any erosion of river or stream	Holder Contractor	On-going	Compliance to be verified by ECO and IEA.
25	Clearing, grubbing and grading	Clearing of vegetation for the construction of access roads, solar panel installations, substations and	Reduce sedimentation of watercourses	No clearing done during rainfall periods	Clearing of vegetation, including for temporary access roads, should preferably be done	Contractor	Construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		other infrastructure can cause sediment load in the water courses before the cleared areas can be stabilized.			outside the main rainfall periods.			
25	Earthworks	Alteration of natural drainage lines may lead to ponding or increased runoff patterns.	Preserve aquatic ecosystem structure and function, as well as riparian habitat.	Limit transformation of aquatic ecosystem	Ensure that any dedicated stream crossings use road crossing designs, such as box culverts or concrete drifts with rock fill, which spread the surface water into a broadly distributed sheet whilst maintaining unrestricted subterranean flow	Engineer, Contractor	Construction	Compliance to be verified by ECO and IEA.
25	Earthworks	Alteration of natural drainage lines may lead to ponding or increased runoff patterns.	Preserve aquatic ecosystem structure and function, as well as riparian habitat.	Limit transformation of aquatic ecosystem	Road crossing designs, such as box culverts or concrete drifts with rock fill, which spread the surface water into a broadly distributed sheet whilst maintaining unrestricted subterranean flow should be sized to accommodate at	Engineer, Contractor	Construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					least 1:100 yr flood events			
25	Stockpiling and Storing (Laydown)	Altered aquatic ecosystem structure and function.	Preserve aquatic ecosystem structure and function, as well as riparian habitat.	Stockpiles are outside of sensitive areas	Aggregate (sand) stockpiles must be stored in the construction camp and outside the ecological buffer zones, including the 1:100-year flood line and delineated riparian habitat.	Contractor	Construction	Compliance to be verified by ECO and IEA.
25	Stormwater management and erosion control	Disturbing topsoil might result in increased turbidity, as well as siltation in watercourses.	Preserve topsoil	No signs of stormwater erosion	Storm water management and erosion control measures should be implemented. These should include the following: (a) The excavated soil should be placed on the upstream side of construction activities in order to act as a storm water diversion berm. (b) Where such diversion berms create concentrated flows, as well as in steep and/or sensitive areas (such as wetlands) the use of swales,	Contractor	Construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					silt fences or other effective erosion control measures is recommended to attenuate runoff. (c) All storm water management measures should be regularly maintained.			
25	Stormwater management and erosion control	Disturbing topsoil might result in increased turbidity, as well as siltation in watercourses.	Preserve topsoil	Gypsum applied.	The project areas are situated on Karoo sediments that are known for high sodium and magnesium content in the soil. Water infiltration can be improved by means of mechanical intervention and the application of gypsum or similar ameliorants.	Contractor	Construction	Compliance to be verified by ECO and IEA.
25	Stormwater management and erosion control	Disturbing topsoil might result in increased turbidity, as well as siltation in watercourses.	Preserve topsoil	Silt traps	Silt traps should be used where there is a danger of topsoil eroding and entering streams and other sensitive areas.	Contractor	Construction	Compliance to be verified by ECO and IEA.
25	Water management (abstraction, storage and use)	Water storage tanks can topple over, leak or overflow.	Avoid erosion from water storage tanks.	Water storage tanks are on a solid foundation, platform or stand.	Place water tanks on solid foundations, platforms or stands to ensure that they	Holder, Contractor	Construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					are level, will not fall over and are above the ground in order to build up the necessary water pressure for the outlet.			
25	Water management (abstraction, storage and use)	Water storage tanks can topple over, leak or overflow.	Avoid erosion from water storage tanks.	Water storage tanks are fastened to the platform or stand.	The platform or stand for water storage tanks must be level and must have hooks onto which the tank can be anchored or fastened.	Holder, Contractor	Construction	Compliance to be verified by ECO and IEA.
25	Water management (abstraction, storage and use)	Water storage tanks can topple over, leak or overflow.	Avoid erosion from water storage tanks.	Water pipes are visibly secured.	The pipes leading to and from the water storage tanks should also be anchored to prevent them from breaking, cracking and leaking.	Holder, Contractor	Construction	Compliance to be verified by ECO and IEA.
25	Water management (abstraction, storage and use)	Water storage tanks can topple over, leak or overflow.	Avoid erosion from water storage tanks.	Design includes an overflow pipe to a soakaway.	Each water storage tank or series of water storage tanks should have an overflow pipe to prevent water being forced out of the inlet when the tank is full. The overflow pipe should be diverted to a soakaway.	Holder, Contractor	Construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
25	Water management (abstraction, storage and use)	Water storage tanks can topple over, leak or overflow.	Avoid erosion from water storage tanks.	No signs of erosion around water storage tanks.	If water storage tanks are placed on a raised platform or stand, then a layer of gravel should be placed around and/or under the platform or stand to ensure good drainage and to prevent forming mud and puddles.	Holder, Contractor	Construction	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
24	L	L	L	neutral	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
24	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
25	L	L	L	neutral	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

25	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

- Despite the mitigations to avoid significant suspended sediment in the river, strong flows or a flash flood during summer would render any river diversion works futile.
- The residual risk of transformation of the aquatic ecosystem (**24**) after mitigation is assumed to be Low.
- The residual risk of increased turbidity due to sedimentation/contamination (**25**) after mitigation is assumed to be Low

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Reg: 2006/023163/23

Receiving Environment: Economical

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Employee management (including appointment, conduct and movement)	Supervision	Avoid harm to the environment and persons	**Impact:** The construction of a solar electricity generating facility and its associated infrastructure will lead to a change of land use and livelihoods. **Consequence:** Change of land use can potentially impact negatively on the livelihood of the affected farmer, which is sheep farming. **Addressed under "Receiving Environment: Terrestrial Fauna"**	N/A	26
Employee management (including appointment, conduct and movement)	Supervision	Avoid harm to the environment and persons	**Impact:** Farm gates being left open, or not being closed properly by construction teams. **Consequence:** Loss of livestock **Addressed under "Receiving Environment: Terrestrial Fauna"**	N/A	26
Employee management (including appointment, conduct and movement)	Keeping warm or cooking	Starting fires	**Impact:** Risk of veld fires caused by workers during the construction of the facility. **Consequence:** - Runaway fires on neighbouring properties will result in a loss of grazing for livestock and/or wild game, increasing the running costs to provide supplementary feed.		26
Construction Plant Management including Deliveries	Driving/Transport	Damage to the environment	**Impact:** Damage to farm infrastructure **Consequence:** Economic costs in replacing damaged infrastructure.	N/A	26
General and Hazardous Waste Management	Disposal	Land contamination	**Impact:** Burning of waste as a disposal method increases the risk of veld fires caused by workers during the construction of the facility. **Consequence:** - runaway fires on neighbouring properties will result in a loss of grazing for livestock and/or wild game, increasing the running costs to provide supplementary feed (indirect). **Addressed under "Receiving Environment: Terrestrial Fauna"**	N/A	26

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Reg: 2006/023163/23

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Fire Management	Wildfires		**Impact:** Risk of veld fires caused by workers during the construction of the facility. **Consequence:** - Runaway fires on neighbouring properties will result in a loss of grazing for livestock and/or wild game, increasing the running costs to provide supplementary feed. **Addressed under "Receiving Environment: Terrestrial Flora"**	N/A	26
Stormwater Management and Erosion Control			**Impact:** Flooding in the predicted "ponded flood occurrence zones" (Hydrology Assessment Report) could cause damage to property **Consequences:** - Damage to property and increased maintenance costs (direct) - Reduced electrical power output and income resulting in diminished return on investment (indirect) **Addressed under "Receiving Environment: Terrestrial and Avia Ecosystem"**	N/A	26
Security		Influx of contractors and workers into the area.	**Impact:** Damage to farm infrastructure **Consequence:** Economic costs in replacing damaged infrastructure.	N/A	26
Road Management	Use including gravel District Road, Transnet Service Road and internal roads	Development of corrugations, potholes and puddles	**Impacts:** Damage to vehicles. **Consequences:** Increased maintenance costs	N/A	26
Quarry (Sourcing materials (aggregate) for roads and concrete)	New Quarry & Crushing Plant Operation (and maintenance)	Dust generation	**Impact:** Excessive dust **Consequence:** damage the durability of the plant, leading to bearing failure, lubricant contamination and increased risk of fire autoignition. Increasing costs of repairs etc.	N/A	27

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

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Reg: 2006/023163/23

Impact 26 (Damage to neighbours' vehicles, property, loss of livestock)

- Construction traffic may impact on the movement of the livestock around the farm.
- There is a risk of stock loss due to farm gates being left open, or not being closed properly by construction teams.
- A concern is the waterflow around the wetland and the potential impact on the road.
- The movement of workers and vehicles on the site could cause damage to farm infrastructure (e.g., fencing, water troughs and gates), during construction and operation.
- Farm owners are concerned about the impact of fences on water flow during heavy rain. If fences are not kept clear of debris, there is a risk that it can affect the waterflow into dams in the area, which is critical in a dry area like the Karoo.
- Soventix assume that there will be 650 construction staff during peak construction and 55 staff during operation.
- There is still a level of uncertainty amongst the directly affected landowners. The timelines for the project are not clear to them, they would like greater clarity about when the construction will start, how long it would be and what the layout and design of the solar panels will be. Other landowners have technical questions about practicalities and the implementation of the project. The farming community is close-knit, and people discuss the project amongst themselves. Soventix may harm their social license to operate if they do not clarify these aspects, since the uncertainty can change into mistrust, which is difficult to undo.
- In the absence of clearly defined drainage channels or streams the area is prone to exhibit ponded flood occurrence zones. Micro sub-catchment sheet flow towards lower-lying areas within the non-perennial river flood plains is likely to dominate flood propagation, and isolated flooded areas are predicted to occur. The flood line determination suggests a low flooding risk as no clearly defined drainage lines occur. As such, no clearly defined exclusion zones or protection buffer areas could be mapped. Care should be taken in areas where development does take place within the likely flooding zones.

Impact 27 (Damage to contractors' machinery and equipment)

- Construction equipment will include at least: Water tankers; Graders; Tipper trucks; Drilling rigs (down to 2m); Mobile pile ramming machines (down to 3m at the most); Rock crushing plant; Excavators; TLBs; Concrete mixers; Compaction equipment; Light delivery vehicles; and Heavy delivery vehicles (for the transformers).

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**

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Reg: 2006/023163/23

H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
26	M	M	M	-R	M	M	1	H	M	1
Reversibility	M	**Irreplaceability**	M	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
27	M	M	L	-I	M	M	1	H	M	1
Reversibility	M	**Irreplaceability**	M	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Traffic Impact Assessment prepared by Annebet Krige of Sturgeon Consulting (Pty) Ltd dated September 2022 (Project No.: STUR0352).
- Social Impact Assessment Report prepared by Ilse Aucamp of Equispectives Research & Consulting Services dated August 2022.
- National Veld and Forest Fire Act, 1998 (Act No. 101 of 1998).

Mitigations:

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Reg: 2006/023163/23

Impact Management Outcome(s):

- Build and maintain trusting relationships with affected stakeholders.
- Limited risk of financial losses to neighbouring farmers.
- Preserve lifespan of rock crushing plant.
-

Targets:

- Minimise risk of and control runaway fires: no evidence of open fires are observed on site.
- Compensation.
- No security breaches of boundary fence.
- No debris blocking boundary fence.
- Roads are in good condition.
- Rock crushing plant is kept clean.
- Dry misting system, dust collectors.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
26	Employee management (including appointment, conduct and movement)	Risk of veld fires caused by workers during the construction of the facility	Limited risk of financial losses to neighbouring farmers.	Minimise risk of and control runaway fires: no evidence of open fires are observed on site.	No open fires.	Contractor	Construction	Compliance to be verified by ECO and IEA
26	Construction Plant Management including Deliveries	Damage to farm infrastructure	Build and maintain trusting relationships with affected stakeholders.	Compensation	Affected landowners must be compensated for losses resulting from any damage to farm infrastructure.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA
26	Security	Damage to farm infrastructure	Build and maintain trusting relationships with affected stakeholders.	No security breaches of boundary fence	Inspections of boundary fences should be done on a daily basis in areas where there are activities.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
26	Security	Damage to farm infrastructure	Build and maintain trusting relationships with affected stakeholders.	No debris blocking boundary fence	All fences should be inspected and be kept clear of debris, especially in the rainy season.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA
26	Road Management	Damage to vehicles.	Limited risk of financial losses to neighbouring farmers.	Roads are in good condition.	The applicant shall maintain any deterioration to the district gravel roads resulting from increased traffic during construction.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA
26	Road Management	Damage to vehicles.	Limited risk of financial losses to neighbouring farmers.	Roads are in good condition.	Corrugations shall be removed as soon as is reasonably practical (e.g., within 5 working days of being noticed).	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA
26	Road Management	Damage to vehicles.	Limited risk of financial losses to neighbouring farmers.	Roads are in good condition.	Potholes and puddles will be filled in and compacted as soon as is reasonably practical (e.g., within 5 working days of being noticed).	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA
26	Road Management	Damage to vehicles.	Limited risk of financial losses to neighbouring farmers.	Roads are in good condition.	Apply environmentally friendly soil binding agents to the road surface to reduce ripple and pothole occurrences as well as help production machines last longer	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA
27	Quarry (Sourcing materials	Excessive dust can damage the durability of the	Preserve lifespan of rock crushing plant	Rock crushing plant is kept clean	Regular plant washing and maintenance.	Contractor	Construction	Compliance to be verified

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
	(aggregate) for roads and concrete)	crushing plant, leading to bearing failure, lubricant contamination and increased risk of fire autoignition.						by ECO and IEA
27	Quarry (Sourcing materials (aggregate) for roads and concrete)	Excessive dust can damage the durability of the crushing plant, leading to bearing failure, lubricant contamination and increased risk of fire autoignition.	Preserve lifespan of rock crushing plant	Dry misting system, dust collectors.	Combination of engineered dust control solutions such as installing a Dry Misting System, dust collectors, improvements of feeding, discharge and transfer points and enclosures.	Contractor	Construction	Compliance to be verified by ECO and IEA

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
26	M	M	M	-R	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
26	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
27	M	M	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
27	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- The residual risk of damage to neighbour's property, loss of livestock, damage to vehicles etc. (**26**) after mitigation is assumed to be Low.
- The residual risk of damage to equipment (rock crushing plant) due to excessive dust (**27**) after mitigation is estimated to be Low.

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Reg: 2006/023163/23

Receiving Environment: Social

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Construction Plant Management including Deliveries	Driving/Transport	Generating noise	**Impact:** Noise pollution due to traffic. **Consequence:** Decrease in sense of place due to noise generated by traffic. **Addressed under "Receiving Environment: Atmosphere"**	N/A	28
Construction Plant Management including Deliveries	Driving/Transport	Congestion for other road users/Disruption to landowners	**Impact:** Potential congestion and delays on the surrounding road network. **Consequence:** Disruptions and delays to local farmers in the area due to increase traffic volumes. Longer time periods in transportation of goods.	N/A	28
Road Management	Use including gravel District Road, Transnet Service Road and internal roads	Dust generation	**Impact:** Stakeholders are concerned about the quality of the roads, increases in traffic and traffic safety. **Consequence:** Increase in accidents, longer time periods in transportation of goods. **Addressed under "Receiving Environment: Atmosphere"**	N/A	28
General and Hazardous Waste Management	Storage	Unpleasant odours	**Impacts:** Large amounts of stored waste can cause unpleasant odours **Consequences:** neighbours could be impacted on regarding unpleasant smells	N/A	29

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 28 (Traffic)

- A concern is the generation of dust. Although the proposed site is far from any communities, it is relatively close to some of the farmers, but the biggest concern is the impact that the dust will have on the quality of the grazing. Farmers acknowledge that the dust will be washed of

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Reg: 2006/023163/23

by rain, but it is an arid area with relatively low rainfall in general. The municipality indicated that the road infrastructure in town started deteriorating when the first renewable projects started in the area.

- It is acknowledged that Soventix will not be the only road user, but it must be considered that their presence will add significant wear and tear to the road.
- Existing traffic information for 2022 indicates that the N10 carries an ADT of 1018 vehicles per day (two-way). The N10 operates well below the capacity of 2000 vehicles per hour for a Class 1 principal arterial with two lanes. Traffic generated during the Operational phase will have an insignificant traffic impact on the surrounding road network.

Impact 29 (Odours)

- It is anticipated that both general and hazardous waste types will be generated during construction. Except for domestic wastewater (13 m3/day), volumes cannot be known.

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
28	M	L	M	-I	M	H	1	M	H	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

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Reg: 2006/023163/23

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
29	M	L	M	-I	M	H	1	M	H	1

Reversibility	H	Irreplaceability	H	Mitigatory Potential	H

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Traffic Impact Assessment prepared by Annebet Krige of Sturgeon Consulting (Pty) Ltd dated September 2022 (Project No.: STUR0352).
- Social Impact Assessment Report prepared by Ilse Aucamp of Equispectives Research & Consulting Services dated August 2022.

Mitigations:

Impact Management Outcome(s):

- Minimise risk of congestion and delays to local farmers.
- Reduce odours with good waste management.

Targets:

- No deliveries or staff trips during peak hours
- No odours.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
28	Construction plant management including deliveries	Potential congestion and delays on the surrounding road network.	Minimise risk of congestion and delays to local farmers.	No deliveries during peak hours	Stagger delivery trips and schedule deliveries outside of the peak traffic periods.	Contractor	Construction	Compliance to be verified by ECO and IEA.
28	Construction plant management including deliveries	Potential congestion and delays on the surrounding road network.	Minimise risk of congestion and delays to local farmers.	No staff trips during peak hours	Staff trips should also occur outside of the peak hours where possible.	Contractor	Construction	Compliance to be verified by ECO and IEA.
29	General and hazardous waste management	Large amounts of stored waste can cause unpleasant odours	Reduce odours with good waste management	No odours	Waste receptacles must not be overfilled. General waste shall be disposed of at the nearest licensed landfill.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
28	M	M	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
28	L	L	L	neutral	L	L	0	L	L	0

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
29	M	M	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
29	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- The residual risk of congestions, dust generation etc. caused by traffic (**28**) after mitigation is assumed to be Low.
- The residual risk of odours from the site due to poor waste management (**29**) after mitigation is assumed to be Low.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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Receiving Environment: Property

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Employee management (including appointment, conduct and movement)	Keeping warm or cooking	Starting fires	**Impact:** Risk of veld fires caused by workers during the construction of the facility. **Consequence:** - damage to property (direct) - runaway fires on neighbouring properties will result in a loss of grazing for livestock and/or wild game, increasing the running costs to provide supplementary feed. **Addressed under "Receiving Environment: Economical"**	N/A	30
General and Hazardous Waste Management	Disposal	Land contamination	**Impact:** Burning of waste as a disposal method increases the risk of veld fires caused by workers during the construction of the facility. **Consequence:** - Damage to property (direct) **Addressed under "Receiving Environment: Terrestrial Fauna"**	N/A	30
Fire Management	Wildfires		**Impact:** Risk of veld fires caused by workers during the construction of the facility. **Consequence:** - damage to property (direct) - runaway fires on neighbouring properties will result in a loss of grazing for livestock and/or wild game, increasing the running costs to provide supplementary feed. **Addressed under "Receiving Environment: Economical" and "Receiving Environment: Terrestrial Flora"**	N/A	30
Installing panel arrays and associated infrastructure (from racks to field transformers) including within 100	Electrical circuits		**Impact:** Damage to property caused by flooding. **Consequence:** - Increased maintenance costs.	N/A	31

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Reg: 2006/023163/23

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
m of a watercourse or 500 m of a wetland/pan					
Blasting		Fly Rock	**Impact:** Fly rock and vibrations from blasting **Consequence:** Damage to property.	N/A	32

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 30 (Fire)

- This impact **has been addressed under Receiving Environment: Economical", "Receiving Environment: Terrestrial Flora" and Receiving Environment: Terrestrial Fauna therefore no further mitigation is required.**

Impact 31 (Flooding)

- The project area falls within a spring to summer rainfall area (October to April), ranging from 112,4 to 738,9 mm/yr but averaging 320 mm/yr. The Mean Annual Evaporation (2 000 – 2 150 mm/yr) exceeds the Mean Annual Precipitation (MAP) by about 85%, so non-perennial streams and rivers will only have water when there are flooding events.
- In the absence of clearly defined drainage channels or streams the area is prone to exhibit ponded flood occurrence zones. Micro sub-catchment sheet flow towards lower-lying areas within the non-perennial river flood plains is likely to dominate flood propagation, and isolated flooded areas are predicted to occur. The flood line determination suggests a low flooding risk as no clearly defined drainage lines occur. As such, no clearly defined exclusion zones or protection buffer areas could be mapped.

Impact 32 (Blasting, Fly rock)

- Blasting may be required for shallow dolerite areas. *"Yes, the dolerite is the hardest rock on site. However, it wears to rounded cobbles and boulders with cobbles, gravel and sand in between. In parts the weathering may be to such an advanced stage that boulders in the rock mass are small enough to enable be moving them with an excavator. However, since the largest part of the dolerite rock is below ground level (e.g., covered by soil) one cannot really judge as to how much of the dolerite rock mass is moveable by excavator. Certainly, in the vicinity of locality P28B very large dolerite boulders which are only slightly weathered occur. Additionally, in many parts, good quality sandstone and siltstone rock mass occurs at shallow depth below ground level and will also require blasting for laying of the three cabling routes."* (pers. comm. Frederik Stapelberg).

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Reg: 2006/023163/23

- Digging of trenches for laying of the underground cabling will be complicated by the frequent occurrence of rock outcrop or sub-outcrop at less than 0,5 metres depth on the Phase 3 site. Excavation will be particularly difficult where the routes cross dolerite dykes or the sill.

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
31	H	L	H	-I	H	H	1	H	H	1
Reversibility	M	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
32	M	M	M	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Social Impact Assessment Report prepared by Ilse Aucamp of Equispectives Research & Consulting Services dated August 2022.
- Hydrological Assessment (Version – Final 2) 11 April 2022 GCS Project Number: 22-0076 by Hendrik Botha
- Geotechnical Assessment Study prepared by FDJ Stapelberg of the Council for Geoscience dated 11 May 2022 (CO2017-5806 (Phase 80)).

Mitigations:

Impact Management Outcome(s):

- Property is protected from flooding.
- Property is protected from blasting activities.

Targets:

- No risk to flood damage.
- Safe explosive magnitude.
- Blast mat.
- Notify neighbours of blasting.
- Photographs of any existing damage to buildings prior to blasting.
- Method statement.
- Logbook.
- Permit for blasting.
- Approval letter.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
31	Installing panel arrays and associated infrastructure (from racks to field transformers)	Damage to property caused by flooding.	Property is protected from flooding	No risk to flood damage.	All electrical connectors and other items vulnerable to flood water should be located at a minimal level of the maximum flood depth determined by the	Engineer, Contractor	Construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
	including within 100 m of a watercourse or 500 m of a wetland/pan				engineers plus a 0,3 m free board above ground level to ensure that they are protected from the design flood event (1:100 year).			
32	Blasting	Fly rock and vibrations from blasting could damage property	Property is protected from blasting activities	Safe explosive magnitude	The contractor carrying out the blasting work shall apply the absolute minimum magnitude and amount of 'explosive' material.	Contractor	Construction	Compliance to be verified by ECO and IEA.
32	Blasting	Fly rock and vibrations from blasting could damage property	Property is protected from blasting activities	Blast mat	The contractor carrying out the blasting work shall use a blast mat (not soil) to reduce fly rock.	Contractor	Construction	Compliance to be verified by ECO and IEA.
32	Blasting	Fly rock and vibrations from blasting could damage property	Property is protected from blasting activities	Notify neighbours of blasting	The applicant shall at least 7 days prior to the commencement of blasting advise owners and occupiers of neighbouring properties.	Contractor	At least 7 days prior to the commencement of blasting	Compliance to be verified by ECO and IEA.
32	Blasting	Fly rock and vibrations from blasting could damage property	Property is protected from blasting activities	Photographs of any existing damage to buildings prior to blasting	Buildings within the potential damaging zone of the blast will be surveyed with the presence of the owner, or a representative nominated by the owner, and any cracks or latent	Contractor	Construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					defects will be pointed out and recorded using photographs.			
32	Blasting	Fly rock and vibrations from blasting could damage property	Property is protected from blasting activities	Method statement	The contractor carrying out the blasting work will prepare a method statement prior to blasting.	Contractor	Construction	Compliance to be verified by ECO and IEA.
32	Blasting	Fly rock and vibrations from blasting could damage property	Property is protected from blasting activities	Method statement	The aforesaid method statement will include: (a) A locality plan of the blast site; (b) The zones of influence of the ground and air shockwaves; (c) Expected limits of fly rock; and (d) Each dwelling, structure, service and water source within the zones of influence.	Contractor	Construction	Compliance to be verified by ECO and IEA.
32	Blasting	Fly rock and vibrations from blasting could damage property	Property is protected from blasting activities	Logbook	The contractor carrying out the blasting work shall log the blasting activities.	Contractor	Construction	Compliance to be verified by ECO and IEA.
32	Blasting	Fly rock and vibrations from blasting could damage property	Property is protected from blasting activities	Permit for blasting	The contractor carrying out the blasting work shall hold and be in possession of a permit authorizing such use in terms of the Explosives Act,	Contractor	Construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					2003 (Act No. 15 of 2003), unless the activity relates to occupational health or occupational safety, in which case the matter is regulated under the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993).			
32	Blasting	Fly rock and vibrations from blasting could damage property	Property is protected from blasting activities	Approval letter	If the explosive to be used is defined in terms of the Occupational Health and Safety Act, 1993 (any substance or article as listed in Class 1: Explosives in the South African Bureau of Standards Code of Practice for the Identification and Classification of Dangerous Substances and Goods, SABS 0228), the contractor carrying out the blasting work shall apply in writing to the chief inspector of occupational health and safety for written approval to use the explosive in the workplace.	Contractor	Construction	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
31	L	L	L	neutral	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
31	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
32	L	M	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
32	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

- The residual risk of fire causing damage to property and loss of grazing capacity (**30**) has been addressed under Receiving Environment: Economical”, “Receiving Environment: Terrestrial Flora” and Receiving Environment: Terrestrial Fauna therefore **no further mitigation is required.**
- The residual risk of damage caused by flooding **(31**) after mitigation is assumed to be Low.
- The residual risk of damage caused by blasting and fly rock (**32**) after mitigation is assumed to be Low.

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Reg: 2006/023163/23

Receiving Environment: Health and Safety

Description of potential impacts:

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Employee management (including appointment, conduct and movement)	Keeping warm or cooking	Starting fires	**Impact:** Risk of veld fires caused by workers during the construction of the facility. **Consequence:** - loss of life (direct) **Addressed under "Receiving Environment: Economical" and "Receiving Environment: Terrestrial Flora"**	N/A	33
Fire Management	Wildfires		**Impact:** Risk of veld fires caused by workers during the construction of the facility. **Consequence:** - loss of life (direct) **Addressed under "Receiving Environment: Economical" and "Receiving Environment: Terrestrial Flora"**	N/A	33
General and Hazardous Waste Management	Disposal	Land contamination	**Impact:** Burning of waste as a disposal method increases the risk of veld fires caused by workers during the construction of the facility. **Consequence:** - Loss of life (direct) **Addressed under "Receiving Environment: Economical" and "Receiving Environment: Terrestrial Flora"**	N/A	33
Construction Plant Management including Deliveries	Driving/Transport	Congestion for other road users/Disruption to landowners	**Impact:** Potential impact on traffic safety and increase in accidents with other vehicles or animals. **Consequence:** Death/injury to humans and loss/injury of livestock.	N/A	34
Construction Plant Management including Deliveries	Driving/Transport	Congestion for other road users/Disruption to landowners	**Impact:** Traffic accidents at primary access location off the N10. **Consequence:** Injury or loss of life.	N/A	34
Construction Plant Management including Deliveries	Driving/Transport	Congestion for other road users/Disruption to landowners	**Impact:** Stakeholders are concerned about traffic safety. **Consequence:** Increase in accidents, longer time periods in transportation of goods.	N/A	34

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Reg: 2006/023163/23

General and Hazardous Waste Management	Reuse	Health and safety	**Impact:** Reuse of certain containers may be harmful to people. **Consequence:** Health risk	N/A	35
Handling Hazardous Substances	Refuelling	Use of resources	**Impact:** Improper safety procedures followed when refuelling. **Consequence:** injury/loss of life of staff (indirect)	N/A	35
Blasting		Fly Rock	**Impact:** Fly rock from blasting **Consequence:** injury/death to persons	N/A	36

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 33 (Fire)

- This impact **has been addressed under Receiving Environment: Economical", "Receiving Environment: Terrestrial Flora" and Receiving Environment: Terrestrial Fauna therefore no further mitigation is required.**

Impact 34 (Traffic)

- The construction phase will generate significant additional traffic on the roads – just the transport of the workers will mean two trips per day, and then the delivery of construction material and management activities must also be considered. At the moment the local farmers do a lot of the road maintenance. They are concerned about the condition that the road will be in after the construction period.
- The municipality indicated that the road infrastructure in town started deteriorating when the first renewable projects started in the area.
- It is acknowledged that Soventix will not be the only road user, but it must be considered that their presence will add significant wear and tear to the road.
- The primary access to the proposed 400 MW solar PV facility will be at the junction of the N10 with the existing Burgerville (District) Road. The shoulder sight distance (> 450 m) to the left of the primary site access location will be sufficient (at a design speed of 120 km/hr). Sight distance to the right, however, was measured as approximately 320 m, which is sufficient for Passenger vehicles (P), but not a Single-Unit Truck (SU). It therefore is proposed that appropriate traffic accommodation be placed on the eastern approach of the N10, indicating a construction access ahead with a possible flagman to alert drivers and slow them down.

Impact 35 (Hazardous materials, refuelling)

- It is anticipated that both general and hazardous waste types will be generated during construction. Except for domestic wastewater (13 m3/day), volumes cannot be known.

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Reg: 2006/023163/23

Impact 36 (Blasting)

- Blasting may be required for shallow dolerite areas. "Yes, the dolerite is the hardest rock on site. However, it wears to rounded cobbles and boulders with cobbles, gravel and sand in between. In parts the weathering may be to such an advanced stage that boulders in the rock mass are small enough to enable be moving them with an excavator. However, since the largest part of the dolerite rock is below ground level (e.g., covered by soil) one cannot really judge as to how much of the dolerite rock mass is moveable by excavator. Certainly, in the vicinity of locality P28B very large dolerite boulders which are only slightly weathered occur. Additionally, in many parts, good quality sandstone and siltstone rock mass occurs at shallow depth below ground level and will also require blasting for laying of the three cabling routes." (pers. comm. Frederik Stapelberg).
- Digging of trenches for laying of the underground cabling will be complicated by the frequent occurrence of rock outcrop or sub-outcrop at less than 0,5 metres depth on the Phase 3 site. Excavation will be particularly difficult where the routes cross dolerite dykes or the sill.

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
34	L	M	L	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
35	M	L	M	-I	M	M	1	M	M	1

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Reg: 2006/023163/23

Reversibility	H	Irreplaceability	H	Mitigatory Potential	H

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
36	M	M	M	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Social Impact Assessment Report prepared by Ilse Aucamp of Equispectives Research & Consulting Services dated August 2022.
- Traffic Impact Assessment prepared by Annebet Krige of Sturgeon Consulting (Pty) Ltd dated September 2022 (Project No.: STUR0352).
- Geotechnical Assessment Study prepared by FDJ Stapelberg of the Council for Geoscience dated 11 May 2022 (CO2017-5806 (Phase 80)).

Mitigations:

Impact Management Outcome(s):

- To ensure the safe exit of Single-Unit Trucks (SU) and especially Single-Unit Truck plus Trailers (SU+T) at the junction of the N10 with the existing Burgerville (District) Road.
- Zero traffic safety incidents.
- Good waste management.
- Avoid injury or fatality amongst staff.

Targets:

- No signs of speeding.
- No traffic incidents.
- Road signage.
- No containers which held a Hazardous Chemical Substance (HCS) are being reused.

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Reg: 2006/023163/23

- All staff have PPE.
- First Aid kit.
- Smoking areas.
- First Aid certificate.
- Copy of license to blast.
- Notification of neighbour's.
- No rock more than 150mm outside the working area.
- Compliance with noise bylaws.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
34	Construction Plant Management including Deliveries	Potential impact on traffic safety and increase in accidents with other vehicles or animals.	Zero traffic safety incidents.	No signs of speeding	Consider speed control by means of stop and go systems.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.
34	Construction Plant Management including Deliveries	Potential impact on traffic safety and increase in accidents with other vehicles or animals.	Zero traffic safety incidents.	No signs of speeding	Enforce speed control through speed limit road signage and fines.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.
34	Construction Plant Management including Deliveries	Traffic accidents at primary access location off the N10.	To ensure the safe exit of Single-Unit Trucks (SU) and especially Single-Unit Truck plus Trailers (SU+T) at the junction of the N10 with the existing	No traffic incidents	Place appropriate traffic accommodation on the eastern approach of the N10, indicating a construction access ahead with a possible flagman to alert drivers and slow them down.	Contractor	Construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
			Burgerville (District) Road.					
34	Construction Plant Management including Deliveries	Stakeholders are concerned about traffic safety	Zero traffic safety incidents.	Road signage	The necessary road signage must be erected on the affected roads to warn road users about the construction activities and traffic.	Contractor	Construction	Compliance to be verified by ECO and IEA.
35	General and hazardous waste management	Reuse of certain containers may be harmful to people.	Good waste management	No containers which held a Hazardous Chemical Substance (HCS) are being reused	Reusable containers which held a Hazardous Chemical Substance (HCS) may not be donated to any person for reuse, and preferably returned to the supplier to be cleaned and decontaminated, otherwise if that is not possible then punctured and disposed of at a licensed hazardous waste disposal facility.	Contractor	Construction	Compliance to be verified by ECO and IEA.
35	General and hazardous waste management	Improper safety procedures followed when refuelling.	Avoid injury or fatality amongst staff.	All staff have PPE	Implement the following restrictions on all staff operating on the site: (a)No work may be done without the use of PPE	Contractor	Construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					(b)No alcohol or illegal substance use on site (c) No firearms permitted on site.			
35	General and hazardous waste management	Improper safety procedures followed when refuelling.	Avoid injury or fatality amongst staff.	First Aid kit	A first aid kit must always be accessible on site and must include the number of the local emergency service.	Contractor	Construction	Compliance to be verified by ECO and IEA.
35	General and hazardous waste management	Improper safety procedures followed when refuelling.	Avoid injury or fatality amongst staff.	Smoking areas	Set up and enforce use of designated smoking area(s)	Contractor	Construction	Compliance to be verified by ECO and IEA.
35	General and hazardous waste management	Improper safety procedures followed when refuelling.	Avoid injury or fatality amongst staff.	First Aid certificate	At least one person within each working team must have a valid First Aid Certificate and a First Aid Kit that is adequate to deal with the range of possible life-threatening injuries.	Contractor	Construction	Compliance to be verified by ECO and IEA.
36	Blasting	Fly rock from blasting	Avoid injury or fatality amongst staff.	Copy of license to blast	Any blasting activity must be conducted by a suitably licensed blasting contractor.	Contractor	Construction	Compliance to be verified by ECO and IEA.
36	Blasting	Fly rock from blasting	Avoid injury or fatality amongst staff.	Notification of neighbour's	Notification of surrounding landowners, emergency services site personnel of blasting activity 24 hours prior to such	Contractor	24 hours prior to blasting	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					activity taking place on Site.			
36	Blasting	Fly rock from blasting	Avoid injury or fatality amongst staff.	No rock more than 150mm outside the working area	Fly rock from blasting activity must be minimised and any pieces greater than 150 mm falling beyond the Working Area, must be collected and removed.	Contractor	Construction	Compliance to be verified by ECO and IEA.
36	Blasting	Fly rock from blasting	Avoid injury or fatality amongst staff.	Compliance with noise bylaws	Adhere to any local bylaws and regulations regarding the generation of noise.	Contractor	Construction	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
34	L	L	L	neutral	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
34	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
35	L	L	L	neutral	M	L	0	L	L	0

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Reg: 2006/023163/23

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
35	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
36	L	L	L	neutral	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
36	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- The residual risk to safety due to fires (**33**) has been addressed under Receiving Environment: Economical", "Receiving Environment: Terrestrial Flora" and Receiving Environment: Terrestrial Fauna therefore **no further mitigation is required.**
- The residual risk to safety due to traffic incidences (**34**) after mitigation is assumed to be Low.
- The residual risk to safety due to staff encountering hazardous chemicals and when refuelling (**35**) after mitigation is assumed to be Low.
- The residual risk to safety due to blasting activities and fly rock (**36**) after mitigation is assumed to be Low.

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Reg: 2006/023163/23

Receiving Environment: Security

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Employee management (including appointment, conduct and movement)	Supervision	Avoid harm to the environment and persons	**Impact:** Increases in stock theft and other crimes. **Consequence:** Economic losses due to loss of livestock/game/property	N/A	37
Construction Plant Management including Deliveries	Driving/Transport	Congestion for other road users/Disruption to landowners	**Impact:** Increases in stock theft and other crimes. **Consequence:** Economic losses due to loss of livestock/game/property	N/A	37
Security		Influx of contractors and workers into the area.	**Impact:** Increases in stock theft and other crimes. **Consequence:** Economic losses due to loss of livestock/game/property	N/A	37
Stockpiling and Storing (Laydown)	Mulch, topsoil, aggregate, spoil and infrastructure	Cover fauna/nests/burrows	**Impact:** Increases in stock theft and other crimes. **Consequence:** Economic losses due to loss of livestock/game/property	N/A	37

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 37 (Crime – stock theft, theft of PV panels)

- Farmers are concerned that the presence of the construction workers in the area will cause an increase in stock theft, due to people becoming aware of where the stock are kept. There is also a possibility that petty theft or opportunistic crimes can take place. The municipality indicated that general crime levels increased during the construction phases of the renewable developments around the town.
- More people moving around in the area will make it easier for opportunistic criminals to enter the area without being noticed.
- Farm safety is a concern in the rural areas of South Africa. Although there is a low incidence of farm attacks in the Karoo, farmers and farm workers are soft targets due to the isolation on farms and distance from emergency services. More people moving around in the area will make it easier for opportunistic criminals to enter the area without being noticed. Stock theft is a problem in the area, and one farmer reported that during the times that Transnet contractors work in the area they lose up to ten sheep a week. Farmers are concerned that the presence of the construction workers in the area will cause an increase in stock theft, due to people becoming aware of where the stock are kept. There is also

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Reg: 2006/023163/23

a possibility that petty theft or opportunistic crimes can take place. The municipality indicated that general crime levels increased during the construction phases of the renewable developments around the town. The municipality reported that once the construction teams left, they perceive that there is an increase in local petty crimes such as housebreaking which they attribute to loss of income amongst some community members. There will be less people in the area during the operational phase and fewer permanent workers onsite. Theft or vandalism of the PV panels or associated infrastructure may be of some concern during the operation phase.

- Theft or vandalism of the PV panels or associated infrastructure may be of some concern during the operation phase.

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
37	M	M	L	-I	M	M	1	H	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
37	M	M	L	-I	M	M	1	H	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

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Reg: 2006/023163/23

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Social Impact Assessment Report prepared by Ilse Aucamp of Equispectives Research & Consulting Services dated August 2022.
- Richard Vimpany (Neighbouring landowner and registered Interested and Affected Party).

Mitigations:

Impact Management Outcome(s):

- A secure solar PV facility.

Targets:

- Staff wear photo ID cards.
- Roster given to landowners.
- Marked vehicles.
- Access control.
- Fenced stockpile areas.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
37	Employee management (including appointment, conduct and movement)	Increases in stock theft and other crimes.	A secure solar PV facility	Staff wear photo ID cards	All contractors and employees need to wear photo identification cards.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.
37	Construction Plant Management including Deliveries	Increases in stock theft and other crimes	A secure solar PV facility	Roster given to landowners	A roster stating dates and approximate times that contractors will be on the farms must be given directly to affected landowners. All access arrangements should be made at least 24 hours before farm access is required.	Holder, Contractor	At least 24 hours before farm access is required.	Compliance to be verified by ECO and IEA.
37	Construction Plant Management including Deliveries	Increases in stock theft and other crimes	A secure solar PV facility	Marked vehicles	Vehicles should be clearly marked as construction vehicles and should have Soventix, or the contractor's logo clearly exhibited.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.
37	Security	Increases in stock theft and other crimes.	A secure solar PV facility	Access control	Entry and exit points of the site should be controlled.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.
37	Stockpiling and storing (Laydown)	Increases in stock theft and other crimes.	A secure solar PV facility	Fenced stockpile areas	Areas where materials are stockpiled must be fenced.	Contractor	Construction	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

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Reg: 2006/023163/23

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
37	L	L	L	-R	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
37	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- The residual risk of security and issues such as criminal activity during construction and operation (**37**) after mitigation is estimated to be Low.

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Reg: 2006/023163/23

Receiving Environment: Public Services

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Road Management	Use including gravel District Road, Transnet Service Road and internal roads	Development of corrugations, potholes and puddles	**Impact:** Increased traffic can result in corrugations and potholes on roads. **Consequence:** Decrease in condition of gravel roads, increase in travel times.	N/A	38
Water management (abstraction, storage and use)	Monitoring		**Impact:** It is anticipated that soils downstream of the proposed development, and the non-perennial streams (feeding into temporary livestock watering dams) are the receivers of any sediment runoff or poor-quality runoff from the site. Sedimentation (or turbidity) caused by working in the watercourse can increase the cost of treating drinking water. **Consequence:** Increased cost of treating water, or if there is limited capacity to treat the water (financial, technical, etc.) then poorer quality drinking water, including appearance, odour and taste problems (indirect).	N/A	39

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 38 (Traffic)

- The main gravel road, Burgerville Road, in the vicinity of the proposed development is in a fair to poor condition. The main surfaced road, the N10, in the vicinity of the proposed development is in a good condition.

Impact 39 (Water quality – sedimentation)

- It is advised that groundwater boreholes be monitored for the decline in water levels/yields, as well as water quality as the boreholes are used as the main water supply for livestock / domestic use.
- Further the impacts of sedimentation are adequately assessed and **mitigated under "Receiving Environment: Terrestrial and Avian Ecosystem" and "Ground and Surface water" and therefore do not need to be repeated here.**

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Reg: 2006/023163/23

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
38	H	L	H	-I	H	H	1	H	H	1
Reversibility	M	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Hydrological Assessment (Version – Final 3) 01 September 2022 GCS Project Number: 22-0076 by Hendrik Botha.
- Traffic Impact Assessment prepared by Annebet Krige of Sturgeon Consulting (Pty) Ltd dated September 2022 (Project No.: STUR0352).

Mitigations:

Impact Management Outcome(s):

- Good road conditions.

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Reg: 2006/023163/23

- Safe (unobstructed) delivery of abnormal loads to site.

Targets:

- No corrugations or potholes.
- Internal roads are in good condition.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
38	Road Management	Increased traffic can result in corrugations and potholes on roads.	Good road conditions.	No corrugations or potholes	Undertake regular maintenance of the gravel access roads during all phases of the project, especially during the construction phase.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.
38	Road Management	Transport of abnormal roads could be delayed.	Safe (unobstructed) delivery of abnormal loads to site.	Internal roads are in good condition	Upgrade the internal farm access road (e.g., internal private roads leading off the Burgerville Road) to suitable standards as specified by the civil engineer.	Holder, Contractor	Construction	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
38	L	L	L	neutral	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
38	L	L	L	neutral	L	L	0	L	L	0

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Reg: 2006/023163/23

Residual Risk (feeds back into "Mitigations"):

- The residual risk of change of traffic impacts and road condition (**38**) after mitigation is estimated to be Low.
- The residual risk of sedimentation on water quality (**39**) has been mitigated **under "Receiving Environment: Terrestrial and Avian Ecosystem" and "Ground and Surface water" and therefore do not need to be repeated here.**

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Reg: 2006/023163/23

Receiving Environment: Visual Aesthetics

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
General and Hazardous Waste Management	Handling and Collection (incl. chemical toilets)	Land contamination	**Impact:** Short-term landscape change from the current rural agricultural sense of place to the semi-industrial RE landscape - Wind-blown litter from the laydown and construction sites (fencing can trap wind-blown litter). **Consequences:** Litter trapped in fences is a visual eye sore	N/A	40
Clearing/Grubbing and Grading	Construction camp (incl. operational area), borrow pit, upgrading existing and new roads, trenches for underground cables and water pipes, holes for racks, fence posts and pylons, foundations for inverters, field transformers and on-site substation, water storage tanks and deionization plant.	Removal of vegetation	**Impact:** Decrease in the "sense of place" as it relates to noise, visual and light pollution. **Consequence:** Lower aesthetic values enjoyed by the community.	N/A	40
Alien Plant Management	Disturbance to natural areas	Favourable conditions for alien plant/animal recruitment.	**Impact:** Disturbance of aquatic or terrestrial habitat can favour the recruitment of alien invasive plants, threatening individuals, habitats and alter the composition, structure and functioning of ecosystems. **Consequence:** - a decrease in aesthetic, cultural and recreational values (indirect).	N/A	41

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Reg: 2006/023163/23

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
			Addressed under "Receiving Environment: Terrestrial Flora and Receiving Environment: Aquatic Flora"		
Road Management	Grading existing and new roads	Creating bare surfaces susceptible to erosion	**Impact:** Short-term landscape change from the current rural agricultural sense of place to the semi-industrial RE landscape - The use of large vehicles and a crane to raise the power line monopoles - small maintenance access routes would be created along the proposed power line route. **Consequence:** Soil erosion if not adequately managed. **Addressed under "Receiving Environment: Soil and Rock" and Receiving Environment: Terrestrial Flora"**	N/A	42
Road Management	Use including gravel District Road, Transnet Service Road and internal roads	Dust generation	**Impact:** (1) Short-term landscape change from the current rural agricultural sense of place to the semi-industrial RE landscape - Wind-blown dust due to the removal of large areas of vegetation and large earth moving equipment driving on gravel roads creating plumes of dust, and visible air pollution. (2) Due to the small footprint of the substation, monopole site and access small track, windblown dust is likely to be limited, but a nuisance value could occur from the movement of vehicles to the substation or occasional maintenance vehicles travelling down the access track to check on possible soil erosion and the power lines. **Consequences:** Dust may become a nuisance to sensitive receptors (neighbouring farmers). **Addressed under "Receiving Environment: Soil and Rock" and Receiving Environment: Terrestrial Flora"**	N/A	42
Road Management	Use including gravel District Road, Transnet	Dust generation	**Impact:** Decrease in the "sense of place" as it relates to noise, visual and light pollution.	N/A	42

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Reg: 2006/023163/23

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
	Service Road and internal roads		**Consequence:** Lower aesthetic values enjoyed by the community. **Addressed under "Receiving Environment: Soil and Rock" and Receiving Environment: Terrestrial Flora"**		
Clearing/Grubbing and Grading	Construction camp (incl. operational area), borrow pit, upgrading existing and new roads, trenches for underground cables and water pipes, holes for racks, fence posts and pylons, foundations for inverters, field transformers and on-site substation, water storage tanks and deionization plant.	Dust generation	**Impact:** Vegetation clearing creates bare and exposed surfaces that will dry out and increase the risk of wind-blown dust, and visible air pollution. **Consequences:** Dust may become a nuisance to sensitive receptors (neighbouring farmers). **Addressed under "Receiving Environment: Soil and Rock" and Receiving Environment: Terrestrial Flora"**	N/A	42

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 40 (Decrease in sense of place – litter, removal of vegetation)

- There is a strong sense and spirit of place associated with the Karoo landscape. The surrounding farms are used for sheep farming, game farming and hunting. The current residents and farm owners have a strong sense of place associated with the farms. Many things can impact on a person's perception of sense of place. Farms are generally noisy places if one considers animal-sounds and farming activities. From the receptors' perspective, this kind of noise is acceptable and even attractive, because this is what living on a farm is all about. Noises such as alarms and reverse hooters are not "normal" and disturb the sense of place and the value that people place on the auditory environment. Although lights are used as a security measure on farms, one of the things people values is the absence of bright lights and that they can see the stars. Lights for any other use than lightening up their direct environment is seen as invasive and disturbs the sense of place. Visual aspects are an important consideration in the experience of sense of place. If people are used to unspoiled vistas, or seeing open fields, the establishment

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Reg: 2006/023163/23

of any buildings or infrastructure that they feel do not belong there can alter their sense of place. Sense of place refers to an individual's personal relationship with his/her local environment, both social and natural, which the individual experiences in his/her everyday daily life (Vanclay et al, 2015). It is highly personal, and once it is affected, it cannot be restored. It is also difficult to quantify. Part of the sense of place is the emotional attachment that the farmers have to their properties, and the hopes that they have for it to serve future generations (their children).

- The spirit of place associated with an area is an important factor in tourism and hunting and the marketing of these activities. Spirit of place refers to the unique, distinctive, and cherished aspects of a place. Aspects that will impact on the sense and spirit of place include an increase in noise and activity levels from construction activities, but this will be a temporary impact during the construction phase.
- Although there is visual and biodiversity impact assessment reports that suggest mitigation, it must be acknowledged that the sense of place will be altered permanently and given the personal experience of this impact from some stakeholders, successful mitigation is extremely hard to do. In the eye of the affected parties the only thing that will not alter the sense and spirit of the place in this instance is to avoid any further development.

Impact 41 (Alien plants)

- No large-scale populations of any listed alien invasive species were noted on site. However, disturbance and construction activity can result in the recruitment of alien invasive plant species.
- This impact **has been mitigated under "Receiving Environment: Terrestrial Flora" and "Aquatic Flora" and therefore do not need to be repeated here.**

Impact 42 (Erosion and Dust)

- The construction phase will see a total transformation from the current setting and landscape of the proposed site. It is inevitable that the visual impact during the construction phase will be affected by dust, increase in vehicle traffic and other construction activities.
- This impact **has been mitigated under "Receiving Environment: Terrestrial Flora" and "Soil and Rock" and therefore do not need to be repeated here.**

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**

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Reg: 2006/023163/23

H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
40	M	M	M	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Social Impact Assessment Report prepared by Ilse Aucamp of Equispectives Research & Consulting Services dated August 2022.
- Richard Vimpany (Neighbouring landowner and registered Interested and Affected Party).
- Personal communication with Steve Stead, Visual Resource Management Africa cc.
- Visual Impact Assessment Report (Final v_2) dated 19th September 2022, prepared by Stephen Stead of Visual Resource Management Africa cc.

Mitigations:

Impact Management Outcome(s):

- A less dominant landscape change to local or neighbouring receptors

Targets:

- No signs of litter.
- No excessive or unnecessary disturbed areas.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
40	General and hazardous waste management	Short-term landscape change from the current rural agricultural sense of place to the semi-industrial RE landscape - Wind-blown litter from the laydown and construction sites (fencing can trap wind-blown litter).	A less dominant landscape change to local or neighbouring receptors	No signs of litter	Littering should be a finable offence.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.
40	Clearing, grubbing and grading	Decrease in the "sense of place" as it relates to noise, visual and light pollution.	A less dominant landscape change to local or neighbouring receptors	No excessive or unnecessary disturbed areas	Minimise areas of surface disturbance.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
40	L	L	L	-I	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
40	L	L	L	neutral	L	L	0	L	L	0

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Residual Risk (feeds back into "Mitigations"):

- The residual risk of litter and vegetation removal (**40**) on visual aesthetic values after mitigation is estimated to be Medium to Low, but generally acceptable.
- The residual risk of alien plant recruitment (**41**) on visual aesthetics has been mitigated **under "Receiving Environment: Terrestrial Flora" and "Aquatic Flora" and therefore do not need to be repeated here.**
- The residual risk of erosion and dust generation (**42**) on visual aesthetics has been mitigated **under "Receiving Environment: Terrestrial Flora" and "Soil and Rock" and therefore do not need to be repeated here.**

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Reg: 2006/023163/23

Receiving Environment: Heritage and Culture

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Chance Finds Protocol Clearing/Grubbing and Grading and Earthworks	Excavating and Trenching	Destruction of artefacts	**Impact:** Earthmoving activities could damage or destroy artefacts or fossils. **Consequence:** The loss of a heritage resources undermines the understanding of previous generations that is vital to creating a sense of unity, belonging, and even pride among South Africans (risk).	N/A	43

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 43 (Archaeology)

- A total of 31 sites were identified during the 2022 assessment in the study and development area (Sites 26-31 are located outside of the proposed development footprint). They included a fairly larger number of open-air Stone Age surface sites (with varying degrees of density), a recent stone kraal and some stone cairns that are most likely associated with an old road.
- The open-air sites were all surface scatters with differing densities of material (cores, waste-flakes, more formal tools such as blades, scrapers and broken points) on them.
- Although the sites and finds situated in the proposed development footprint are open-air surface locations and are therefore not located in a primary & stratified context such as those in rock shelters and caves, it is believed that they could contribute to our knowledge of the Stone Age of the specific and larger geographical area. As is the case with the 2017 and 2021 Heritage Assessment, if the sites can't be avoided by the development activities that will be mostly drilling holes to insert the poles that support the solar modules, and two-track dirt roads and need to be destroyed as a result then mitigation is recommended prior to development commencing.
- The study area is not within a World Heritage Site or within 10 km of a World Heritage Site according to the PAR.
- Although the age, origin and function of this possible old road is not known, it could date to the late 19th/early 20th century, with some cultural material dating to this period found in association (Martini Henry cartridge). This was likely an old wagon road linking farmsteads with each other, as well as these with Hanover and other towns. From this point of view this road and related features (cairns) are relatively significant from a

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Reg: 2006/023163/23

Cultural Heritage point of view and at least should in part be preserved. Stone cairns can be demolished in sections where they cannot be avoided by development actions. The exact age and historical origin should also be researched.

Impact 43 (Palaeontology)

- The **Very High** Palaeontology theme according to the Screening Report was confirmed in the Site Sensitivity Verification Report.
- The project area is underlain at depth by potentially fossiliferous continental bedrocks of the Lower Beaufort Group (Karoo Supergroup) of Middle Permian age that have yielded sparse but scientifically important vertebrate remains in the Hanover area as well as commoner petrified wood. Also present are unfossiliferous dolerite intrusions and Late Caenozoic superficial sediments (e.g., alluvium, surface gravels) which might contain important fossil mammal and other remains as well as reworked fossil wood blocks. Satellite imagery suggests that bedrock exposure is limited but not insignificant within all three study sites. (*Dr. John Almond, NATURA VIVA cc*)
- "The most likely outcome, based on comparable project areas in the Hanover - De Aar region of the Great Karoo, is that comparatively few scientifically useful fossil sites will be recorded, while No-Go palaeontological areas are very unlikely to be designated. Most Karoo fossil sites are of limited extent and can be effectively mitigated in the pre-construction phase, so palaeontological constraints on the project footprint are not anticipated, although they cannot be completely excluded in advance." (*Dr. John Almond, NATURA VIVA cc*).

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
43	M	L	L	-R	M	M	1	H	M	1
Reversibility	L	**Irreplaceability**	L	**Mitigatory Potential**	H					

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Reg: 2006/023163/23

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- Preserve the section of old wagon road in the development footprint demarcated by the Heritage Specialist in a kmz file and stone cairns at sites 19 to 22.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- A Report on a Phase 1 Archaeological & Heritage Impact Assessment prepared by A.J. Pelser dated August 2022 (Report: APAC022/49).
- Site Sensitivity Verification Report for the Proposed Development of a 400 Mw Solar Photovoltaic Facility on the Remainder of Farm Goede Hoop 26c and Portion 3 Of Farm Goede Hoop 26C, between De Aar & Hanover, Emthanjeni Local Municipality, Pixley Ka Seme District Municipality, Northern Cape Province, South Africa prepared by John E. Almond of Natura Viva cc dated May 2022.
- National Heritage Resources Act, 1999 (Act No. 25 of 1999)
    - *Structures*
        - No person may alter or demolish any structure or part of a structure, which is older than 60 years without a permit issued by the LIHRA [2] (Section 34(1) of NHRA).
    - *Archaeological Sites and Remains*
        - In terms of Section 35(3) of the NHRA, any person who discovers archaeological or palaeontological objects or material or a meteorite during development or an agricultural activity must **immediately report the find** to the LIHRA.
        - In terms of Section 35(4) of the NHRA, **no person may without a permit** issued by the LIHRA destroy, damage, excavate, alter, deface, or otherwise disturb any archaeological or palaeontological site or any meteorite, or remove from its original position any archaeological, or palaeontological material or object or any meteorite.
    - *Graves*
        - In terms of Section 36(6) any person who during development discovers the location of a grave **must immediately cease such activity and report the discovery** to the LIHRA. The LIHRA must then, in co-operation with the SAPS, carry out an investigation.
        - In terms of Section 36(3) of the NHRA, **no person may, without a permit** issued by LIHRA, destroy, damage, alter, exhume, or remove from its original position or otherwise disturb the grave of a victim of conflict, any burial ground or part thereof which contains such graves, or any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority (Section 36(3) of NHRA).

Mitigations:

Impact Management Outcome(s):

- Protection and preservation of heritage resources.

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Reg: 2006/023163/23

Targets:

- Avoid unnecessary damage or destruction of heritage resources: Vigilance is observed.
- Avoid unnecessary damage or destruction of heritage resources: Written findings or photographs of cursory inspection.
- Avoid unnecessary damage or destruction of heritage resources: Supervision when clearing and grubbing, and excavating
- Avoid unnecessary damage or destruction of heritage resources: Construction has ceased at a site of discovery.
- Avoid unnecessary damage or destruction of heritage resources: Site of discovery has been cordoned off.
- Avoid unnecessary damage or destruction of heritage resources: A written response from the LIHRA and SAPS.
- Avoid unnecessary damage or destruction of heritage resources: Implement Chance Fossil Finds Protocol.
- Avoid unnecessary damage or destruction of heritage resources: Phase 2 rescue.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
43	Chance Finds Protocol Clearing, grubbing and Grading. Earthworks	Earthmoving activities could damage or destroy artefacts or fossils.	Protection and preservation of heritage resources.	Avoid unnecessary damage or destruction of heritage resources: Vigilance is observed.	The bulk of archaeological and palaeontological remains are normally located beneath or near the soil surface, so please be especially vigilant when clearing and grubbing, and excavating.	Contractor, SEO	During clearing and grubbing operations and excavations.	Compliance to be monitored by the SEO and verified by ECO and IEA.
43	Chance Finds Protocol Clearing, grubbing and Grading. Earthworks	Earthmoving activities could damage or destroy artefacts or fossils.	Protection and preservation of heritage resources.	Avoid unnecessary damage or destruction of heritage resources: Written findings or photographs of cursory inspection.	The ECO must give a cursory inspection of the soil surface for Stone Age open-air surface scatters (cores, waste-flakes, more formal tools such as blades, scrapers and broken points) before clearing, and of the bedrock after clearing and before drilling, in this case for small marine invertebrates and/or trace	Contractor, SEO, ECO	Before clearing and grubbing of bedrock in river.	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
					fossils (e.g., footprints, trails, burrows, etc.).			
43	Chance Finds Protocol Clearing, grubbing and Grading. Earthworks	Earthmoving activities could damage or destroy artefacts or fossils.	Protection and preservation of heritage resources.	Avoid unnecessary damage or destruction of heritage resources: Supervision when clearing and grubbing, and excavating	(3) The SEO shall supervise all clearing and grubbing, as well as excavation activities: (3.1) Examples of cultural or archaeological objects include inter alia (a) Stone Age open-air surface scatters (e.g., cores, waste-flakes, more formal tools such as blades, scrapers and broken points), and (b) stone cairns. (3.2) Examples of paleontological objects (fossils) include inter alia (a) Rare vertebrate bones and teeth, (b) petrified wood and other plant material, (c) Fossil mammal bones, teeth, horn cores, freshwater molluscs, calcretised termitaria, plant material in Late Caenozoic alluvium and pan deposits, and (d) Blocks of reworked silicified wood within surface gravels and older alluvium.	Contractor, SEO	During clearing and grubbing operations and excavations.	Compliance to be monitored by the SEO and verified by ECO and IEA.
43	Chance Finds Protocol	Earthmoving activities could damage or destroy	Protection and preservation	Avoid unnecessary damage or destruction of	If any evidence of archaeological sites or artefacts (e.g., remnants of stone-made structures	Contractor, SEO or ECO.	Chance Find Protocol - artefacts	Compliance to be monitored by the SEO

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
	Clearing, grubbing and Grading. Earthworks	artefacts or fossils.	of heritage resources.	heritage resources: Construction has ceased at a site of discovery.	or artefacts, indigenous ceramics, bones, stone cairns, ostrich eggshell fragments, charcoal, and ash concentrations), fossils or other categories of heritage resources are found or uncovered by construction staff during construction: 1. IMMEDIATELY cease the construction activity, 2. notify the ECO, 3. Alert SAHRA APM Unit (Natasha Higgitt/Phillip Hine 021 462 5402) and 4. don't tamper with the finds.			and verified by ECO and IEA.
43	Chance Finds Protocol Clearing, grubbing and Grading. Earthworks	Earthmoving activities could damage or destroy artefacts or fossils.	Protection and preservation of heritage resources.	Avoid unnecessary damage or destruction of heritage resources: Site of discovery has been cordoned off.	The site of discovery must be cordoned off and demarcated a no-go area with security tape / fence / sand bags if necessary. Access to construction staff shall be prohibited until further notice by the ECO.	Contractor, SEO or ECO.	Chance Find Protocol - artefacts	Compliance to be monitored by the SEO and verified by ECO and IEA.
43	Chance Finds Protocol Clearing, grubbing and Grading.	Earthmoving activities could damage or destroy artefacts or fossils.	Protection and preservation of heritage resources.	Avoid unnecessary damage or destruction of heritage resources: A written response from the LIHRA.	A professional archaeologist or palaeontologist, depending on the nature of the finds, must be contracted as soon as possible to inspect the heritage resource and	SEO or ECO, Heritage Specialist.	Chance Find Protocol - artefacts	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
	Earthworks				assess the significance of the findings.			
43	Chance Finds Protocol Clearing, grubbing and Grading. Earthworks	Earthmoving activities could damage or destroy artefacts or fossils.	Protection and preservation of heritage resources.	Avoid unnecessary damage or destruction of heritage resources: A written response from the SAPS.	In the case of unmarked human burials, the ECO shall also alert the local police and SAHRA Burial Grounds and Graves (BGG) Unit (Thingahangwi Tshivhase/ Ngqabutho Madida 012 320 8490).	SEO or ECO.	Chance Find Protocol - artefacts	Compliance to be verified by ECO and IEA.
43	Chance Finds Protocol Clearing, grubbing and Grading. Earthworks	Earthmoving activities could damage or destroy artefacts or fossils.	Protection and preservation of heritage resources.	Avoid unnecessary damage or destruction of heritage resources: Implement Chance Fossil Finds Protocol	In the case of finding any small pieces of petrified wood, particularly when excavating through the ephemeral drainage line between PV Blocks 1 and 2 (see Figure 2 of the SSV Report for Palaeontology, May 2022), simply relocate these to a safe place (a similar setting, preferably). Major finds of fossil wood or other fossil material (of high scientific and conservation value) will, however, trigger the Chance Fossil Finds Protocol (Appendix A).	SEO or ECO.	Chance Find Protocol - artefacts	Compliance to be verified by ECO and IEA.
43	Chance Finds Protocol Clearing, grubbing	Earthmoving activities could damage or destroy artefacts or fossils.	Protection and preservation of heritage resources.	Avoid unnecessary damage or destruction of heritage resources: Phase 2 rescue	If the newly discovered heritage resources prove to be of archaeological or paleontological significance, a Phase 2 rescue operation may be	SEO or ECO.	Chance Find Protocol - artefacts	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
	and Grading. Earthworks				required subject to permits issued by SAHRA.			
43	Chance Finds Protocol Clearing, grubbing and Grading. Earthworks	Earthmoving activities could damage or destroy artefacts or fossils.	Protection and preservation of heritage resources.	Avoid unnecessary damage or destruction of heritage resources: Area is cordoned off	Ensure the heritage site remains safeguarded until clearance is given by the Heritage Specialist and/or SAHRA for work to resume.	SEO or ECO.	Chance Find Protocol - artefacts	Compliance to be verified by ECO and IEA.

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
43	L	L	L	neutral	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
43	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

- The residual risk of damage to cultural heritage resources and paleoethological material like fossils and petrified wood (**43**) after mitigation is estimated to be Low.

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Reg: 2006/023163/23

PREFERRED ALTERNATIVE IMPACT ASSESSMENT

POST - CONSTRUCTION PHASE

TABLE OF CONTENTS

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Identification (and assessment) of impacts and risks for the preferred alternative

3(1) A EIA report… must include –

(h) a full description of the process followed to reach the proposed development footprint within the approved site, as contemplated in the accepted scoping report, including;

(v) the impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts- (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated;

(vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;

(viii) the possible mitigation measures that could be applied and level of residual risk;

Appendix 3 (Content of the EIA Report) of the EIA Regulations, 2014 as amended

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Reg: 2006/023163/23

Post - Construction Phase

Receiving Environment: Terrestrial fauna

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Facility Management	N/A	N/A	**Impact:** Roadkill, electrocutions of fauna during construction and post-construction. **Consequence:** Loss/injury to faunal species.	Quantity	01
Facility Management	N/A	N/A	**Impact:** Bird mortalities during the operational phase due to the addition of grazing sheep to the footprint which may attract raptor SCC who may scavenge on dead lambs/ adult sheep or prey upon livestock. **Consequence:** Decrease in avifauna population.	Quantity	01
Maintenance and Monitoring	N/A	Bat monitoring	**Impact:** Possible bat fatalities incurred from collisions with infrastructure associated with the solar PV facility including solar arrays, security fencing, transmission lines, and buildings. **Consequence:** Decline in bat population due to injury/death	Quantity	02
Maintenance and Monitoring	N/A	Avian Study monitoring	**Impact:** birds may collide with panels and overhead powerlines. **Consequence:** injury/death and decline in numbers.	Quantity	03
Maintenance and Monitoring	N/A	Avian Study monitoring	**Impact:** Cumulative impact of the project and other projects in the area concerning collision risk, habitat loss and fragmentation and loss of suitable habitat for threatened species. **Consequence:** Decline in numbers of avifauna/ disturbance to ecological patterns of avifauna	Quantity	03

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

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Reg: 2006/023163/23

Impact 01 (Animal Species)

- Sedentary animals pose a higher risk of harm than active animals.

Impact 03 (Bats)

- Annual monitoring during preconstruction, construction and during the operational phase will provide much needed insight into the changes in bat activity, species composition and ecology over the affected property.
- By following monitoring guidelines, data sets can be gathered that are comparable with other large-scale renewable energy projects that impact bats and consolidated to understand the extent of the impacts of these projects and define effective mitigation strategies.
- The risk of direct collisions of bats with solar PV panels is unknown and the perception of smooth surfaces by bats is not well studied. If bats perceive smooth surfaces as voids, solar PV panels left in a resting position perpendicular or more than 45 degrees in relation to the ground could pose a collision risk. However, this risk is negated for the proposed Phase 3 since single-axis tracker that allows the panels to be stowed horizontally at night to reduce wind-load and if bats are “confused” by the smooth surface or perceive it as a potential drinking source may approach the surface at a slower speed and not collide with it.
- A 1.8 m high galvanised diamond razor mesh security fence will be installed around each of the four PV Blocks within the facility. The risk of the security fence in relation to bat collisions and bat injury/mortality is largely unknown.

Impact 04 (Avian)

- The purpose of monitoring would be to establish if and to what extent displacement of priority species has occurred through the altering of breeding and foraging behaviour post-construction, and to search for and identify carcasses near panels and newly erected powerlines (mortality).
- According to SABAP2 and Taylor et al. (2015), and as mentioned above, seventeen (17) SCC are known to occur in the region with ten (10) species confirmed during the respective surveys, representing a very high success rate given the short study period. Of the confirmed species and according to Taylor et al. (2015), three of the species are Endangered, four of the species are Vulnerable species and three are Near Threatened. Given that even long-term studies conducted over multiple periods, these species warrant increased contextual discussion regarding predicted impacts and mitigation measures.
- As an Endangered species, Ludwig’s bustard demands higher degrees of auditing and monitoring attention than other Red-Listed birds (a fact supported by multiple publications including Visser et. al. 2018 and Scott et. al. 2012). It is also vital to highlight that presence or absence over time for a nomadic species is difficult to predict and spatial/ temporal population reductions may or may not be development-induced.

<u>Assessment without mitigation:</u>

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Reg: 2006/023163/23

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
01	M	M	M	-I	M	H	1	H	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
02	M	M	M	-I	M	H	1	H	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
03	M	M	L	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

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Reg: 2006/023163/23

- Perform continuous bat monitoring using passive bioacoustic recording systems in line with the South African Good Practice Guidelines for Surveying Bats at WEF's (Sowler and Stoffberg, 2014) and SAGPG for Operational Monitoring (Aronson et al. 2014) for one year pre-construction, during construction and two years post-construction (operation). During the first two years of operation, it is expected that any changes in bat activity and perceived impacts will be most evident.
- An EMPr for the Operational Phase must be created and be updated every three years in order to revaluate the effectiveness of the mitigations.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Chiropteran Specialist Report for Phase 3 of the Proposed Soventix-Solar Africa Solar PV Facility, Hanover, Northern Cape Prepared by: Dawn Cory Toussaint dated July 2022.
- Avifauna Specialist Assessment (Final) prepared by Enviro-Insight CC (Sam Laurence and A.E. van Wyk) dated October 2022.
- BirdLife SA's Best Practice Guidelines on Birds and Solar Energy (Jenkins et al., 2017).
- Terrestrial Animal Species Compliance Statement – Soventix Phase 3 Pv Project (Second Draft) prepared by Simon Todd of 3 Foxes Biodiversity Solutions dated September 2022.
- Terrestrial Biodiversity Specialist Assessment – Soventix Phase 3 PV Project prepared by Simon Todd of 3 Foxes Biodiversity Solutions dated September 2022.

Mitigations:

Impact Management Outcome(s):

- Faunal mortalities are reduced.
- Ensure protection of bats and aves.
- Cumulative impacts are monitored during post construction of the facility.

Targets:

- Log of fauna related incidents.
- Operational EMPr.
- Livestock carcasses are removed from site.
- Bat monitoring results.
- Bat monitoring systems in working order.
- Bat carcasses.
- Avian monitoring results.

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Reg: 2006/023163/23

- Target species movement and breeding is tracked.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
01	Facility Management	Roadkill, electrocutions of fauna during construction and post-construction.	Faunal mortalities are reduced.	Log of fauna related incidents	A log should be kept detailing all fauna-related incidences or mortalities that occur on site, including roadkill, electrocutions etc. during construction and operation. These should be reviewed annually and used to inform operational management and mitigation measures.	Holder	On-going. Reviewed annually	Compliance to be verified by ECO and IEA.
01	Facility Management	Roadkill, electrocutions of fauna during construction and post-construction.	Faunal mortalities are reduced.	Operational EMPr	An EMPr for the Operational Phase must be created and be updated every three years in order to revaluate the effectiveness of the mitigations.	Holder, SEO	Operation and updated every 3 years	Compliance to be verified by ECO and IEA.
01	Facility Management	Bird mortalities during the operational phase due to the addition of grazing sheep to the footprint which may attract raptor SCC who may scavenge on dead lambs/ adult sheep or	Ensure protection of aves	Livestock carcasses are removed from site.	Strict carcass retrieval. Where carcasses are removed and correctly disposed of within the same day of death. This will require constant monitoring of all sheep herds in the footprint.	Holder, Landowner, SEO	On-going	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		prey upon livestock.						
02	Maintenance and Monitoring	Possible bat fatalities incurred from collisions with infrastructure associated with the solar PV facility including solar arrays, security fencing, transmission lines, and buildings.	Ensure protection of bats	Bat monitoring results	Perform continuous bat monitoring using passive bioacoustic recording systems in line with the South African Good Practice Guidelines for Surveying Bats at WEF's (Sowler and Stoffberg, 2014) and SAGPG for Operational Monitoring (Aronson et al. 2014) for one year pre-construction, during construction and two years post-construction (operation). During the first two years of operation, it is expected that any changes in bat activity and perceived impacts will be most evident.	Holder, Bat specialist, SEO	Two years post-construction	Compliance to be verified by ECO and IEA.
02	Maintenance and Monitoring	Possible bat fatalities incurred from collisions with infrastructure associated with the solar PV facility including solar arrays, security fencing,	Ensure protection of bats	Bat monitoring systems in working order	A specialist should maintain these systems and determine the impacts of solar PV facility on bat populations in relation to landscape changes in both the physical changes with the installation of the solar PV panels, the resulting change in	Holder, Bat specialist, SEO	Two years post-construction	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		transmission lines, and buildings.			vegetation structure underneath the solar PV panels and the management strategy of the operational facility.			
02	Maintenance and Monitoring	Possible bat fatalities incurred from collisions with infrastructure associated with the solar PV facility including solar arrays, security fencing, transmission lines, and buildings.	Ensure protection of bats	Bat carcasses	Mortality searches near infrastructure and along the security fence line must be conducted to determine if the security fences pose a threat to bats	Holder, Bat specialist, SEO	On-going	Compliance to be verified by ECO and IEA.
03	Maintenance and Monitoring	Impact: birds may collide with panels and overhead powerlines.	Ensure protection of aves	Avian monitoring results	Two years (repeat baseline monitoring, plus carcass searches); may include construction phase.	Holder, Avian specialist, SEO	Two years (including construction phase)	Compliance to be verified by ECO and IEA.
03	Maintenance and Monitoring	Impact: birds may collide with panels and overhead powerlines.	Ensure protection of aves	Avian monitoring results	The need for further baseline data collection is assessed, particularly if considerable time elapses between collection of data for impact assessment and the commencement of construction.	Holder, Avian specialist, SEO	Two years (including construction phase)	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
03	Maintenance and Monitoring	Impact: birds may collide with panels and overhead powerlines.	Ensure protection of aves	Avian monitoring results	The post-construction monitoring protocols are refined and post-construction monitoring is initiated as soon as the solar arrays are in place. Post-construction phase monitoring data are periodically analysed, and if necessary, data collection protocols are adjusted to ensure that sufficient data are accumulated and sufficient coverage is achieved to adequately inform operational decisions.	Holder, Avian specialist, SEO	As soon as the solar arrays are in place	Compliance to be verified by ECO and IEA.
03	Maintenance and Monitoring	Cumulative impact of the project and other projects in the area concerning collision risk, habitat loss and fragmentation and loss of suitable habitat for threatened species.	Cumulative impacts are monitored during post construction of the facility.	Avian monitoring results	Formal post construction monitoring must be applied once the development has been activated, as per the most recent edition of the best practice guidelines (Jenkins et al. 2017).	Holder, Avian Specialist, SEO	Operation	Compliance to be verified by ECO and IEA.
03	Maintenance and Monitoring	Cumulative impact of the project and	Cumulative impacts are monitored	Avian monitoring results	Post-construction monitoring should be undertaken as per the	Holder, Avian Specialist,	On-going	Compliance to be verified by

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		other projects in the area concerning collision risk, habitat loss and fragmentation and loss of suitable habitat for threatened species.	during post construction of the facility.		EMPr. The exact scope, nature and frequency of the post-construction monitoring will be informed on an ongoing basis by the results of the monitoring through a process of adaptive management.	SEO		ECO and IEA.
03	Maintenance and Monitoring	Cumulative impact of the project and other projects in the area concerning collision risk, habitat loss and fragmentation and loss of suitable habitat for threatened species.	Cumulative impacts are monitored during post construction of the facility.	Target species movement and breeding is tracked	High value target species such as Tawny Eagle, Verreaux's Eagle, Secretary Bird, Bustards and Martial Eagles can be tracked using periodic ECO monitoring regimes to monitor movement patterns and breeding success. These programs should be implemented during and post construction	Holder, Avian Specialist, SEO	On-going	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
01	L	L	M	-I	M	M	1	L	L	0

Alternative No. 2 – No-Go Option

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Reg: 2006/023163/23

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
01	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
02	L	L	L	-I	M	M	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
02	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
03	L	M	L	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
03	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

- The residual risk of a loss of animal species due to road collisions, electrocutions, collisions with fencing etc. (**01**) after mitigation is assumed to be Low.
- The residual risk of a loss of bat species and changes to bat behaviours (**02**) after mitigation and monitoring is implemented is assumed to be Low.
- The residual risk of a loss of avian species and changes to avian behaviours (**03**) after mitigation and monitoring is implemented is assumed to be Low.

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Reg: 2006/023163/23

Receiving Environment: Terrestrial flora

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Rehabilitation	Disturbed areas – terrestrial and aquatic. Borrow Pit	Overgrazing	**Impact:** New growth will be selected for by grazers resulting in overgrazing, which can weaken plant vigour or its capacity to recover. **Consequence:** - Reduced productivity and carrying capacity (direct). - Reduced plant cover increases erosion leading to ecosystem degradation and dysfunction (indirect).	Quantity	04
Maintenance and Monitoring		Erosion	**Impact:** Risk of erosion at the base of the panels. **Consequence:** Erosion, sedimentation of watercourse.	Quantity	05
Maintenance and Monitoring		Revegetation	**Impact:** Revegetation may not be sufficient to bind and protect the topsoil from erosion. **Consequence:** - reduced productivity and carrying capacity (direct). - altered or dysfunctional ecosystem (indirect). - loss of biodiversity and climate change resilience	Quantity	05

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 04 (Overgrazing)

- The grazing capacity for Phase 3 in 2022 is the result of vegetation responses from higher rainfall compared with 2017.
- Regenerative grazing management improves the grass basal cover, water cycle, as well as the accumulation of organic matter on the soil surface, enhancing the mineral cycle and improving the water holding capacity of the soil, ensuring minimal soil temperature fluctuations, and improving the grass composition and forage production potential of the grass layer.
- Ultra-high density grazing strategies results in the controlled impact of hooves, trampling grasses in moribund state ("taller unpalatable, woody grasses, with vertical growth form and unfavourable structure for grazers), covering bare ground and improving the carbon cycle.
- Kraaling, that is short duration trampling & over-night occupancy of patches to allows for the deposition of manure and grass seed.
- Resting camps will improve the recovery of forage reserves, allow grasses to seed and establish Decreaser species, thereby improving the grass production potential.

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Reg: 2006/023163/23

- The total exclusion of grazers in such environments will be detrimental to maintaining important ecological processes such as the energy cycle, mineral cycle, and water cycle.
- Overgrazing or continuous grazing in areas should be prevented by planned resting. Time management per camp is essential. This includes removing grazers when available forage reserves become low, resting of camps for periods up to 12 months, at a frequency of once every four years. This will assist to improve recovery of forage reserves and allow for grass seeding and establishment of Decreaser grasses, which will result in an improvement in grass production potential. Sound management will improve the grass and bossie components with important forage species. This recommendation applies to all the camps. Planned resting should be carefully controlled while monitoring veld condition. It is especially important not to let any area be excluded from grazing as this will inevitably result in degradation in veld condition and in soil erosion.
- Furthermore, if the management guidelines are not followed in this report, it is envisaged that further deterioration in grass basal cover will occur, associated with increased bare ground and accelerated soil erosion, and it is envisaged that the potential impact from the planned development would then also need to be considered and be mitigated for.

Impact 05 (Erosion)

- The entire site has very thin soils and either bedrock sub-outcrop at less than 0,5 metres depth below ground surface or bedrock outcrop/dispersed outcrop. The thickest soils of 1,0 to 1,2 metres thickness over minor parts occur in areas of either gully wash material, alluvial deposits or pediplain positions (at low landscape localities). These soils are generally of a silty sand to clayey sand nature.
- Most of the soils are very shallow with an average depth of less than 30cm. Clay content ranges from sandy loam to very clayey. Calcareous soils are covering relatively small areas. Soils are unsuitable for most types of agriculture.
- No severe donga erosion has been observed in the study areas. Minor to moderate plate erosion is present. Severe donga and sheet erosion have been observed on flood plains outside the study areas.
- It is not envisaged that the proposed development will result in major soil erosion or any other degradation of the soils of the focus areas if there is proper runoff management from roads and other bare areas.

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant

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Reg: 2006/023163/23

L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
04	L	M	L	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
05	L	M	L	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Aquatic Biodiversity Impact Assessment, Section 21(c) & (i) Risk Assessment and Wetland Delineation Verification Report prepared by Dr Andrew Deacon dated August 2022.
- Grazing Potential Assessment prepared by Francois de Wet of Enviro Pulse and Shobie Arnoldi of Topveld dated June 2022.

Mitigations:

Impact Management Outcome(s):

- Restoration of provisioning services, particularly food or grazing for livestock, and regulating services such as erosion control.
- Preserve topsoil, control erosion.

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Reg: 2006/023163/23

- Restoration of ecological functioning or ecosystem services.

Targets:

- No signs of restoration areas being grazed.
- No sheep in rehabilitated areas.
- No bare areas between and below panels.
- Visual inspections.
- Grass cover at panel bases is maintained.
- Inspections after heavy rainfall events.
- Successful rehabilitation.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
04	Rehabilitation	New growth will be selected for by grazers resulting in overgrazing, which can weaken plant vigour or its capacity to recover.	Restoration of provisioning services, particularly food or grazing for livestock, and regulating services such as erosion control.	No signs of restoration areas being grazed	Protect vegetation recruitment from grazers by packing brush from legitimate bush clearing operations onto topsoiled and/or reseeded areas.	Holder, Landowner, Contractor	On-going	Compliance to be verified by ECO and IEA.
04	Rehabilitation	New growth will be selected for by grazers resulting in overgrazing, which can weaken plant vigour or its capacity to recover.	Restoration of provisioning services, particularly food or grazing for livestock, and regulating services such as erosion control.	No sheep in rehabilitated areas	Do not allow sheep into rehabilitated areas during the first growing season.	Holder, Landowner, Contractor	On-going	Compliance to be verified by ECO and IEA.
05	Maintenance and Monitoring	Risk of erosion at the base of the panels.	Preserve topsoil, control erosion	No bare areas between and below panels	A vegetation cover that at least matches the natural,	Holder	On-going	Compliance to be verified

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					pre-development cover, should be maintained at all times between and beneath the solar panels.			by ECO and IEA.
05	Maintenance and Monitoring	Risk of erosion at the base of the panels.	Preserve topsoil, control erosion	Visual inspections	Monitoring in the form of visual inspections of the vegetation cover.	Holder	On-going	Compliance to be verified by ECO and IEA.
05	Maintenance and Monitoring	Risk of erosion at the base of the panels.	Preserve topsoil, control erosion	Grass cover at panel bases is maintained	Grass cover at base of panels, particularly on drip line, should be actively maintained.	Holder	On-going	Compliance to be verified by ECO and IEA.
05	Maintenance and Monitoring	Risk of erosion at the base of the panels.	Preserve topsoil, control erosion	Inspections after heavy rainfall events	Inspection of the area frequently especially after intense rainfall and runoff events, with particular emphasis on the dripline areas and at access roads.	Holder	Ongoing	Compliance to be verified by ECO and IEA
05	Maintenance and Monitoring	Revegetation may not be sufficient to bind and protect the topsoil from erosion	Restoration of ecological functioning or ecosystem services.	Successful rehabilitation	Regularly monitor the effectiveness of revegetation on the rehabilitated areas, and if necessary, implement appropriate corrective measures, which may include bringing in additional topsoil,	ECO	On-going	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					reseeding, mulching and/or additional brush packing depending on the reasons for the failure of the original re-vegetation methods.			

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
04	L	M	L	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
04	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
05	L	M	L	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
05	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

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Reg: 2006/023163/23

- The residual risk of loss of overgrazing (**04**) after mitigation and implementing proper rangeland management is assumed to be Low.
- The residual risk of soil erosion (**05**) particularly due to unsuccessful rehabilitation/revegetation after mitigation is assumed to be Low.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Receiving Environment: Aquatic flora

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Rehabilitation	Disturbed areas - aquatic	Bare ground Overgrazing	**Impact:** A direct loss of local aquatic plants by construction activities in a watercourse. **Consequences:** - The loss of threatened (Red Data) species may result in a loss of biodiversity and ecosystem resilience to climate change (direct). - The loss of a threatened keystone species may alter the functioning of the aquatic ecosystem (direct).	Quantity	06

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 06 (General)

- In terms of the regional vegetation and aquatic habitat composition, there is very little discernible riparian vegetation, which consists of a relatively dense low shrubby system, often visible by the formation of smaller washes and dense encroachment by spiny shrubs. Nonetheless, the vegetation integrity score is 93.9% which represents an Ecological Class A (90-100%), which is considered an "Unmodified, natural." status.
- The only aquatic habitat present to sample, was a series of isolated pools in the system, filled with rainwater but not flowing. These pools are certainly very temporary and the habitats available were overhanging grass and a sandy pool bottom with loose pebbles and stones. The Integrated Habitat Assessment System (IHAS) and Habitat Quality Index (HQI) scores were mostly "Poor" due to the shallow water level, brief presence of surface water and the lack of flow.

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
06	L	L	L	-I	L	L	0	L	L	0

Reversibility	H	Irreplaceability	H	Mitigatory Potential	H

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Aquatic Biodiversity Impact Assessment, Section 21(c) & (i) Risk Assessment and Wetland Delineation Verification Report prepared by Dr Andrew Deacon dated August 2022.

Mitigations:

Impact Management Outcome(s):

- Reinstate the 'riparian' habitat.

Targets:

- No bare patches.
- No artificial seeding in the ephemeral drainage line.
- Rehabilitated areas are protected.
- Successful rehabilitation using stockpiled sods.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
06	Rehabilitation	A direct loss of local aquatic plants by construction activities in a watercourse.	Reinstate the 'riparian' habitat.	No bare patches	Conduct active rehabilitation during the construction activities according to a rehabilitation plan or implement the Bare Patch Protocol (Appendix C) that will restore the natural vegetation to what it was prior to the construction of, for example, underground pipeline and cable routes, so that the long-term impact could be negligible.	Contractor, ECO	On-going	Compliance to be verified by ECO and IEA.
06	Rehabilitation	A direct loss of local aquatic plants by construction activities in a watercourse.	Reinstate the 'riparian' habitat.	No artificial seeding in the ephemeral drainage line.	As emergent wetlands will recover more quickly than others, artificial seeding is not advised as it creates competition for reestablishment of native facultative and obligate wetland vegetation.	Contractor, SEO	On-going	Compliance to be verified by ECO and IEA.
06	Rehabilitation	A direct loss of local aquatic plants by construction activities in a watercourse.	Reinstate the 'riparian' habitat.	Rehabilitated areas are protected	Cordon off areas under rehabilitation as “no-go areas” to prevent vehicular, pedestrian and livestock access.	Contractor, ECO	On-going	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
06	Rehabilitation	A direct loss of local aquatic plants by construction activities in a watercourse.	Reinstate the 'riparian' habitat.	Successful rehabilitation using stockpiled sods	Once construction is completed, those sods that were removed during the clearing operation and stored, should be used to rehabilitate the disturbed areas from where they were removed. In the absence of timely rainfall, the sods should be watered well after planting and at least twice more over the next 2 weeks.	Contractor, ECO	On-going	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
06	L	L	L	-I	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
06	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

- The residual risk of loss of threatened aquatic plants during post-construction (**06**) after mitigation is assumed to be Low.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Receiving Environment: Soil and Rock

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Rehabilitation	Pollution and Waste	Soil contamination (hydrocarbon spills)	**Impact:** Hydrocarbon spills can contaminate soil resulting in soil pollution **Consequence:** Reduced soil viability interferes with supporting services (nutrient cycle, microbial decomposition, etc.) necessary for sustaining healthy ecosystems (direct).	Quality	07
Maintenance and Monitoring		Compromised topsoil	**Impact:** Spills from damaged and leaking substations will contaminate the topsoil (Risk). **Consequences:** -sterile habitat for fauna and flora.	Quality	07
Rehabilitation	Borrow Pit Disturbed areas - terrestrial	Surface water hydrology (run-off)	**Impact:** Altered surface water flow pattern causing ponding or erosion. **Consequence:** Altered or degraded terrestrial ecosystem function (direct)	Quantity	08
Rehabilitation		Compaction	**Impact:** The driving and parking of vehicles, for example, will compact the ground increasing surface water run-off and erosion. **Consequence:** Degraded or dysfunctional terrestrial ecosystem (direct).	Quantity	08
Rehabilitation		Compromised topsoil	**Impact:** Insufficient topsoil **Consequence:** Degraded or dysfunctional terrestrial ecosystem (direct).	Quantity	08
Rehabilitation		Compromised topsoil	**Impact:** Topsoil that has been stockpiled for too long may lose its viability. **Consequence:** Reduced soil viability interferes with supporting services (nutrient cycle, microbial decomposition, etc.) necessary for sustaining healthy ecosystems (direct).	Quality	08

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Reg: 2006/023163/23

Rehabilitation		Bare ground	**Impact:** Bare patches (or areas where the original vegetation was cleared or severely disturbed) are susceptible to erosion. **Consequence:** Erosion leads to dysfunctional landscapes and reduced agricultural potential.	Quantity	08
Rehabilitation		Bare ground	**Impact:** Areas cleared or disturbed around site might be affected by erosion of topsoil. **Consequence:** Increased turbidity and siltation in watercourses.	Quantity	08
Maintenance and Monitoring		Erosion	**Impact:** Erosion of rehabilitated terrestrial areas. **Consequence:** Degraded or dysfunctional terrestrial ecosystem (direct).	Quantity	08
Maintenance and Monitoring		Erosion	**Impact:** Risk of erosion **Consequence:** Erosion, sedimentation of watercourse.	Quantity	08
Maintenance and Monitoring		Compromised topsoil	**Impact:** Natural revegetation may not be sufficient to bind and protect the topsoil from erosion. **Consequence:** Degraded or dysfunctional ecosystem.	Quantity	08
Maintenance and Monitoring		Revegetation	**Impact:** Revegetation may not be sufficient to bind and protect the topsoil from erosion. **Consequence:** Altered or dysfunctional ecosystem and loss of biodiversity and climate change resilience.	Quantity	08
Rehabilitation		Surface water hydrology (run-off)	**Impact:** Change the visual aesthetics of the Nama Karoo. **Consequence:** Loss of cultural services, negatively impacting on human well-being.	Quantity	09

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

- During the rainy season terrain mobility on high clay soils in low lying areas with drainage lines will be difficult and might increase soil erosion when drainage lines are disturbed.

Impact 07 (Soil quality –contamination)

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

- The study area is part of the Beaufort Group of the Karoo Supergroup of geology in South Africa and consist mainly of sandstones and shales dominated by the Mispah soil form. Sub dominant soil forms are Swartland and Oakleaf forms. Dolerite koppies also form a small but conspicuous part of the landscape.
- Construction equipment (risk of leaking/spills of hydrocarbons) will include at least: Water tankers; Graders; Tipper trucks; Drilling rigs (down to 2m); Mobile pile ramming machines (down to 3m at the most); Rock crushing plant; Excavators; TLBs; Concrete mixers; Compaction equipment; Light delivery vehicles; and Heavy delivery vehicles (for the transformers).

Impact 08 (Soil quantity – erosion, loss of topsoil)

- The entire site has very thin soils and either bedrock sub-outcrop at less than 0,5 metres depth below ground surface or bedrock outcrop/dispersed outcrop. The thickest soils of 1,0 to 1,2 metres thickness over minor parts occur in areas of either gully wash material, alluvial deposits or pediplain positions (at low landscape localities). These soils are generally of a silty sand to clayey sand nature.
- Most of the soils are very shallow with an average depth of less than 30cm. Clay content ranges from sandy loam to very clayey. Calcareous soils are covering relatively small areas. Soils are unsuitable for most types of agriculture.
- No severe donga erosion has been observed in the study areas. Minor to moderate plate erosion is present. Severe donga and sheet erosion have been observed on flood plains outside the study areas.
- Keeping as much of the original vegetation intact should be a high priority during all phases. The project area is situated on Karoo sediments that are known for high sodium and magnesium content in the soil. Sodic soils are highly dispersive, that is susceptible to soil capping and erosion.
- The only area of concern is potential enhanced soil erosion. Some infrastructure e.g., substations will have weatherproof surfaces and will cover in general relatively small areas with very little influence on soil erosion. Most of the areas will be covered by PV solar panels.
- Erosion and sedimentation are only likely to take place during severe storm events (e.g., 1:2 to 1:100y events). Incidental rainfall will likely not cause sedimentation.
- It is not envisaged that the proposed development will result in major soil erosion or any other degradation of the soils of the focus areas if there is proper runoff management from roads and other bare areas.

Impact 09 (Visual)

- The visual recommendations from the scoping phase reporting were all incorporated into the layout design, accommodating a wide buffer on the adjacent properties, as well as accommodating wide ecological corridors between the four PV blocks. While the local sense of place will be modified, the impacted visual resources are localised to some degree and are not highly significant such that a No-go Option would be preferred. Goede Hoop Farmstead could experience partial views of the panels at 4.5 km (the dwelling is at the fringe of the viewshed analysis), with direct views from Skilpadskuil Farmstead screened by local vegetation. As such, the Preferred PV development option is recommended with mitigation.

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Reg: 2006/023163/23

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
07	H	L	H	-I	H	M	1	M	L	0
Reversibility	L	**Irreplaceability**	M	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
08	H	L	M	-I	H	M	1	H	M	1
Reversibility	M	**Irreplaceability**	M	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
09	H	L	M	-I	H	M	1	H	M	1
Reversibility	M	**Irreplaceability**	M	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

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Reg: 2006/023163/23

- Proper runoff management from roads and other bare areas is to be implemented.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Hydrological Assessment (Version – Final 3) 01 September 2022 GCS Project Number: 22-0076 by Hendrik Botha.
- Geohydrological Assessment Report (Final Rev 3) prepared by GCS Water and Environmental Consultants dated 10th August 2022 (GCS Project Number: 22-0401).
- Soil Mapping Report prepared by Hennie van den Burg of Iris International and Francois Botha of Eco Soil dated June 2022.
- Aquatic Biodiversity Impact Assessment, Section 21(c) & (i) Risk Assessment and Wetland Delineation Verification Report prepared by Dr Andrew Deacon dated August 2022.
- Plant Species Compliance Statement – Soventix Phase 3 Pv Project prepared by Simon Todd of 3 Foxes Biodiversity Solutions dated September 2022.
- Visual Impact Assessment Report (Final v_2) dated 19th September 2022, prepared by Stephen Stead of Visual Resource Management Africa cc.

Mitigations:

Impact Management Outcome(s):

- Preserve landscape hydrological pattern
- Good quality soil for reinstatement
- Improve surface water infiltration and minimise erosion
- Minimize loss of topsoil
- Control soil erosion
- Restoration of ecological functioning or ecosystem services
- Successful revegetation and rehabilitation of disturbed areas
- Retain aesthetic values and sense of place or restore ecosystem cultural services

Targets:

- No signs of pollution, e.g., contaminated soil
- Waybill(s)
- Field transformers are well maintained
- Shaped to natural forms indicative of the site's location within the landscape

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Reg: 2006/023163/23

- Ripped areas remain rough
- Ripped areas have been covered with a sufficient topsoil layer
- No rills in the replaced topsoil
- Rehabilitated areas have been mulched
- Stockpile test results and ameliorated
- Topsoil harvesting during dry season
- Restored bare patches.
- Successful revegetation
- No signs of erosion
- Revegetated areas must achieve at least 75% of the aerial cover of adjacent undisturbed areas within the first growing season.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
07	Rehabilitation	Hydrocarbon spills can contaminate soil resulting in soil pollution	Good quality soil for reinstatement.	No signs of pollution, e.g., contaminated soil. Waybill(s)	Remove all signs of pollution from site, e.g., hydrocarbon spills, slurry, concrete hardpan layers, etc. to the depth of penetration for disposal at an appropriate licensed landfill.	Contractor, SEO	Ongoing	Compliance verified by ECO and IEA
07	Rehabilitation	Hydrocarbon spills can contaminate soil resulting in soil pollution	Good quality soil for reinstatement.	No signs of pollution, e.g., contaminated soil. Waybill(s)	Remove all waste from site, e.g., litter, concrete debris or rubble, used oil, etc. for collection by a registered collector and/or disposal at an appropriate licensed landfill.	Contractor, SEO	Ongoing	Compliance verified by ECO and IEA
07	Maintenance and Monitoring	Spills from damaged and leaking	Good quality soil for reinstatement.	Field transformers are well maintained	Regular inspections (monthly) and	Holder	On-going	Compliance to be verified by

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		substations will contaminate the topsoil			maintenance of field transformers.			ECO and IEA
08	Rehabilitation	Altered surface water flow pattern causing ponding or erosion.	Preserve landscape hydrological pattern.	Shaped to natural forms indicative of the site's location within the landscape	All disturbed areas should be reshaped to retain landscape hydrological pattern, that is the natural functioning of the site (as a source, transfer, sink or any combination of these) relating to the redistribution of surface water and sediment.	Contractor	On-going	Compliance to be verified by ECO and IEA
08	Rehabilitation	Altered surface water flow pattern causing ponding or erosion.	Preserve landscape hydrological pattern.	Shaped to natural forms indicative of the site's location within the landscape	Revegetate denuded areas as soon as possible to maintain ground cover across the site.	Contractor	As soon as possible	Compliance to be verified by ECO and IEA
08	Rehabilitation	The driving and parking of vehicles, for example, will compact the ground increasing surface water run-off and erosion.	Good quality soil for reinstatement	Ripped areas have been covered with a sufficient topsoil layer	All compacted surfaces from construction activities must be ripped to a minimum depth of 250 mm in two directions at right angles.	Contractor, SEO	Once-off	Compliance verified by ECO and IEA
08	Rehabilitation	The driving and parking of vehicles, for	Good quality soil for reinstatement	Ripped areas have been covered with a	Alternatively, smaller compacted or bare areas can	Contractor, SEO	Once-off	Compliance verified by

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		example, will compact the ground increasing surface water run-off and erosion.		sufficient topsoil layer	be tilled using a hand-held hoe to a depth of 150 – 200 mm, and perpendicular to the prevailing slope.			ECO and IEA
08	Rehabilitation	Insufficient topsoil	Good quality soil for reinstatement	Ripped areas remain rough.	All ripped areas must be left rough to facilitate binding of topsoil.	Contractor, SEO	Once-off	Compliance verified by ECO and IEA
08	Rehabilitation	Insufficient topsoil	Good quality soil for reinstatement	Ripped areas have been covered with a sufficient topsoil layer	Reinstate 150mm – 200mm of topsoil on the ripped subsoil.	Contractor, SEO	Once-off	Compliance verified by ECO and IEA
08	Rehabilitation	Insufficient topsoil	Good quality soil for reinstatement	No rills in the replaced topsoil	Topsoil replaced on steep slopes that are particularly susceptible to erosion must be stabilised with erosion control fabric, mats, netting, or blankets made of natural fibres (proper installation is critical to success).	Engineer, Contractor, SEO	Ongoing	Compliance to verified by ECO and IEA.
08	Rehabilitation	Insufficient topsoil	Good quality soil for reinstatement	Rehabilitated areas have been mulched.	Reinstated topsoil must be stabilised by brushpacking the stockpiled mulch from the clearing operations (good mulch-to-soil	Contractor, SEO	Once-off	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					contact is critical to success).			
08	Rehabilitation	Topsoil that has been stockpiled for too long may lose its viability.	Restoration of ecosystem services.	Stockpile test results and ameliorated	If the topsoil has been stockpiled for two or more growing seasons, then it shall be tested for pH, nutrients, colloidal matter, microbes, etc. to determine its viability, and ameliorated accordingly, prior to its reinstatement on disturbed areas.	Contractor, SEO	Once-off	Compliance to be verified by ECO and IEA.
08	Rehabilitation	Topsoil that has been stockpiled for too long may lose its viability.	Restoration of ecosystem services.	Topsoil harvesting during dry season	All topsoil harvesting must take place in the dry season (late dry season).	Contractor, SEO	Once-off	Compliance to be verified by ECO and IEA.
08	Rehabilitation	Bare patches (or areas where the original vegetation was cleared or severely disturbed) are susceptible to erosion.	Improve surface water infiltration and minimise erosion.	Restored bare patches.	Implement the Bare Patch Restoration Protocol (Appendix C) from the onset of construction.	Holder, Landowner	Continuous	Compliance verified by ECO and IEA
08	Rehabilitation	Areas cleared or disturbed around site might be affected by	Minimize loss of topsoil	Successful revegetation	Replanting activities should be undertaken at the end of the dry season (middle to end September) to	Contractor, SEO	End of dry season	Compliance to be verified by ECO and IEA

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		erosion of topsoil.			ensure optimal conditions for germination and rapid vegetation establishment.			
08	Rehabilitation	Areas cleared or disturbed around site might be affected by erosion of topsoil.	Minimize loss of topsoil	Successful revegetation	The sowing of grass seeds in combination with the chemical and mechanical water infiltration improvement measures should also be considered for highly degraded areas.	Holder, Contractor	On-going	Compliance to be verified by ECO and IEA
08	Rehabilitation	Areas cleared or disturbed around site might be affected by erosion of topsoil.	Minimize loss of topsoil	Successful revegetation	Should plants not successfully establish within two growing seasons after the first planting, new plant material should be provided.	Holder, Contractor	Two growing seasons	Compliance to be verified by ECO and IEA
08	Maintenance and Monitoring	Erosion of rehabilitated terrestrial areas.	Control soil erosion	No signs of erosion	Regularly monitor rehabilitated areas for signs of erosion and implement appropriate stormwater management and erosion control measures at the onset of erosion.	Contractor, SEO	Ongoing	Compliance to verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
08	Maintenance and Monitoring	Erosion of rehabilitated terrestrial areas.	Control soil erosion	No signs of erosion	Stormwater management and erosion control measures shall adhere to the following principles: (a) Identify and control the source of the erosion. (b) Diffuse any concentrated flows. (c) Encourage infiltration of surface water runoff (e.g., good mulch-to-soil contact). (d) Avoid releasing stormwater directly into a watercourse. (e) Repair and stabilise the site of erosion.	Contractor, SEO	Ongoing	Compliance to verified by ECO and IEA.
08	Maintenance and Monitoring	Risk of erosion	Control soil erosion	No signs of erosion	Annual rehabilitation activities in line with the EMPr requirements. Any erosion problems observed on-site should be rectified as soon as possible using the appropriate revegetation and erosion control works.	Holder, Contractor, SEO	Annually	Compliance to verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
08	Maintenance and Monitoring	Natural revegetation may not be sufficient to bind and protect the topsoil from erosion.	Restoration of ecological functioning or ecosystem services.	Revegetated areas must achieve at least 75% of the aerial cover of adjacent undisturbed areas within the first growing season.	Rehabilitated areas are to be re-seeded by hand with locally indigenous plants if sufficient aerail cover has not been achieved after the first growing season.	Contractor, SEO	Ongoing	Compliance to verified by ECO and IEA.
08	Maintenance and Monitoring	Revegetation may not be sufficient to bind and protect the topsoil from erosion.	Successful revegetation and rehabilitation of disturbed areas.	No signs of erosion	Implement the revegetation and rehabilitation plan.	Contractor, SEO	On-going	Compliance to verified by ECO and IEA.
09	Maintenance and Monitoring	Change the visual aesthetics of the Nama Karoo.	Retain aesthetic values and sense of place or restore ecosystem cultural services.	Shaped to natural forms indicative of the site's location within the landscape	All disturbed areas must be reshaped to blend in with the natural surrounding landforms.	Contractor, SEO	Once-off	Compliance to verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
07	L	L	L	-I	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
07	L	L	L	neutral	L	L	0	L	L	0

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Reg: 2006/023163/23

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
08	L	L	L	-I	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
08	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
09	L	L	L	-I	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
09	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

- The residual risk of contaminated soils being used in rehabilitation (**07**) after mitigation is assumed to be Low.
- The residual risk of the loss of topsoil and soil erosion (**08**) after mitigation is assumed to be Low.
- The residual risk of a change in landscape and visual aesthetics (**09**) after mitigation is assumed to be Low.

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Reg: 2006/023163/23

Receiving Environment: Ground and Surface Water

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Rehabilitation	Temporary structures and infrastructure		**Impact:** The retention of foreign temporary structures and materials could alter river or stream channel hydraulics during high flows. **Consequence:** Causing sedimentation and/or excessive bank erosion, undercutting of property and loss of riparian vegetation (indirect).	Behaviour	10
Rehabilitation	Disturbed areas - aquatic	Reshaped bed and banks	**Impact:** Reshaping could alter river or stream channel hydraulics during high flows. **Consequence:** Causing sedimentation and/or excessive bank erosion, undercutting of property and loss of riparian vegetation (indirect).	Behaviour	10
Rehabilitation	Disturbed areas - aquatic	Reshaped bed and banks	**Impact:** Areas cleared or disturbed around site might be affected by erosion of topsoil. **Consequence:** Increased turbidity and siltation in watercourses.	Behaviour	10
Maintenance and Monitoring		Erosion	**Impact:** Erosion of rehabilitated watercourses. **Consequence:** Degraded or dysfunctional aquatic ecosystem (direct).	Behaviour	10
Maintenance and Monitoring		Water Quality/Quantity	**Impact:** Natural Resource depletion (groundwater reserve) - Construction will require the abstraction of water from boreholes for dust suppression, mixing concrete and potable usage. Declining groundwater abstraction yields as a result of no water quality and quantity monitoring plan. **Consequence:** Depletion of groundwater reserve, particularly under future climate change scenarios. Less water in the underground aquifer means less water for other water users, including for reasonable domestic use and livestock watering (direct).	Quantity	11
Maintenance and Monitoring		Water Quality/Quantity	**Impact:** It is anticipated that soils downstream of the proposed development, and the non-perennial streams (feeding into temporary livestock watering dams) are the receivers of any sediment runoff or poor-quality runoff from the site. Suspended sediment (or turbidity) during construction in the watercourse can influence water quality. **Consequences:** - making it unfit for agricultural use (irrigation), affecting crop yield by	Quality	11

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Reg: 2006/023163/23

			photosynthetic activity reducing films, reducing infiltration rate and/or seedling emergence because of a soil surface crust being deposited by suspended solids, clogging of drip irrigation systems as well as accelerated wear and tear of sprinkler irrigation nozzles (indirect). - making it unfit for domestic water use, by having aesthetics effects (appearance, taste, and odour), and affecting human health (indirect).		

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 10 (Water Quality - Sedimentation)

- Considering the District Municipality's Climate Change Response Plan highlighted the risk of reduced deterioration in (surface) water quality due to increased salt concentrations in dams, wetlands and soil/plant systems from enhanced evaporation rates, and the farmer has 'always' supplied his livestock with groundwater via boreholes, it is assumed that no further treatment is required for livestock production.
- Groundwater is vulnerable to pollution (DHS Redbook, Section J)
- Almost a third of the households in Ward 6 get their water from a borehole.
- Erosion and sedimentation are only likely to take place during severe storm events (e.g., 1:2 to 1:100y events). Incidental rainfall will likely not cause sedimentation.
- Most of the soils are very shallow with an average depth of less than 30cm. Clay content ranges from sandy loam to very clayey. Calcareous soils are covering relatively small areas. Soils are unsuitable for most types of agriculture.
- No severe donga erosion has been observed in the study areas. Minor to moderate plate erosion is present.
- Groundwater boreholes are generally situated within and downstream of the development areas, hence are potential receptors to pollution.
- It is also advised that groundwater boreholes be monitored for the decline in water levels/yields, as well as water quality as the boreholes are used as the main water supply for livestock / domestic use.

Impact 11 (Water Quantity)

- A Geohydrological Assessment was commissioned to determine if there is enough groundwater to support demand during construction and operation under normal conditions and under drought years/climate change scenarios, as well as investigate the feasibility of drilling an additional borehole should it be required.

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Reg: 2006/023163/23

- A geophysical investigation aimed to identify likely dolerite contact zones, as these are known preferential flow paths for groundwater movement, revealed two high-feasibility drilling positions which can be considered for future water supply: T1 and T2 located in the southwestern corner of Phase 3.
- If the combined sustainable abstraction yield for both boreholes (336.67 m³/day for 8 hours of pumping) is used as the Proposed Use in the water balance calculation for the HRU2 sub-catchment (Phase 3), there will be a surplus amount of 54 824.94 m3/yr (or 150.21 m3/day) available after the allocation of existing uses, basic human needs, base flow (to surface water streams) and PU (refer to Table 5-4 of the Geohydrological Assessment Report).
- However, if the PU is substituted for the estimated demand during construction (including the period when construction and operation overlap), that is 216 m3/day, there will be a greater surplus of 98 869,79 m3/yr (or 270,87 m3/day)
- It is therefore estimated that there is enough groundwater available on a sub-catchment level to sustain the proposed 8-hour abstraction from the designated boreholes and the sub- catchments they fall in. Provided the surplus estimates are not exceeded, the impact on the groundwater reserve will likely be minimum.
- The base case water balance will be different under the forecasted climate change scenario for 2050. If the combined sustainable abstraction yield for both boreholes (336.67 m³/day for 8 hours of pumping) is used as the Proposed Use (PU) in the water balance calculation under the climate change scenario (lower rainfall and effective recharge to the aquifer), there will be a deficit amount of -29 954.96 m3/yr (or -82.07 m3/day) available after the allocation of existing uses, basic human needs, base flow (to surface water streams) and PU (refer to Table 5-4 of the Geohydrological Assessment Report). Based on the climate change predictions, HRU2 will therefore not be able to meet the demand for water uses by 2050. Water abstraction rates, or specifically the PU, would need to be considerably decreased nearing the 2050 mark. The potential deficit must be avoided by reducing water usage during operation and substituting the PU with the estimated demand during operation, that is 150 m3/day, in which case there will be a surplus of 38 180 m3/yr (or 140,60 m3/day).
- Although forecasted production rates (to support the development and operation of the Solar PV facility) under current and future climate change scenarios, are/can be sustainable, groundwater is a very important resource for locals in the area, so care should be taken not to overproduce from boreholes chosen for this project, and to ensure that there is a limited impact on existing livestock/domestic watering already implemented.
- Almost a third of the households in Ward 6 get their water from a borehole, a much higher proportion than on local, district or provincial level, while just over 60% get their water from a regional or local water scheme (much lower than on local, district or provincial level).
- The project area overlies a moderate to high yielding aquifer (median yields of 0,5 to 2 L/sec), on average 6,9 m below ground level, and generally in bedding planes in shale or interbedded sandstone of the Beaufort Group and jointed and fractured contact zones between sedimentary rocks and dolerite dykes.
- However, the landowner, Willem Retief has indicated that each windmill pump yields approximately 1 200l/hr from both (two) boreholes in the project area for Phase 3. This is equivalent to 0,33 L/s, which falls at the bottom of the range (0.5 to 2 L/s – Class D3 Intergranular & Fractured

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Reg: 2006/023163/23

Aquifer System) that is considered the median aquifer yield of the project area (Meyer, P.S., Chetty, & T., Jonk, F., 2002). Furthermore, Willem observed the water table dropped by at least 3 ms over the last few years during the drought.

- The electrical conductivity (EC) for the underlying aquifers generally ranges from 70 to 300 mS/m and the pH ranges from 6 to 8. Consequently, groundwater can generally be used for domestic and recreational use.
- Water scarcity in the arid Pixley Ka Seme District Municipality is expected to be exacerbated by climate change, specifically drought. Most of the province receives minimal summer rainfall ranging from 50 mm to 400 mm depending on the location. Under a low climate change mitigation scenario (Climate Change Adaptation Response Strategy for the Northern Cape, 2016), model simulations indicated an average temperature increase by 2.3 °C, an increase of 16.1 in the total number of heat waves experienced and a decrease in rainfall to 17 mm - 74.3 mm annually.
- Where a series of boreholes are drilled in the same contact, and close to each other (< 500 m), borehole interference may likely occur as the fractures are simultaneously dewatered. Over-production may lead to fracture failures which will lead to borehole collapse. However, due to the degree of fracturing being unknown, the anticipated impact cannot be pre-determined.
- As a good practice, it is advised that all new boreholes drilled in the project area be pump tested, and interference (if any) be evaluated by long-duration pump tests. In terms of the development, limited impacts are anticipated due to the foreseeable low volumes required.
- Currently, no groundwater (GW) monitoring is taking place. It is proposed that a proper monitoring programme be implemented to monitor both the water quality and quantity at the site.
- It is advised that all groundwater boreholes (4 identified within proximity of the solar farm) be monitored for the decline in water levels/yields, as well as water quality. It is known that the boreholes are used as the main water supply for livestock / domestic use.
- It is advised that water be pumped to dedicated storage tanks from the boreholes to build up a reserve, whereafter the boreholes are only used to top up the storage tanks. Allowing boreholes to rest and recover between pumping cycles will help to decrease the impact on the aquifer reserve.
- He (Willem Retief, Landowner) also mentioned that the water table dropped by at least 3 metres over the last few years, due to the drought. So the question is how effective are the windmills, for if the water table drops below the intake pump the mill will spin, but no water will be abstracted?" (pers. comm. Henri Botha, Hydrologist).
- The abstraction of water for dust suppression will likely be very high.
- The water demand will depend on the frequency of spraying events for dust suppression. It is recommended that environmentally safe binding liquids be considered to decrease water use volumes. If dust suppression and operational water use volumes taken from groundwater resources in the sub-catchments are within the surplus estimates, the impact on the groundwater reserve will likely be minimum.
- Dust Suppression - Assuming four litres of water on every square meter, the access road from the N10 to the main entrance of the facility (a road roughly 18,5 km long and 6 m wide) would require the use of roughly 444 m3 of water for dust suppression or control.
- Total permissible abstraction for the project area, that is both properties combined is 109 +107 = 216 m3 per day.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
10	H	M	M	-I	H	M	1	H	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
11	M	L	M	-I	M	M	1	M	M	1
Reversibility	M	**Irreplaceability**	M	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

None

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Hydrological Assessment (Version – Final 2) 11 April 2022 GCS Project Number: 22-0076 by Hendrik Botha
- Geohydrological Assessment Report (Final Rev 3) prepared by GCS Water and Environmental Consultants dated 10th August 2022 (GCS Project Number: 22-0401).

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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- Aquatic Biodiversity Impact Assessment, Section 21(c) and (i) Risk Assessment and Wetland Delineation Verification by Dr Andrew Deacon August 2022.

Mitigations:

Impact Management Outcome(s):

- Preserve river channel hydrological pattern.
- Minimize loss of topsoil
- Minimise water usage during construction (and operation) to avoid depleting the underground aquifer.

Targets:

- No sign of temporary man-made structures or infrastructure on site.
- Shaped to natural forms.
- No signs of exposed erosions channels
- No signs of erosion
- Abstraction records
- Water level monitoring results
- Pump tests
- Water level logbook
- Water wise technologies are installed
- Groundwater Monitoring protocol results

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
10	Rehabilitation	The retention of foreign temporary structures and materials could alter river or stream channel hydraulics	Preserve river channel hydrological pattern.	No sign of temporary man-made structures or infrastructure on site.	Remove all temporary man-made structures, e.g., river diversion works and materials, e.g., sandbags, plastic sheets, etc. from	Contractor, SEO	Once-off	Compliance to be verified by the ECO and IEA

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		during high flows.			within the watercourse.			
10	Rehabilitation	Reshaping could alter river or stream channel hydraulics during high flows.	Preserve river channel hydrological pattern.	Shaped to natural forms.	The final grading of the disturbed areas within the bed and banks should not significantly alter the flow characteristics of the river during periods of high flows, e.g., shaped to natural forms that blend in with pre-construction topography.	Engineer, Contractor, SEO	Once-off	Compliance to be verified by ECO and IEA.
10	Rehabilitation	Reshaping could alter river or stream channel hydraulics during high flows.	Preserve river channel hydrological pattern.	Shaped to natural forms.	Road crossings and stormwater outlets associated with any watercourse crossing should be designed in such a way so as not to cause erosion of the bed or banks by incorporating such stabilisation mechanisms as terracing, boulder and rock placement, minor gabion basket work construction, reno mattresses and/or rock pitching.	Engineer, Contractor, SEO	Once-off	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
10	Rehabilitation	Areas cleared or disturbed around site might be affected by erosion of topsoil. Consequence: Increased turbidity and siltation in watercourses.	Minimize loss of topsoil	No signs of exposed erosions channels	Any erosion channels developing after the construction period should be appropriately backfilled (and compacted where relevant) and the areas restored to a condition similar to the condition before the erosion occurred.	Contractor, SEO	Post-construction	Compliance to be verified by ECO and IEA.
10	Rehabilitation	Areas cleared or disturbed around site might be affected by erosion of topsoil. Consequence: Increased turbidity and siltation in watercourses.	Minimize loss of topsoil	Shaped to natural forms.	Site rehabilitation should as far as is feasible aim to restore surface draining patterns, natural soil and vegetation.	Contractor, SEO	Post-construction	Compliance to be verified by ECO and IEA.
10	Maintenance and Monitoring	Erosion of rehabilitated watercourses.	Preserve stream or river channel hydrological pattern.	No signs of erosion	Regularly monitor watercourse crossings for signs of erosion and implement appropriate stormwater management and erosion control	Contractor, SEO	Post-construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					measures at the onset of erosion.			
11	Maintenance and Monitoring	Natural Resource depletion (groundwater reserve) - Construction will require the abstraction of water from boreholes for dust suppression, mixing concrete and potable usage. Declining groundwater abstraction yields as a result of no water quality and quantity monitoring plan.	Minimise water usage during construction (and operation) to avoid depleting the underground aquifer.	Abstraction records	The abstraction of groundwater from both properties combined (but limited to sub-catchment HRU2 of Quaternary Catchment D62D), including all boreholes contained thereon, shall not exceed 216 m3/ day (or 78 840,43 m3/ yr) during the construction period (including when it overlaps with operation), and 150 m3/day (or 54 750,3 m3/ yr) during operation.	Holder, Contractor.	Ongoing	Compliance to be verified by ECO and IEA.
11	Maintenance and Monitoring	Natural Resource depletion (groundwater reserve) - Construction will require the abstraction of water from boreholes for dust	Minimise water usage during construction (and operation) to avoid depleting the underground aquifer.	Abstraction records	Abstraction may not exceed the sustainable abstraction yield at the recommended pumping rate of 8 hrs per day for each borehole, that is 6,58 l/s @ 8hrs (or 189,5 m3/8hr day) for BH4 and 5,11 l/s	Holder, Contractor.	Ongoing	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		suppression, mixing concrete and potable usage. Declining groundwater abstraction yields as a result of no water quality and quantity monitoring plan.			@ 8 hrs (or 147,17 m3/8hr day) for BH5.			
11	Maintenance and Monitoring	Natural Resource depletion (groundwater reserve) - Construction will require the abstraction of water from boreholes for dust suppression, mixing concrete and potable usage. Declining groundwater abstraction yields as a result of no water quality and quantity monitoring plan.	Minimise water usage during construction (and operation) to avoid depleting the underground aquifer.	Water level monitoring results	Undertake water level monitoring of boreholes within a 1.5 km radius of the pumping borehole. If a decline in water levels is noted in all boreholes, because of pumping, the abstraction rate should be lowered to prevent aquifer depletion.	Holder	Ongoing	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
11	Maintenance and Monitoring	Natural Resource depletion (groundwater reserve) - Construction will require the abstraction of water from boreholes for dust suppression, mixing concrete and potable usage. Declining groundwater abstraction yields as a result of no water quality and quantity monitoring plan.	Minimise water usage during construction (and operation) to avoid depleting the underground aquifer.	Pump tests	All new boreholes drilled in the project area (such as T1 or T2) must be pump tested, and interference (if any) with other existing boreholes (closer than 500 m) be evaluated by long-duration pump tests.	Holder, Engineer, Contractor.	When new boreholes are drilled.	Compliance to be verified by ECO and IEA.
11	Maintenance and Monitoring	Natural Resource depletion (groundwater reserve) - Construction will require the abstraction of water from boreholes for dust suppression, mixing concrete	Minimise water usage during construction (and operation) to avoid depleting the underground aquifer.	Water level logbook	Conduct multi borehole water level logging, to ensure that no cumulative dewatering impacts are taking place for boreholes which may be in the same contact zones.	Holder, Contractor.	Ongoing	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		and potable usage. Declining groundwater abstraction yields as a result of no water quality and quantity monitoring plan.						
11	Maintenance and Monitoring	Natural Resource depletion (groundwater reserve) - Construction will require the abstraction of water from boreholes for dust suppression, mixing concrete and potable usage. Declining groundwater abstraction yields as a result of no water quality and quantity monitoring plan.	Minimise water usage during construction (and operation) to avoid depleting the underground aquifer.	Water wise technologies are installed	Continually investigate and implement water-saving strategies and technologies or alternatives, including designs.	Holder, Engineer, Contractor.	Ongoing	Compliance to be verified by ECO and IEA.
11	Maintenance and Monitoring	It is anticipated that soils downstream of	Minimise water usage during construction (and	Groundwater Monitoring protocol results	Implement the Surface and Groundwater	Holder, Contractor, SEO	Ongoing	Compliance to be verified

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		the proposed development, and the non-perennial streams (feeding into temporary livestock watering dams) are the receivers of any sediment runoff or poor-quality runoff from the site. Suspended sediment (or turbidity) during construction in the watercourse can influence water quality.	operation) to avoid depleting the underground aquifer.		Monitoring Protocol during construction and operation (Appendix D).			by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
10	L	L	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
10	L	L	L	neutral	L	L	0	L	L	0

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
11	L	L	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
11	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- The residual risk of erosion and sedimentation caused by changed surface water flow patterns (**10**) after mitigation is assumed to be Low.
- The residual risk of a reduction in the water quantity through abstraction of groundwater for post-construction and operational activities such as dust suppression (**11**) after mitigation is assumed to be Low.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Receiving Environment: Atmosphere

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Maintenance and Monitoring		Erosion	**Impact:** Altered surface water flow patterns, e.g., changing sheet flow (natural open system) to concentrated flows leads to erosion. **Consequence:** Increased suspended solids, siltation in watercourses and soil erosion.	Quality	12
Maintenance and Monitoring		Revegetation	**Impact:** The PV "heat island" (PVHI) effect would be the result of a detectable increase in sensible heat flux (atmospheric warming). This may be compounded by the forecasted increase in temperatures linked to climate change. **Consequences:** - Warming surrounding areas could potentially influence wildlife habitat, ecosystem function and human health.(indirect)	Quality	13

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 12 (Dust Generation)

- For the PV scope (excluding the MTS and DX works) we have projected the following number of delivery trucks per 100MW sub-phase of the project: Panels - 273 trucks, Mounting Structure - 300 trucks, Inverters - 13 trucks, Field Transformers - 12 trucks, Cable & BOS - 120 trucks *(pers. comm Bruce Conné, General Manager, Soventix).*
- Although still to be finalised it is projected that staff will be transported in mini-bus taxis or small busses daily. Assuming mini-bus taxis one could work on 15 people per taxi which would result in an estimated average of 20 taxis per day X 2 for morning and afternoon trips. Using busses will reduce the number of vehicle-trips *(pers. comm Bruce Conné, General Manager, Soventix).*

Impact 13 (Heat Island Effect)

- The maintenance of vegetation and ecosystem regulating services will reduce, but not avoid the potential PV "heat island" effect.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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- The decreased albedo due to a PV power plant and their associated warming from the PVHI is at least offset by the carbon dioxide emission reductions associated with PV power plant and more so when ecosystem regulating services, such as carbon sequestration, are maintained through sound ecological management.
- A risk averse approach to counter increased climatic uncertainty is through climate change mitigation, specifically the need to halt and reverse existing degradation primarily from extensive livestock production and adopt the most effective management practices.
- The study area is not within an Air Quality Priority Area.

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
12	M	M	M	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
13	M	M	M	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

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Reg: 2006/023163/23

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Barron-Gafford G.A., et al (2016) "The Photovoltaic Heat Island Effect: Larger solar power plants increase local temperatures" www.nature.com/scientificreports.
- Aquatic Biodiversity Impact Assessment, Section 21(c) & (i) Risk Assessment and Wetland Delineation Verification Report prepared by Dr Andrew Deacon dated August 2022.

Mitigations:

Impact Management Outcome(s):

- Preserve topsoil, control soil erosion.
- Increased ecosystem resilience to atmospheric warming.

Targets:

- No excessive dust.
- Reduce the potential PVHI: Restored bare patches.
- Reduce the potential PVHI: No signs of overgrazing.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
12	Maintenance and Monitoring	Altered surface water flow patterns, e.g., changing sheet flow (natural open system) to concentrated flows leads to erosion.	Preserve topsoil, control soil erosion.	No excessive dust	Ensure dust abatement measures are in place during and post construction.	Holder, Contractor, SEO	Ongoing	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
13	Maintenance and Monitoring	The PV "heat island" (PVHI) effect.	Increased ecosystem resilience to atmospheric warming.	Reduce the potential PVHI: Restored bare patches.	Halt and reverse existing ecological degradation primarily from extensive livestock production or other drivers to counter increased climatic uncertainty - restore all bare patches of soil with vegetation.	Holder	Continuous	Compliance to be verified by ECO and IEA.
13	Maintenance and Monitoring	The PV "heat island" (PVHI) effect.	Increased ecosystem resilience to atmospheric warming.	Reduce the potential PVHI: No signs of overgrazing.	Ensure responsible natural resource management that maintains the integrity of ecosystems and the continued provision of ecosystem services to current and future generations.	Holder, Landowner	Continuous	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
12	L	M	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
12	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
13	L	M	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
13	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

- The residual risk of the solar PV facility on increased dust generation (**12**) with mitigation measures is assumed to be Low.
- The residual risk of the solar PV facility on increased atmospheric warming (**13**) after (a) the maintenance and sound ecological management of ecosystem regulating services, such as carbon sequestration, (b) fragmentation of the facility, and (c) spacing of the arrays is assumed to be “Low”, particularly when considered in combination with the carbon dioxide emission reductions associated with a PV power plant.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Receiving Environment: Terrestrial and Avian Ecosystem

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Rehabilitation	Temporary structures and infrastructure		**Impact:** The retention of temporary structures and infrastructure (including roads) will change the habitat to the benefit or detriment of various faunal species. **Consequence:** - Altered (composition and structure) or dysfunctional ecosystem (indirect). - Altered biodiversity pattern (indirect). - Reduced resilience to climate change (indirect).	Transformation	14
Rehabilitation	Disturbed areas - terrestrial	Bare ground	**Impact:** Habitat changes beneath the solar panels. **Consequence:** Bat foraging patterns affected	Transformation	14
Rehabilitation	Disturbed areas - terrestrial	Bare ground	**Impact:** Removal of vegetation and disruption to the ephemeral watercourse **Consequence:** (1) Habitat degradation leads to disturbance/alteration of important areas of bat activity such as roosting sites, commuting, foraging and socialising areas. (2) Habitat degradation leads to changes in bat community and abundance of bat species.	Transformation	14
Facility Management			**Impact:** Impacts on Ecological Support Areas (ESAs) and general ecological processes within the site **Consequence:** Disturbance to ecological functioning.	Transformation	14
Grazing Management		Veld condition	**Impact:** Removal of vegetation and disruption to the watercourse **Consequence:** (1) Habitat degradation leads to disturbance/alteration of important areas of bat activity such as roosting sites, commuting, foraging and socialising areas. (2) Habitat degradation leads to changes in bat community and abundance of bat species.	Transformation	15
Grazing Management		Veld condition	**Impact:** Overgrazing **Consequence:** Overgrazing negatively impacts on veld	Transformation	15

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Reg: 2006/023163/23

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
			condition, specifically reducing plant vigor, primary production and increasing soil erosion and sedimentation.		
Maintenance and Monitoring		Veld condition	**Impact:** Removal of vegetation and disruption to the ephemeral watercourse **Consequence:** (1) Habitat degradation leads to disturbance/alteration of important areas of bat activity such as roosting sites, commuting, foraging and socialising areas. (2) Habitat degradation leads to changes in bat community and abundance of bat species.	Transformation	15
Maintenance and Monitoring		Veld condition	**Impact:** The development of bare patches is a degradation process that can be attributed to overgrazing and patch selection, usually in combination with drought conditions. **Consequence:** Diminished climate change resilience.	Transformation	15
Maintenance and Monitoring		Veld condition	**Impact:** Mismanagement **Consequence:** Overgrazing negatively impacts on veld condition, specifically reducing plant vigour, primary production and increasing soil erosion and sedimentation.	Transformation	15
Maintenance and Monitoring		Alien plant recruitment	**Impact:** Recruitment of alien invasive plants. Disturbance can favour the recruitment of pioneer species and alien invasive plants, threatening habitats and alter the composition, structure and functioning of ecosystems. **Consequence:** - reduced productivity and carrying capacity (direct). - altered or dysfunctional ecosystem (indirect). - loss of biodiversity and climate change resilience (indirect).	Transformation	16

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 14 (Terrestrial Biodiversity)

- Although there are no CBAs within the affected area, the whole of the Soventix Phase 3 site falls within an extensive ESA. According to the reasons layer that accompanies the CBA map, the ESA is based on the selection of the area as Northern Upper Karoo, the Platberg - Karoo

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Conservancy Important Bird Area, the presence of natural wetlands, rivers, and wetland FEPAs. However, the aquatic features listed above have been excluded from the development footprint, with the result that the impact of the development on these features would be minimal.

- There are no impacts associated with the development of the Soventix Phase 3 site on terrestrial biodiversity that cannot be mitigated to an acceptable level.
- Northern Upper Karoo is one of the most extensive vegetation types in the country and occupies over 40 000km2 of the interior Karoo. The vegetation consists of shrubland dominated by dwarf Karoo shrubs, grasses and Acacia mellifera subsp. detinens, and other low trees particularly on the sandy soils. Four plant species are known to be endemic to the vegetation type, Lithops hookeriana, Stomatium pluridens, Galenia exigua and Manulea deserticola. Northern Upper Karoo has not been significantly affected by transformation and is still approximately 96% intact and is classified as Least Threatened.
- The change in the microclimate between and beneath the solar panels may provide different ecological conditions which may encourage or provide suitable conditions for botanical diversity. Botanical diversity influences invertebrate diversity as plants provide forage, suitable habitat and structure for reproduction, and thus in turn may positively influence and possibly increase bat foraging activity.

Impact 15 (Grazing management)

- The grazing capacity for Phase 3 in 2022 is the result of vegetation responses from higher rainfall compared with 2017.
- Regenerative grazing management improves the grass basal cover, water cycle, as well as the accumulation of organic matter on the soil surface, enhancing the mineral cycle and improving the water holding capacity of the soil, ensuring minimal soil temperature fluctuations, and improving the grass composition and forage production potential of the grass layer.
- Ultra-high density grazing strategies results in the controlled impact of hooves, trampling grasses in moribund state ("taller unpalatable, woody grasses, with vertical growth form and unfavourable structure for grazers), covering bare ground and improving the carbon cycle.
- Kraaling, that is short duration trampling & over-night occupancy of patches to allows for the deposition of manure and grass seed.
- Resting camps will improve the recovery of forage reserves, allow grasses to seed and establish Decreaser species, thereby improving the grass production potential.
- The total exclusion of grazers in such environments will be detrimental to maintaining important ecological processes such as the energy cycle, mineral cycle, and water cycle.
- Overgrazing or continuous grazing in areas should be prevented by planned resting. Time management per camp is essential. This includes removing grazers when available forage reserves become low, resting of camps for periods up to 12 months, at a frequency of once every four years. This will assist to improve recovery of forage reserves and allow for grass seeding and establishment of Decreaser grasses, which will result in an improvement in grass production potential. Sound management will improve the grass and bossie components with important forage species. This recommendation applies to all the camps. Planned resting should be carefully controlled while monitoring veld condition. It is especially important not to let any area be excluded from grazing as this will inevitably result in degradation in veld condition and in soil erosion.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

- Furthermore, if the management guidelines are not followed in this report, it is envisaged that further deterioration in grass basal cover will occur, associated with increased bare ground and accelerated soil erosion, and it is envisaged that the potential impact from the planned development would then also need to be considered and be mitigated for.
- Maintaining the natural vegetation in an optimal state is seen as the best and most cost-effective method to limit soil erosion to the minimum.
- It is possible that the shading effect of the proposed solar panels will increase soil moisture content (through reduced evapotranspiration) and therefore improve the general grazing capacity of the study areas.
- Overgrazing will significantly alter plant canopies, potentially leading to a reduction in leaf litter from the plants which is important for seed retention and will expose the soil to erosion by both wind and water. With the loss of precious topsoil, the restoration of these areas will be difficult.
- The "Grazing Capacity Range" provides extreme limits in potential grazing capacity based on rainfall variability. In the long term these limits must be refined from more quantitative data.

Impact 16 (Pollution including alien invasive plants, waste material, contaminated soil)

- Imported material (aggregate) is a potential source of contaminant (seed of alien invasive plants).
- It is anticipated that both general and hazardous waste types will be generated during construction. Except for domestic wastewater (13 m3/day), volumes cannot be known.
- Construction equipment (risk of leaking/spills of hydrocarbons) will include at least: Water tankers; Graders; Tipper trucks; Drilling rigs (down to 2m); Mobile pile ramming machines (down to 3m at the most); Rock crushing plant; Excavators; TLBs; Concrete mixers; Compaction equipment; Light delivery vehicles; and Heavy delivery vehicles (for the transformers).

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
14	M	L	M	-I	M	H	1	M	H	1
Reversibility	M	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
15	H	L	M	-I	H	H	1	H	H	1
Reversibility	M	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
16	H	L	M	-I	H	M	1	H	M	1
Reversibility	M	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Aquatic Biodiversity Impact Assessment, Section 21(c) & (i) Risk Assessment and Wetland Delineation Verification Report prepared by Dr Andrew Deacon dated August 2022.
- Hydrological Assessment (Version – Final 3) 01 September 2022 GCS Project Number: 22-0076 by Hendrik Botha.
- Soil Mapping Report prepared by Hennie van den Burg of Iris International and Francois Botha of Eco Soil dated June 2022.
- Terrestrial Biodiversity Specialist Assessment – Soventix Phase 3 Pv Project (Final) prepared by Simon Todd of 3 Foxes Biodiversity Solutions dated September 2022.
- Chiropteran Specialist Report for Phase 3 of the Proposed Soventix-Solar Africa Solar PV Facility, Hanover, Northern Cape Prepared by: Dawn Cory Toussaint dated July 2022.
- Grazing Potential Assessment prepared by Francois de Wet of Enviro Pulse and Shobie Arnoldi of Topveld dated June 2022.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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Mitigations:

Impact Management Outcome(s):

- Restoration of ecological functioning or biodiversity pattern.
- Ensure least impact on animal behaviour.
- Good environmental management of the facility in accordance with management plans.
- Preserve the agricultural potential and maintain or improve the agricultural productivity of the land.
- Ecological restoration to improve climate change resilience and increase the production potential for improved grazing capacity.
- Improve surface water infiltration and minimise erosion.
- Achieve good to excellent veld condition classes.
- Reduce the potential for the recruitment of alien invasive plants.

Targets:

- No sign of temporary man-made structures or infrastructure on site.
- Revegetated unused roads
- No bare areas between and below panels
- Compliance with all plans and monitoring taking place
- Grazing sheep
- No signs of overgrazing
- Grazing strategy
- Grazing monitoring results
- Vegetation surveys and results
- Restored areas
- Grazing assessments and Veld condition results
- Veld condition results
- No adult or reproductively mature alien invasive plants observed on site.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
14	Rehabilitation	The retention of temporary structures and infrastructure (including roads) will change the habitat to the benefit or detriment of various faunal species.	Restoration of ecological functioning or biodiversity pattern.	No sign of temporary man-made structures or infrastructure on site.	Remove all temporary man-made structures and infrastructure including buildings, fences, barriers, and other demarcations, e.g., danger tape, associated with the construction site.	Contractor, SEO	Once-off	Compliance to be verified by ECO and IEA.
14	Rehabilitation	The retention of temporary structures and infrastructure (including roads) will change the habitat to the benefit or detriment of various faunal species.	Restoration of ecological functioning or biodiversity pattern.	No sign of temporary man-made structures or infrastructure on site.	The contractor must ensure that all fence uprights are appropriately removed, ensuring that no uprights are cut at ground level but rather removed completely.	Contractor, SEO	Once-off	Compliance to be verified by ECO and IEA.
14	Rehabilitation	The retention of temporary structures and infrastructure (including roads) will change the habitat to the benefit or detriment of various faunal species.	Restoration of ecological functioning or biodiversity pattern.	Revegetated unused roads	Any access route deviation from that in the written agreement must be closed and re-vegetated immediately, at the contractor's expense.	Contractor, SEO	Once-off	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
14	Rehabilitation	Habitat changes beneath the solar panels.	Ensure least impact on animal behaviour.	No bare areas between and below panels	Restore the natural vegetation on disturbed bare areas between and below the solar panels after construction to protect the topsoil and encourage invertebrate species richness, that is suitable prey availability for bats.	Contractor, SEO	Once-off	Compliance to be verified by ECO and IEA.
14	Rehabilitation	Habitat changes beneath the solar panels.	Ensure least impact on animal behaviour.	No bare areas between and below panels	Sow indigenous plant seed mixes into the tilled rows, using a combination of palatable locally indigenous Karoo dwarf shrubs (or 'bossies') and grasses at a seeding density or rate of 5 to 15 kg of seed mixture per hectare.	Contractor, SEO	Once-off	Compliance to be verified by ECO and IEA.
14	Facility management	Impacts on Ecological Support Areas (ESAs) and general ecological	Good environmental management of the facility in accordance with	Compliance with open space management plan	Adhere to the open space management plan which makes provision	Holder, SEO	On-going	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		processes within the site	management plans.		for the favourable management of the facility and the surrounding area for fauna.			
14	Facility management	Impacts on Ecological Support Areas (ESAs) and general ecological processes within the site	Good environmental management of the facility in accordance with management plans.	Compliance with all plans and monitoring taking place	Ensure that all the operational phase management plans are fully implemented and that the associated monitoring and feedback mechanisms to management are in place.	Holder, SEO	On-going	Compliance to be verified by ECO and IEA.
15	Grazing management	Removal of vegetation and disruption to the watercourse	Preserve the agricultural potential and maintain or improve the agricultural productivity of the land.	Grazing sheep	The use of domestic livestock (preferably sheep) should be used to control the height of vegetation instead of herbicides.	Holder, Landowner SEO	On-going	Compliance to be verified by ECO and IEA.
15	Grazing management	Removal of vegetation and disruption to the watercourse	Preserve the agricultural potential and maintain or improve the agricultural productivity of the land.	No signs of overgrazing	Ensure that the vegetation in the solar plant farm footprint is not overgrazed.	Holder, Landowner, SEO	On-going	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
15	Grazing management	Overgrazing	Improve surface water infiltration and minimise erosion. Achieve good to excellent veld condition classes.	Grazing strategy	Develop a long-term grazing strategy using the findings (land capability classes/grazing units and carrying capacities) as well as Grazing Management Principles (Appendix F) identified in the Soil Mapping and Grazing Potential Assessments.	Holder, Landowner, SEO	On-going	Compliance to be verified by ECO and IEA.
15	Grazing management	Overgrazing	Improve surface water infiltration and minimise erosion. Achieve good to excellent veld condition classes.	Grazing strategy	Implement good rangeland management practices defined by an adopted long-term grazing strategy with small stock for the areas underneath the solar panels to maintain optimal vegetation cover and to reduce soil erosion and runoff.	Holder, Landowner, SEO	On-going	Compliance to be verified by ECO and IEA.
15	Maintenance and monitoring	Removal of vegetation and disruption to the	Improve surface water infiltration	Grazing monitoring results	Monitor the effects of the grazing	Holder, Landowner, SEO	On-going	Compliance to be verified by

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		ephemeral watercourse	and minimise erosion. Achieve good to excellent veld condition classes		management strategy on veld condition as (a) grazing during and shortly after a drought can cause palatable plant species to die off, (b) heavy grazing pressure in summer will favour the growth of karoid shrubs, and (c) high grazing pressure during winter will favour the growth of perennial grasses (Mucina and Rutherford, 2011) all of which can affect insect abundance which in turn may affect bats.			ECO and IEA.
15	Maintenance and monitoring	The development of bare patches is a degradation process that can be attributed to overgrazing and patch selection, usually in combination with drought conditions	Ecological restoration to improve climate change resilience and increase the production potential for improved grazing capacity.	Vegetation surveys	Undertake vegetation surveys of rehabilitated bare patches annually, measuring at least plant density, species composition and richness, vegetation cover	Holder, SEO	Annually	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					and growth stage (seedling, vegetative and reproductive).			
15	Maintenance and monitoring	The development of bare patches is a degradation process that can be attributed to overgrazing and patch selection, usually in combination with drought conditions	Ecological restoration to improve climate change resilience and increase the production potential for improved grazing capacity.	Vegetation survey results	The results of the vegetation surveys should inform the need for and nature of any further interventions.	Holder, SEO	Annually	Compliance to be verified by ECO and IEA.
15	Maintenance and monitoring	The development of bare patches is a degradation process that can be attributed to overgrazing and patch selection, usually in combination with drought conditions	Ecological restoration to improve climate change resilience and increase the production potential for improved grazing capacity.	Restored areas	Interventions and vegetation surveys may cease once the fence has been removed after 4 years and the site has been restored to the same or a better condition than the adjacent remnant vegetation, e.g., species richness, vegetation cover and plant density are comparable or better, and seedling, vegetative and reproductive	Holder, SEO	4 years after the fence has been removed and site is restored	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					growth stages of all species are recorded.			
15	Maintenance and monitoring	Mismanagement	Improve surface water infiltration and minimise erosion. Achieve good to excellent veld condition classes.	Grazing assessments and Veld condition results	Apply follow-up grazing assessments as well as annual monitoring of veld condition and veld condition trends, estimate current grazing capacity, and adapt grazing management accordingly.	Holder, SEO	Annually	Compliance to be verified by ECO and IEA.
15	Maintenance and monitoring	Mismanagement	Improve surface water infiltration and minimise erosion. Achieve good to excellent veld condition classes.	Veld condition results	Annual monitoring of veld condition should also investigate the influence of planned resting on veld condition as the exclusion of grazing can result in degradation of the veld and erosion.	Holder, SEO	Annually	Compliance to be verified by ECO and IEA.
16	Maintenance and monitoring	Recruitment of alien invasive plants. Disturbance can favour the recruitment of	Reduce the potential for the recruitment of alien invasive plants.	No adult or reproductively mature alien invasive plants observed on site.	The rehabilitated construction site must be monitored regularly for the	Contractor, SEO	Once-off	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		pioneer species and alien invasive plants, threatening habitats and alter the composition, structure and functioning of ecosystems.			presence of alien invasive plant species.			
16	Maintenance and monitoring	Recruitment of alien invasive plants. Disturbance can favour the recruitment of pioneer species and alien invasive plants, threatening habitats and alter the composition, structure and functioning of ecosystems.	Reduce the potential for the recruitment of alien invasive plants.	No adult or reproductively mature alien invasive plants observed on site.	Immediately control alien invasive plants upon being identified, using preferably mechanical control methods.	Holder, Contractor, SEO	On-going	Compliance to be verified by ECO and IEA.
16	Maintenance and monitoring	Recruitment of alien invasive plants. Disturbance can favour the recruitment of pioneer species and alien invasive plants, threatening habitats and alter the composition, structure and functioning of ecosystems.	Reduce the potential for the recruitment of alien invasive plants.	No adult or reproductively mature alien invasive plants observed on site.	Do not apply foliar hand spray chemical applications under conditions where chemical drift may impact non-targeted species (as indicated on the manufacturer's directions for use on the herbicide label)	Holder, Contractor, SEO	On-going	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
16	Maintenance and monitoring	Recruitment of alien invasive plants. Disturbance can favour the recruitment of pioneer species and alien invasive plants, threatening habitats and alter the composition, structure and functioning of ecosystems.	Reduce the potential for the recruitment of alien invasive plants.	No adult or reproductively mature alien invasive plants observed on site.	Use Working for Water guidelines for approved herbicides.	Holder, Contractor, SEO	On-going	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
14	L	L	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
14	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
15	L	L	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
15	H	L	H	-I	H	M	1	M	M	1

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
16	L	L	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
16	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

- The residual risk of changing behaviours of fauna such as bats and a loss of functioning ecological support areas (14) after mitigation is assumed to be Low.
- The residual risk of lost biodiversity from overgrazing and poor rangeland management (**15**) after mitigation is assumed to be Low.
- The residual risk of the recruitment of alien invasive plants (**16**) after mitigation is assumed to be Low.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Receiving Environment: Aquatic Ecosystem

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Maintenance and Monitoring		Erosion	**Impact:** (1) The largest risk is potential run-off and stormwater discharge from the site into the surrounding causing soil erosion. (Hydrology Assessment) **Consequences:** - Erosion can result in a degraded or dysfunctional ecosystem (direct) and loss of ecosystem services (indirect)	Transformation	17
Maintenance and Monitoring		Alien plant recruitment	**Impact:** Recruitment of alien invasive plants. Disturbance can favour the recruitment of pioneer species and alien invasive plants, threatening habitats and alter the composition, structure and functioning of ecosystems. **Consequence:** - reduced productivity and carrying capacity (direct). - altered or dysfunctional ecosystem (indirect). - loss of biodiversity and climate change resilience (indirect). **Addressed under "Receiving Environment: Terrestrial and Avian Ecosystem"**	Transformation	18

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 17 (Surface Water Hydrology)

- The rivers are ephemeral and only have water shortly after storm events. (Hydrology Assessment).
- It is anticipated that soils downstream of the proposed development, and the non-perennial streams (feeding into temporary livestock watering dams) are the receivers of any sediment runoff or poor-quality runoff from the site. (Hydrology Assessment)
- The largest risk is potential run-off and stormwater discharge from the site into the surrounding causing soil erosion and should be managed according to the CSWMP and Monitoring Plan for the Storm Water Management System and ground and surface water resources.

Impact 18 (Pollution including alien invasive plants, waste material, contaminated soil)

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

- This impact has been **addressed under Receiving Environment: Terrestrial and Avian Ecosystem" therefore no further mitigation is required**.

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
17	M	L	M	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

None.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Hydrological Assessment (Version – Final 3) 01 September 2022 GCS Project Number: 22-0076 by Hendrik Botha
- Aquatic Biodiversity Impact Assessment, Section 21(c) and (i) Risk Assessment and Wetland Delineation Verification by Dr Andrew Deacon August 2022.
- Soil Mapping Report prepared by Hennie van den Burg of Iris International and Francois Botha of Eco Soil dated June 2022.

Mitigations:

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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Impact Management Outcome(s):

- Minimise the risk of erosion on dispersive soils.

Targets:

- Good stormwater management.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
17	Maintenance and monitoring	The largest risk is potential run-off and stormwater discharge from the site into the surrounding causing soil erosion.	Minimise the risk of erosion on dispersive soils.	Good stormwater management	Stormwater run-off and discharge from the site shall be managed according to the CSWMP (Appendix E).	Holder, Contractor, SEO	On-going	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
17	L	L	L	neutral	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
17	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

- Despite the mitigations to avoid significant suspended sediment in the river, strong flows or a flash flood during summer would render any river diversion works futile.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

- The residual risk of transformation of the aquatic ecosystem due to erosion and sedimentation (**17**) after mitigation is assumed to be Low.
- The residual risk of recruitment of alien invasive plants (**18**) **has been addressed under "Receiving Environment: Terrestrial and Avian Ecosystem" and therefore no mitigation is required** here.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Receiving Environment: Economical and Social

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Facility Management	N/A	N/A	**Impact:** A solar PV facility of this size (400 MW), particularly when considered together with Phases 1 and 2 (1 GW in total), will make a significant contribution to our country's power deficit when supply falls behind demand. **Consequences:** - Rolling scheduled and controlled shutdowns (known as load shedding) as well as unplanned and unpredictable outages or blackouts are crippling economic growth. - For businesses, unreliable electricity results in increased running costs and reduced productivity and profitability. It's estimated that the loss to businesses and industries that battle with scheduled power cuts, stands at about R1-billion per stage, per day.	N/A	19

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

None.

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
19	M	M	M	-R	M	M	1	H	M	1
Reversibility	M	**Irreplaceability**	M	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- (https://www.thesouthafrican.com/news/how-long-load-shedding-monday-9-december-when-eskom-floods/).

Mitigations:

Impact Management Outcome(s):

- The Solar PV facility is energy efficient, social, and financially feasible.

Targets:

- A well-managed facility

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
19	Facility management	A solar PV facility of this size (400 MW), particularly when considered together with	The Solar PV facility is energy efficient, social, and financially feasible.	A well-managed facility	Planning decisions relating to the design and management of the Solar PV Facility and associated infrastructure should always be founded on	Holder	On-going	Compliance to be verified by ECO and IEA

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		Phases 1 and 2 (1 GW in total), will make a significant contribution to our country's power deficit when supply falls behind demand.			the guiding principle to optimise generational efficiency whilst simultaneously improving the economic feasibility of the project as well as the social and ecological integrity of the local community and ecosystem that supports it, or at the very least without compromising either aspect.			

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
19	M	M	M	-R	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
19	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

- The residual risk of economic and social impacts of the PV facility (**19**) after mitigation is assumed to be Low.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
Reg: 2006/023163/23

Receiving Environment: Public Services

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Rehabilitation	Roads	N/A	**Impact:** Increased traffic can result in corrugations and potholes on roads. **Consequence:** Decrease in condition of gravel roads, increase in travel times. Mitigation: (1) Ensure access roads are restored to original pre-construction road condition. Management Outcome: Good road conditions.	N/A	20
Maintenance and Monitoring	N/A	Water Quality/Quantity	**Impact:** It is anticipated that soils downstream of the proposed development, and the non-perennial streams (feeding into temporary livestock watering dams) are the receivers of any sediment runoff or poor-quality runoff from the site. Sedimentation (or turbidity) caused by working in the watercourse can increase the cost of treating drinking water. **Consequence:** Increased cost of treating water, or if there is limited capacity to treat the water (financial, technical, etc.) then poorer quality drinking water, including appearance, odour and taste problems (indirect).	N/A	21

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 20 (Roads)

- The main gravel road, Burgerville Road, in the vicinity of the proposed development is in a fair to poor condition. The main surfaced road, the N10, in the vicinity of the proposed development is in a good condition.

Impact 21 (Water quality – sedimentation)

- It is advised that groundwater boreholes be monitored for the decline in water levels/yields, as well as water quality as the boreholes are used as the main water supply for livestock / domestic use.

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Reg: 2006/023163/23

- Further the impacts of sedimentation are adequately assessed and **mitigated under "Receiving Environment: Terrestrial and Avian Ecosystem" and "Ground and Surface water" and therefore do not need to be repeated here.**

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
20	M	L	M	-I	M	H	1	M	H	1
Reversibility	M	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
21	H	L	M	-I	H	M	1	H	M	1
Reversibility	M	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

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Reg: 2006/023163/23

- Hydrological Assessment (Version – Final 3) 01 September 2022 GCS Project Number: 22-0076 by Hendrik Botha.
- Traffic Impact Assessment prepared by Annebet Krige of Sturgeon Consulting (Pty) Ltd dated September 2022 (Project No.: STUR0352).

Mitigations:

Impact Management Outcome(s):

- Good road conditions.
- Minimise the risk of erosion on dispersive soils.

Targets:

- No corrugations or potholes.
- No signs of erosion and sedimentation

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
20	Rehabilitation	Increased traffic can result in corrugations and potholes on roads.	Good road conditions.	No corrugations or potholes	Ensure access roads are restored to original pre-construction road condition.	Holder, SEO	On-going	Compliance to be verified by ECO and IEA.
21	Maintenance and monitoring	It is anticipated that soils downstream of the proposed development, and the non-perennial streams (feeding into temporary livestock watering dams) are the receivers of any sediment runoff or poor-quality runoff from the site. Sedimentation (or turbidity) caused by	Minimise the risk of erosion on dispersive soils.	No signs of erosion and sedimentation	Implement the Surface and Groundwater Monitoring Protocol during construction and operation (Appendix D).	Holder, SEO	On-going	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		working in the watercourse can increase the cost of treating drinking water.						

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
20	L	L	L	neutral	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
20	L	L	L	neutral	L	L	0	L	L	0

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
21	L	L	M	-I	M	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
21	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

- The residual risk of poor road condition (**20**) after mitigation is estimated to be Low.
- The residual risk of sedimentation on water quality (**21**) after mitigation is estimated to be Low.

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Reg: 2006/023163/23

Receiving Environment: Visual Aesthetics

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Rehabilitation	N/A	Bare ground	**Impact:** Decrease in the "sense of place" as it relates to noise, visual and light pollution. **Consequence:** Lower aesthetic values enjoyed by the community.	N/A	22
Rehabilitation	Disturbed areas - aquatic	Reshaped bed and banks	**Impact:** Change the visual aesthetics of the Nama Karoo. **Consequence:** Loss of cultural services, negatively impacting on human well-being.	N/A	22
Maintenance and Monitoring	N/A	Erosion	**Impact:** Short-term landscape change from the current rural agricultural sense of place to the semi-industrial RE landscape. **Consequence:** Possible soil erosion from temporary roads. The use of large vehicles and a crane to raise the power line monopoles - small maintenance access routes would be created along the proposed power line route which could result in soil erosion if not adequately managed.	N/A	22

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 22 (Decrease in sense of place – erosion, removal of vegetation)

- There is a strong sense and spirit of place associated with the Karoo landscape. The surrounding farms are used for sheep farming, game farming and hunting. The current residents and farm owners have a strong sense of place associated with the farms. Many things can impact on a person's perception of sense of place. Farms are generally noisy places if one considers animal-sounds and farming activities. From the receptors' perspective, this kind of noise is acceptable and even attractive, because this is what living on a farm is all about. Noises such as alarms and reverse hooters are not "normal" and disturb the sense of place and the value that people place on the auditory environment. Although lights are used as a security measure on farms, one of the things people values is the absence of bright lights and that they can see the stars. Lights for any other use than lightening up their direct environment is seen as invasive and disturbs the sense of place. Visual aspects are an important consideration in the experience of sense of place. If people are used to unspoiled vistas, or seeing open fields, the establishment

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Reg: 2006/023163/23

of any buildings or infrastructure that they feel do not belong there can alter their sense of place. Sense of place refers to an individual's personal relationship with his/her local environment, both social and natural, which the individual experiences in his/her everyday daily life (Vanclay et al, 2015). It is highly personal, and once it is affected, it cannot be restored. It is also difficult to quantify. Part of the sense of place is the emotional attachment that the farmers have to their properties, and the hopes that they have for it to serve future generations (their children).

- The spirit of place associated with an area is an important factor in tourism and hunting and the marketing of these activities. Spirit of place refers to the unique, distinctive, and cherished aspects of a place. Aspects that will impact on the sense and spirit of place include an increase in noise and activity levels from construction activities, but this will be a temporary impact during the construction phase.
- Although there is visual and biodiversity impact assessment reports that suggest mitigation, it must be acknowledged that the sense of place will be altered permanently and given the personal experience of this impact from some stakeholders, successful mitigation is extremely hard to do. In the eye of the affected parties the only thing that will not alter the sense and spirit of the place in this instance is to avoid any further development.
- During the operational phase, visual impacts such as glare from the solar panels, buildings, power lines, lack of vegetation and light at night will also impact on the sense and spirit of place and will be an impact as long as the plant is operational. Modern solar modules are designed to absorb the solar radiation and hence are not susceptible to reflection or glinting. Nonetheless, the contrast between the solar arrays and surrounding vegetation will exist, in colour, form, line and texture.

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE

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Reg: 2006/023163/23

22	M	M	M	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Social Impact Assessment Report prepared by Ilse Aucamp of Equispectives Research & Consulting Services dated August 2022.
- Richard Vimpany (Neighbouring landowner and registered Interested and Affected Party).
- Personal communication with Steve Stead, Visual Resource Management Africa cc.
- Visual Impact Assessment Report (Final v_2) dated 19th September 2022, prepared by Stephen Stead of Visual Resource Management Africa cc.

Mitigations:

Impact Management Outcome(s):

- Retain aesthetic values and sense of place or restore ecosystem cultural services.
- Minimize soil erosion.

Targets:

- Successful rehabilitation.
- Shaped to natural forms indicative of the site's location within the landscape.
- No signs of soil erosion along the powerline service road.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
22	Rehabilitation	Decrease in the "sense of place" as it relates to noise, visual and light pollution.	Retain aesthetic values and sense of place or restore ecosystem	Successful rehabilitation	Sense of place is a personal experience, but successful rehabilitation will go a long way in recreating a rural sense of place.	Holder, SEO	On-going	Compliance to be verified by ECO and IEA.

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Reg: 2006/023163/23

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
			cultural services.					
22	Rehabilitation	Change the visual aesthetics of the Nama Karoo.	Retain aesthetic values and sense of place or restore ecosystem cultural services.	Shaped to natural forms indicative of the site's location within the landscape	All disturbed areas must be reshaped to blend in with the natural surrounding landforms.	Holder, Contractor, SEO	Post-construction	Compliance to be verified by ECO and IEA.
22	Maintenance and monitoring	Short-term landscape change from the current rural agricultural sense of place to the semi-industrial RE landscape.	Minimize soil erosion	No signs of soil erosion along the powerline service road	Soil erosion along the power line maintenance road needs to be adequately monitored on a Bi-Annual basis.	Holder, SEO	Bi-annual	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
22	L	L	L	-I	L	L	0	L	L	0

Alternative No. 2 – No-Go Option

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
22	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

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Reg: 2006/023163/23

- The residual risk of a change in landscape (**22**) on visual aesthetic values after mitigation is estimated to be Medium to Low, but generally acceptable.

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