ALTERNATIVE IMPACT ASSESSMENT

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MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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Identification (and assessment) of impacts and risks for each alternative

2(1) A scoping report… must include –

(g) a full description of the process followed to reach the proposed preferred activity, site and location of the development footprint within the site, including –

(v) ***the impacts and risks which have informed the identification of each alternative, including*** *the nature, significance, consequence, extent, duration and probability of such identified 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 2 (Content of the Scoping Report) of the EIA Regulations, 2014 as amended

Receiving Environment: Legal System

Description of potential impacts:

Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Impact No.
1	Protected Species	NCNCA, 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 watercourse, 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	**01**

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Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Impact No.
			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).	
1	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.	**01**
1	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).	**01**
1	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	**01**

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Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Impact No.
			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).	
1	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).	**01**
1	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).	**01**
1	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	**01**

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Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Impact No.
			or to both a fine and such imprisonment (S151 of NWA, 1998 as amended).	
1	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).	**01**
1	Eskom 132kV servitude	Servitude Agreement and Letter of Consent	**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 (Get the servitude deed registration number from the title deed and then request a copy from the Deeds Office to ascertain the conditions of the servitude). **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)	**01**
1	Construction of the 20 m high 66 - 132 kV distribution line & 10 - 15m lightning mast	Civil Aviation Act, 2009 (Act No. 13 of 2009)	**Impact:** Construction of the 20 m high 66 - 132 kV distribution line and 10 to 15 m lightning mast represents a potential obstacle to aviation. **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.	**01**
1	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	**01**

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			Environmental Impact Assessment Regulations, 2014, as 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;"	
1	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.	**01**
1	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.	**01**
4	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:** Proposed land use is incompatible with current zoning. **Consequence:** - Uses other than the primary rights of use and consent uses would constitute an offence.	**01**
5	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.	**01**

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Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Impact No.
6	Lighting	Eskom	**Impact:** Legitimate lighting can be a nuisance to neighbours.	**01**
6	Access Roads	EIA Regulations Listing Notice 1 (and 3) of 2014, as amended	**Impact:** LN 1, Listed Activity 24 The development of a road - (ii) … where the road is wider than 8 metres; 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). Assumption: The existing network of two-track farm roads is not wider than 2 m.	**01**
6	Ecological Buffers	Specialist Assessment Reports	**Impact:** Degradation of sensitive environments identified by specialists 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)	**01**
6	Flood lines	NA	**Impact:** Ignorance of flood lines can cause significant damage to the environment and infrastructure. 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 changed.	**01**

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Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Impact No.
			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).	
6	Building Plans	Municipal Bylaws	**Impact:** Unlawful planning and development of land, that is without approved building plans. **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 National Building Regulations and Building Standards Act, 1977 (Act No. 103 of 1977) as amended.	**01**
4 and 6	Building Lines	Agriculture Zone 1	**Impact:** Unlawful planning and development of land, that is without regard of prescribed building lines.	**01**
6	Building Lines	Eskom 132 kV Servitude	**Impact:** Unlawful planning and development of land, that is without regard of Eskom's 132 kV servitude.	**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 project represents a low risk of interference to the SKA radio telescope (including MeerKAT) with a compliance surplus of 57.02 dBm/Hz.

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(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)

- … is published in The Annual List of All Tree Species which are protected under Section 12 of the NFA, 1998 (GN No. 1935 of 25th March 2022, Gazette No. 46094).

Impact 01 (Listed Invasive Plants)

- The Terrestrial Assessment identified … alien and invasive plants within the study area, namely … (NEMBA Category 1b).

Impact 01 (Water Uses)

- Upgrading three existing two-track road crossings within a watercourse shall not impound water, and as such, constitute Section 21(c) and (i) water uses only.
- Although the demand for water during construction and/or operation may fall within the permissible rate of abstraction for catchment D62D (45 m^3 per hectare per year of groundwater but no more than 40 000 m^3 per year on a property) in terms of the General Authorisation for taking and storing water (GN No. 538 of 02nd September 2016), the GA is subject to the following exclusion: "No groundwater that is taken in terms of this authorisation may be taken within a 500 metre radius from the boundary of a wetland or estuary, within a 100 metre radius from the delineated riparian edge of a water course ..." – **both boreholes are either located inside a watercourse or within 500 m of a pan**.
- Although the General Authorisation for taking and storing water (GN No. 538 of 02nd September 2016) permits the storage of 2 000 m^3 per property, the GA further states that, "A person who is otherwise entitled to store water on a property or piece of communal land may not store more water on the property or piece of land than the total volume that the person is otherwise entitled to store on the property or piece of land, or the volume authorised in this notice, whichever is the largest." - **the current cumulative storage capacity (< 14 710,5 m3) exceeds the maximum permissible volume in terms of the General Authorisation (2 000 m^3) for Portion 3 of the Farm Goede Hoop 26C**.
- The General Authorisation for impeding or diverting, and altering the bed and banks (GN No. 509 of 26th August 2016) is subject to the following exclusion: "(c) in instances where an application must be made for a water use license for the authorisation of any other water use as defined in section 21 of the Act that may be associated with a new activity;" – **a water use license will be required for taking and/or storing water**.

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).

Impact 01 (Obstacles to Aviation)

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- 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 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)

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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 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.**

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.**

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)

- 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)
- 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 changed.
- 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. (Hydrology Assessment) - **As such, no clearly defined exclusion zones or protection buffer areas could be mapped**.

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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))

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):

- Construction may not commence without a water use license from the regional office of the Department of Water and Sanitation.

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- 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:

- 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;
- 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)

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- 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
- Hydrological Assessment (Version – Final 2) 11 April 2022 GCS Project Number: 22-0076 by Hendrik Botha
- National Building Regulations and Building Standards, 1977 (Act No. 103 of 1977) as amended
    - **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.
- 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.

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- Protect sensitive areas by avoidance.
- Lawful planning and development of the Solar PV facility with respect to flood lines and building lines.

Targets:

- A license under the NFA, 1998, a permit under NCNCA, 2009 and/or a permit under NEMBA, 2004.
- 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 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.
- 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.

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1	H1	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.	Obtain the applicable permit(s) and/or license prior to (a) carrying out a restricted activity involving, (b) picking, and/or (c) 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.
1	C1, H1	Unlawful picking of any indigenous plant (**"pick"** includes to collect, to cut, to chop off, to take, to gather, to pluck, to uproot, to break, to damage or to destroy).	Lawful clearing of any indigenous plants.	A permit under NCNCA, 2009.	Obtain a permit prior to picking any indigenous plant within an area bordering a natural water course, whether wet or dry, up to and within 100 m from the middle of a river on either side of the natural water course.	SEO or ECO	Prior to commencement of clearing and grubbing.	Compliance to be verified by ECO and IEA.
1	H1	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.
1	H1	Unlawful commenceme	Lawful commenceme	A water use license for	Obtain a water use license for Section 21(c)	Holder	Prior to commenceme	Compliance to be

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		nt of section 21 (c) and (i) water uses in terms of the NWA, 1998.	nt of section 21 (c) and (i) water uses in terms of the NWA, 1998.	Section 21(c) and (i) water uses.	and (i) water uses from the regional office of the Department of Water and Sanitation.		nt of those construction activities relating to S21 (c) and (i) water uses.	verified by ECO and IEA.
1	H1	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.	Obtain a water use license for Section 21(a) water uses from the regional office of the Department of Water and Sanitation.	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.
1	H1	Unlawful storage of water.	Lawful commencement of Section 21 (b) water uses in terms of the NWA, 1998.	A water use license for Section 21(b) water uses.	Obtain a water use license for Section 21(b) water uses from the regional office of the Department of Water and Sanitation.	Holder	Prior to commencement of those construction activities relating to S21(b) water uses, e.g., installing storage tanks.	Compliance to be verified by ECO and IEA.
1	H1	Unlawful disposal of wastewater (and storage	Lawful commencement of Section 21 (g) water	A water use license for Section 21(g) water uses.	Obtain a water use license for Section 21(g) water uses from the regional office of the	Holder	Prior to commencement of those construction	Compliance to be verified by

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		of treated effluent for reuse).	uses in terms of the NWA, 1998.		Department of Water and Sanitation.		activities relating to S21(g) water uses, e.g., installing an on-site disposal facility and storage tanks for treated effluent.	ECO and IEA.
1	H1	Unlawful "irrigation" of wastewater generated by a waterwork.	Lawful commencement of Section 21 (e) water uses in terms of the NWA, 1998.	A water use license for Section 21(e) water uses.	If required by the regional office of the Department of Water and Sanitation, obtain a water use license for Section 21(e) water uses related to the reuse, specifically washing or "irrigation" of solar modules.	Holder	Prior to commencement of S21(e) water uses, e.g., washing ("irrigating") solar modules with treated effluent.	Compliance to be verified by ECO and IEA.
1	H1	The construction of the 66 - 132 kV powerline and upgrading the servitude access road will impact Eskom's 132 kV powerline servitude	Lawful commencement of construction activities affecting Eskom's 132 kV powerline servitude.	A Letter of Consent from Eskom	(1) No construction or excavation work shall be executed within Eskom's servitude without their consent. The extent and width of the servitude is 15,5 m on either side of the centre line of the (132kV) power lines. (2) The applicant must apply for co-use of Eskom's 132 kV powerline servitude by	Holder	At least 30 days before the intended date of commencing with constriction within Eskom's servitude.	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					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, 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			

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					the on-site substation on Phase 3 across/underneath Eskom's 132 kV powerline.			
1	H1	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 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	Holder	Planning and design phase. At least 120 days prior to commencing with construction.	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					completed the final layout plan. Refer queries to Yanga Nofuma, Obstacle Administrator | COO - Air Traffic Services, Bruma, T: 011 607 1474 • F: 086 695 2610 • E: obstacles@atns.co.za • W: www.atns.com. (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) • A KMZ file with the positions of the proposed structures •			

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					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.			
1	C1, H1	A person is guilty of an offence if that	Compliance with the	Two generic EMPrs completed by	(1) Adopt the generic EMPr for the development and	Holder and Contractor	Prior to the commencement of	Compliance to be verified by

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		person fails to comply with or contravenes a condition of an approved environmental management programme.	applicable generic EMPrs	the contractor and accepted (signed) by the Holder.	expansion of substation infrastructure for the transmission and distribution of electricity, 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.		construction of the on-site substation and 66 – 132 kV powerline.	ECO and IEA.
1	H1	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.
1	H1, H4	Proposed land use is incompatible with current zoning.	Compliance with the Municipal Scheme Regulations.	A decision by the District Municipal Planning Tribunal	The applicant shall submit a Rezoning Land use application for a "special zone" or a "consent use" (temporary) through the Emthanjeni LM for a decision by the District	Holder	Prior to the pre-construction (and contractor readiness) phase.	Compliance to be verified by ECO & IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					Municipal Planning Tribunal (contact person: Ms Lucy Billy lbilly@emthanjeni.co.za) .			
1	H4	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 photovoltaic power generation and Agriculture.	Holder	Prior to the pre-construction (and contractor readiness) phase.	Compliance to be verified by ECO & IEA.
1	H5	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	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.	Holder	Planning & Design Phase.	Compliance to be verified by ECO & IEA.
1	H6	Legitimate lighting can be a nuisance to neighbours.	Maintain project operational safety and security without	Substation lighting meets Eskom's Requirements without causing light	Provide lighting at the on-site substation as per Eskom's requirements, but whilst incorporating effective light management into the	Holder	Planning & Design Phase.	Compliance to be verified by ECO & IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
			causing light pollution.	pollution, light spillage, and distracting glare.	design of the lighting to ensure that the visual influence (such as light pollution, light spillage, and distracting glare) is limited to the solar PV facility, without jeopardising project operational safety and security.			
1	H1, H6	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, (b) Only two-track roads shall be used between solar arrays and for the fire-break road inside the perimeter fence, (c) New roads may be wider than 4 m, 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 may not be wider than 8 m, (f) Sections of existing road with a passing lane may be wider than 8 m if justified by the Engineer, and (g) Passing lanes	Holder	Planning & Design Phase.	Compliance to be verified by ECO & IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					shall not be constructed within the ecological buffer of a watercourse.			
1	H1, H6	Degradation of sensitive environments identified by specialists	Protect sensitive areas by avoidance.	Layout of the Solar PV facility overlaid on map of the sensitive areas identified by specialists.	No development, other than linear activities authorised in terms of the environmental authorisation such as crossings for roads, fence lines, electrical cables, and water pipes, may take place within the demarcated ecological buffers.	Holder, Engineer	Planning & Design Phase.	Compliance to be verified by ECO & IEA.
1	H1, H6	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.	Holder, Engineer	Planning & Design Phase.	Compliance to be verified by ECO & IEA.

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					(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-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	H6	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.

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1	H1, H4, H6	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.
1	H5, H6	Poor planning and development of land, that is without regard of Eskom's Infrastructure.	Eskom's existing infrastructure and future planning is not impeded.	Proof of correspondence with Eskom Grid Access Unit.	(1) 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. (2) 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.	Holder	Planning & Design Phase.	Compliance to be verified by ECO and IEA.

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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:

Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Impact No.
2	NA	NA	**Impact:** **(1)** 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). **(2)** Disturbance during construction can cause active mammals 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 (indirect).	**02**
6	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 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. - Undergrazing does have a deleterious effect on veld condition (indirect).	**02**
6	Distribution Lines	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	**02**

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Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Impact No.
			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.	

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

Impact 02 (Animal species)

- The **Medium** Animal Species theme according to the Screening Report and owing to the presence of *Aves-Neotis ludwigii*, was confirmed in the Site Sensitivity Verification Report.
- 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 (Important Bird Area)

- The **Low** Avian theme according to the Screening Report was disputed in the Site Sensitivity Verification Report as being at least **High**.
- A relatively high diversity of 128 bird species for the area has been recorded within the 4 SABAP pentads in which the study area is situated. During the March 2022 site visit, a total of 69 species were recorded within the 4 pentads. A total of 24 priority species (e.g., rare, SA endemic) are expected to occur within and surrounding the study area. Fourteen (14) of these species have medium to high occurring probability (POC) on the site. Thirteen (13) of the 24 priority species are listed as threatened and near threatened. Seven (7) of these regionally/globally threatened and near-threatened species were observed during the site visit, including Ludwig's Bustard, Blue Crane, Martial Eagle, Verreaux's Eagle, Lanner Falcon, Karoo Korhaan, and Secretary Bird – all of these birds are the IBA trigger species (see below). (Avifauna Scoping Report and Plan of Study prepared by Enviro-Insight cc and dated April 2022)
- The study area is within an Important Bird Area (IBA) called Platberg-Karoo Conservancy (unprotected). The following information was taken off the BirdLife website (https://www.birdlife.org.za/iba-directory/platberg-karoo-conservancy - page last updated Friday 13th February 2015).

  IBA trigger species

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- Globally threatened species are Blue Crane, Ludwig's Bustard, Kori Bustard, Secretary bird, Martial Eagle, Blue Korhaan, Black Harrier (*Circus maurus*) and Denham's Bustard (*Neotis denhami*). Regionally threatened species are Black Stork, Lanner Falcon (*Falco biarmicus*), Tawny Eagle, Karoo Korhaan and Verreauxs' Eagle.
- Biome-restricted species include Karoo Lark (*alendulauda albescens*), Karoo Long-billed Lark (*Certhilauda subcoronata*), Karoo Chat (*Cercomela schlegelii*), Tractrac Chat (*C. tractrac*), Sickle-winged Chat (*C. sinuata*), Namaqua Warbler (*Phragmacia substriata*), Layard's Tit-Babbler (*Sylvia layardi*), Pale-winged Starling (*Onychognathus nabouroup*) and Black-headed Canary (*Serinus alario*). Congregatory species include Lesser Kestrel and Amur Falcon.

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.

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).

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- 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**
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):

- None

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

- Screening Report
- Site Sensitivity Verification Report.
- BirdLife website (https://www.birdlife.org.za/iba-directory/platberg-karoo-conservancy - page last updated Friday 13th February 2015).
- 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.
- Avifauna Scoping Report and Plan of Study prepared by Enviro-Insight cc and dated April 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

Mitigations:

Impact Management Outcome(s):

- Ensure the protection of sedentary or active fauna, including mammals, aves, reptiles and arachnids.
- Ensure least impact on animal behaviour.

Targets:

- No unnecessary physical harm to wildlife.
- No incidents of negligently killing animals from speeding.
- No poaching (e.g., snares)
- Environmental Awareness relating to the protection of fauna
- No unnecessarily loud noise that is a nuisance to wildlife.
- Avoid or reduce possible PVHI effect on neighbouring game farm (Farm No. 149) – 200 m 'visual sensitivity' buffer along north-eastern property boundary.

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- 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.

Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
2	C8, H8	Loss of sedentary fauna and aves when clearing site.	Ensure the protection of sedentary fauna and aves.	No unnecessary physical harm to wildlife.	Undertake a search within the development and construction camp footprints for local sedentary or burrowing fauna, such as the Ground Squirrel.	SEO or ECO	After marking the boundaries of the construction camp, borrow pit and any working servitude.	Compliance to be verified by ECO and IEA.
2	C8, H8	Loss of sedentary fauna and aves when clearing site.	Ensure the protection of sedentary 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 SEO or ECO, and only if it is not possible to relocate a physical footprint.	SEO or ECO, Engineer, Contractor.	After marking the boundaries of the construction camp, borrow pit and any working servitude.	Compliance to be verified by ECO and IEA.
2	C?, H7	Loss of sedentary or active fauna and aves when driving.	Ensure the protection of active fauna, and aves.	Content of induction. No signs of speeding.	Drivers must adhere to the construction site's speed limit (30km/hr) and slow down when approaching game. This is to be included in the induction.	Contractor, SEO or ECO.	Continuous	Compliance to be verified by ECO and IEA.
2	C?, H7	Loss of sedentary or	Ensure the protection of	Content of Induction.	Drivers must be vigilant and on the	Contractor, SEO or ECO.	Continuous	Compliance to be

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		active fauna and aves when driving.	sedentary fauna.	Drivers have a knowledge of which animals to be vigilant for.	lookout for such sedentary animals as the … when driving. This is to be included in the induction.			verified by ECO and IEA.
2	C?	Illegal harvesting of animals.	Ensure the protection of sedentary fauna, and aves.	No poaching (e.g., snares)	Poaching of any animal or bird is prohibited.	Contractor	Continuous	Compliance to be verified by ECO and IEA.
2	C7, H7	Illegal harvesting of animals.	Ensure the protection of sedentary fauna, and aves.	Signed register of attendance, and content of induction.	The contractor's staff must be made aware of the prohibition on poaching in an induction.	Contractor, SEO or ECO.	Prior to site establishment.	Compliance to be verified by ECO and IEA.
2	C?	Forced redistribution of fauna out of territories or home ranges.	Ensure least impact on animal behaviour.	No unnecessarily loud noise that is a nuisance to wildlife.	Keep noise levels as low as practically possible when working.	Contractor	Continuous	Compliance to be monitored by SEO and verified by ECO and IEA.
2	H6	Possible PVHI effect on wild game.	Ensure least impact on animal behaviour.	Avoid or reduce possible PVHI effect on neighbouring game farm (Farm No. 149) – 200 m 'visual sensitivity' buffer along	A risk averse approach to the unknown lateral and vertical extent of the PVHI effect on wild game is to establish a 200 m corridor along the concerned neighbours' game farm boundary (Richard Vimpany of Farm No. 149).	Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
				north-eastern property boundary.				
2	H6	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.
2	H6	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	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					marked with bird diverting devices from pylon to pylon along their entire length (Shaw J.M., 2013).			
2	H6	Power lines are a major cause of avian mortality among power line sensitive species.	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 protect birds that fly at night, such as Flamingos.	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
2	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 basic assessment process.

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- Although sedentary animals pose a higher risk of harm than active animals, both types of animals are susceptible to harm when construction vehicles are driven at speed.
- Sound can travel beyond the boundaries of the development footprint, impacting redistribution of animal home ranges and territories.
- Poaching by the contractor's staff.
- 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 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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Receiving Environment: Terrestrial flora

Description of potential impacts:

Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Impact No.
2	NA	NA	**Impact:** **(1)** 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).	**03**
4	Uncertainty (SIA)	NA	**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 (indirect).	**03**

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

Impact 03 (Ecosystem/Vegetation Type)

- The De Aar area falls within the Nama Karoo biome.
- Not a critically endangered or endangered ecosystem in terms of SANBI's latest NBA (2018). The ecosystem threat status as per the NBA 2018 data provides a holistic view of the vegetation type, the threatened species associated with the ecosystem and the overall land use currently in the area. The National vegetation type is Northern Upper Karoo and is considered Least Threatened in the National List of Threatened Ecosystems (NBA, 2018). However, the Ecosystem Protection Level for the Northern Upper Karoo is categorised as Poorly Protected Ecosystem (NBA, 2018). Less than 2,9% of the area is statutorily conserved (protected), compared with the national conservation target of 21%. Although none of this vegetation type is conserved in statutory conservation areas, very little has been cleared for cultivation or irreversibly transformed (99,7% Remaining) through human settlement or infrastructure development. (Visual Assessment)

Assessment without mitigation:

Legend

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

- NBA (2018)
- Mucina, L. & Rutherford, M.C. (Eds.). 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelizia 19. South African National Biodiversity Institute, Pretoria, South African.

Mitigations:

Impact Management Outcome(s):

- Conserve terrestrial plants, particularly protected or threatened plants (SCC).

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Targets:

- No unnecessary loss of or harm to terrestrial plants, particularly protected or threatened plants (SCC).
- No illegal harvesting of terrestrial plants or plant parts (e.g., debarking).
- Environmental Awareness relating to the protection of flora.
- No run-away (uncontrolled) fires.

Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
3	C8, H8	Loss of local terrestrial plants.	Conserve terrestrial plants, particularly SCC	No unnecessary loss of or harm to terrestrial plants, particularly SCC - Marked SCC	Perform a search for any threatened or protected flora in those areas that will be disturbed by construction activities, including the construction camp, borrow pit and any working servitude.	SEO or ECO	After marking the boundaries of the construction camp, borrow pit and any working servitude.	Compliance to be verified by ECO and IEA.
3	C8, H8	Loss of local terrestrial plants.	Conserve terrestrial plants, particularly SCC	No unnecessary loss of or harm to terrestrial plants, particularly SCC - A license under the NFA, 1998, a permit under NEMBA, 200	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.	SEO or ECO Engineer	Prior to commencement of clearing and grubbing.	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
				and/or a permit under NCNCA, 2009.				
3	C8, C?	Loss of local terrestrial plants.	Conserve terrestrial plants, particularly SCC	No unnecessary loss of or harm to terrestrial plants, particularly SCC - Rescued SCC cared for in a nursery.	Rescue any SCC found to occur during a search within any area to be physically disturbed by construction activities and maintain those plants in a nursery until they can be returned during rehabilitation	SEO	Prior to commencement of clearing and grubbing.	Compliance to be verified by ECO and IEA.
3	C?	Illegal harvesting of terrestrial plants.	Conserve terrestrial plants, particularly SCC	No signs of 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	Continuous	Compliance to be monitored by SEO and verified by ECO and IEA.
3	C8, H8	Illegal harvesting of terrestrial plants.	Conserve terrestrial plants, particularly SCC	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 in an induction.	Contractor, SEO or ECO.	Prior to site establishment.	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
3	C?	Risk of veld fires caused by workers during the construction of the facility.	Conserve terrestrial plants, particularly SCC	No run-away (uncontrolled) fires - no open fires	1) Open fires are prohibited.	Contractor	Continuous	Compliance to be verified by ECO and IEA.
3	C?	Risk of veld fires caused by workers during the construction of the facility.	Conserve terrestrial plants, particularly SCC	No run-away (uncontrolled) fires - no cigarette butts observed in veld.	Do not discard lit cigarettes into the veld.	Contractor	Continuous	Compliance to be verified by ECO and IEA.
3	C?	Risk of veld fires caused by workers during the construction of the facility.	Conserve terrestrial plants, particularly SCC	No run-away (uncontrolled) fires - visible firebreaks.	Maintain a firebreak around the perimeter of the solar PV facility.	Contractor	Continuous	Compliance to be verified by ECO and IEA.
3	C?	Risk of veld fires caused by workers during the construction of the facility.	Conserve terrestrial plants, particularly SCC	No run-away (uncontrolled) fires - observed firefighting equipment.	Adequate firefighting equipment shall be regularly maintained and readily available during construction (and operation).	Contractor	Continuous	Compliance to be verified by ECO and IEA.
3	C?	Risk of veld fires caused by workers during the construction of the facility.	Conserve terrestrial plants, particularly SCC	No run-away (uncontrolled) fires - trained personnel.	A team of designated firefighting personal shall be trained and readily available to immediately deal with any runaway veld fires.	Contractor	Continuous	Compliance to be verified by ECO and IEA.

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Assessment with mitigation:

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"):

- Protected or threatened plant species may be missed during the Search.
- Plants or plant parts, such as tree bark or tubers, may be illegally harvested for muthi.
- The residual risk of loss of threatened terrestrial flora (**03**) 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 No.	Sub-activity	Environmental Aspect	Impact-Consequence	Impact No.
2	NA	NA	**Impact:** **(1)** 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 (direct).	**04**

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

Impact 04 (General)

- Except for localised benthic organisms within free standing or flowing waterbodies, aquatic fauna is capable of emigrating from an area upon being disturbed.
- Any in-stream dams located on the properties will not be disturbed or impacted by construction activities as they are located within the ecological buffers to be excluded from the development footprint.

Impact 04 (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. (Plan of Study prepared by Dr Andrew Deacon)
- 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 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. (Hydrology Assessment)
- **Impact No. 04 is non-significant and does not require further investigation or mitigation.**

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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
04	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):

- None

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

- Plan of Study prepared by Dr Andrew Deacon (Aquatic Specialist)
- Hydrological Assessment (Version – Final 2) 11 April 2022 GCS Project Number: 22-0076 by Hendrik Botha

Mitigations:

Impact Management Outcome(s):

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- Ensure the protection of sedentary or active fauna, including amphibians.
- ~~Ensure the protection of aquatic macro- and microfauna.~~

Targets:

- No unnecessary physical harm to aquatic life.
- ~~No fishing and netting.~~
- ~~Environmental Awareness relating to the protection of aquatic fauna.~~
- ~~No deep excavations that could entrap fish in isolated ponds.~~

Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
4	C8, H8	Loss of sedentary fauna and aves when clearing site.	Ensure the protection of sedentary fauna and aves.	No unnecessary physical harm to wildlife.	Undertake a search for local sedentary or burrowing fauna, such as frogs, within the boundaries of the three road crossings to be upgraded, and any working servitude crossing a watercourse, such as those for the fence line, fire break road, underground cables and pipes.	SEO or ECO	After marking the boundaries for the three road crossings to be upgraded, and any working servitude crossing a watercourse, such as those for the fence line, fire break road, underground cables, and pipes.	Compliance to be verified by ECO and IEA.
4	C8, H8	Loss of sedentary fauna and	Ensure the protection of sedentary	Photographic evidence of relocation operation.	If any sedentary animals or ground nesting birds are found, then these are	SEO or ECO, Engineer, Contractor.	After marking the boundaries for the three road	Compliance to be verified by

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		aves when clearing site.	fauna, and aves.		to be relocated to a suitable distance and habitat by the SEO or ECO, and only if it is not possible to relocate the physical footprint.		crossings to be upgraded, and any working servitude crossing a watercourse, such as those for the fence line, fire break road, underground cables, and pipes.	ECO and IEA.
4		~~Illegal harvesting of fish.~~	~~Ensure the protection of aquatic macro- and microfauna.~~	~~No fishing and netting in the river.~~	~~Fishing and netting of any fish are prohibited.~~	~~Contractor~~	~~Continuous~~	~~Compliance to be verified by ECO and IEA.~~
4		~~Illegal harvesting of fish.~~	~~Ensure the protection of aquatic macro and microfauna.~~	~~Signed register of attendance, and content of induction.~~	~~The contractor's staff must be made aware of the prohibition on fishing and netting in an induction.~~	~~Contractor, SEO or ECO.~~	~~Prior to site establishment.~~	~~Compliance to be verified by ECO and IEA.~~
4		~~Ponded water isolated from the main channel may strand entrapped fish carried there during high water events.~~	~~Ensure the protection of aquatic macro- and microfauna.~~	~~No large, random, and deep excavations in the riverbed.~~	~~Sand shall be mined using the Dry Pit Mining method, which requires scraping off the top layer from within dry ephemeral streambeds and/or from exposed sand~~	~~Engineer, Contractor.~~	~~Continuous~~	~~Compliance to verified by ECO and IEA.~~

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					~~bars without excavating below the low-flow water level, e.g., conventional sand bar skimming, or scalping.~~			
~~4~~		~~Ponded water isolated from the main channel may strand entrapped fish carried there during high water events.~~	~~Ensure the protection of aquatic macro- and microfauna.~~	~~No large, random, and deep excavations in the riverbed.~~	~~Skim as little sand as possible (300-600mm) from different sand banks/ bars outside the active channel to minimise impacts at one area.~~	~~Engineer, Contractor.~~	~~Continuous~~	~~Compliance to verified by ECO and IEA.~~
~~4~~		~~Ponded water isolated from the main channel may strand entrapped fish carried there during high water events.~~	~~Ensure the protection of aquatic macro and microfauna.~~	~~Shaped to natural forms during operations.~~	~~Re-instatement of the original landscape levels must be done concurrent with mining operations.~~	~~Engineer, Contractor.~~	~~Continuous~~	~~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
04	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
04	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- ~~Aquatic fauna, specifically fish, may be caught by staff.~~
- 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 threatened aquatic fauna (**04**) 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 No.	Sub-activity	Environmental Aspect	Impact-Consequence	Impact No.
2	NA	NA	**Impact:** **(1)** 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).	**05**

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

Impact 05 (Surface Water Hydrology)

- 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)

Impact 05 (Wetlands)

- The study area is not within an area identified in terms of an international convention, such as a RAMSAR site.
- The project area contains (National Freshwater Ecosystem Priority Areas) “Wetlands and Estuaries” (Screening Report, and Site Sensitivity Verification Report).
- Based on available National Wetland Freshwater Ecosystem Priority Areas (NFEPA) (Van Deventer, 2018 in Hydrology Assessment) the non-perennial drainage streams associated with the site are classified as riverine wetland systems (to be confirmed by the wetland assessment report – not part of this study). (Hydrology Assessment)

Impact 05 (General)

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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- Apart from linear infrastructure crossings, the solar PV facility is planned to remain outside of sensitive ecological areas, including watercourses and wetlands.
- **Impact No. 05 is non-significant and 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
05	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:

- Screening Report.
- Site Sensitivity Verification Report.

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Reg: 2006/023163/23

- Hydrological Assessment (Version – Final 2) 11 April 2022 GCS Project Number: 22-0076 by Hendrik Botha

Mitigations:

Impact Management Outcome(s):

- Conserve aquatic (wetland) plants, particularly protected or threatened plants (SCC).

Targets:

- No unnecessary loss of or harm to aquatic (wetland) plants, particularly protected or threatened plants (SCC).
- No illegal harvesting of aquatic (wetland) plants or plant parts (e.g., reeds or grasses).
- Environmental Awareness relating to the protection of aquatic flora.

Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
5	C8, H8	Loss of local aquatic plants.	Conserve aquatic (wetland) plants, particularly SCC	No unnecessary loss of or harm to terrestrial plants, particularly SCC - Marked SCC	Perform a search for any threatened or protected flora in those areas that will be disturbed by construction activities, including the three road crossings to be upgraded, and any working servitude crossing a watercourse, such as those for the fence line, fire break	SEO or ECO	After marking the boundaries for the three road crossings to be upgraded, and any working servitude crossing a watercourse, such as those for the fence line, fire break road, underground	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					road, underground cables and pipes.		cables and pipes.	
5	C8, H8	Loss of local aquatic plants.	Conserve aquatic (wetland) plants, particularly SCC	No unnecessary loss of or harm to terrestrial plants, particularly SCC - A license under the NFA, 1998, a permit under NEMBA, 200 and/or a permit under NCNCA, 2009.	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.	SEO or ECO Engineer	Prior to commencement of clearing and grubbing.	Compliance to be verified by ECO and IEA.
5	C8, H8	Unlawful picking of any indigenous plant (**"pick"** includes to collect, to cut, to chop off, to take, to gather, to pluck, to uproot, to break, to damage or to destroy).	Conserve aquatic (wetland) plants, particularly SCC	A permit under NCNCA, 2009.	Apply for a permit prior to picking any indigenous plant within an area bordering a natural watercourse, whether wet or dry, up to and within 100 m from the middle of a river on either side of the natural watercourse.	SEO or ECO	Prior to commencement of clearing and grubbing.	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
5	C8, C?	Loss of local aquatic plants.	Conserve aquatic (wetland) plants, particularly SCC	No unnecessary loss of or harm to terrestrial plants, particularly SCC - Rescued SCC cared for in a nursery.	Rescue any SCC found to occur during a search within any area to be physically disturbed by construction activities and maintain those plants in a nursery until they can be returned during rehabilitation	SEO	Prior to commencement of clearing and grubbing.	Compliance to be verified by ECO and IEA.
5	C?	Illegal harvesting of aquatic plants.	Conserve aquatic (wetland) plants, particularly SCC	No signs of 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	Continuous	Compliance to be monitored by SEO and verified by ECO and IEA.
5	C8, H8	Illegal harvesting of aquatic plants.	Conserve aquatic (wetland) plants, particularly SCC	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 in an induction.	Contractor, SEO or ECO.	Prior to site establishment.	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
05	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"):

- Aquatic flora, such as reeds or grasses, may be harvested by staff.
- The residual risk of loss of threatened aquatic plants (**05**) 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 No.	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
2	NA	NA	**Impact:** **(1)** Suitable material sourced from crushed rock for road upgrades will remove and reduce a natural resource (direct). **Consequence:** - No foreseeable consequences in terms of resource availability as rock is a plentiful resource. (direct) - the removal of rock from a dolerite dyke may change the unique vegetation in cases where the location and orientation of the dyke within the local landscape has an obvious effect on water availability and species composition. (indirect)	quantity	**06**
6	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	**07**

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

- ~~Despite water storage infrastructure, such as dams interrupting the longitudinal continuity of sediment transport, the presence of sand shoals at both alternative sites does indicate that sediment is replenished during strong flow events.~~

Impact 06 (Geology)

- According to the 1:1 000 000 series geology map for the area (ESRI Geology Map Series, 2022 referred to in Hydrology Assessment), the geology of the study area is underlain by flat-lying sedimentary rocks of the Karoo Supergroup, which have been intruded by innumerable sills

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and dykes of dolerite (Hydrology Assessment). Dolerite generally provides suitable material or aggregate for road construction (pers. comm. Frederik Stapelberg, Engineering Geologist (Pr. Sci. Nat.)) - **Considering there is no shortage of dolerite within the project area, its mining for developing new roads and upgrading existing roads will not significantly impact on its availability.**

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
07	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):

- None.

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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.

Mitigations:

Impact Management Outcome(s):

- Maintain biodiversity relating to different vegetation communities.
- Conserve topsoil/prevent contamination.

Targets:

- Avoid the loss of any sensitive or unique vegetative features directly resulting from the location and orientation of the dyke within the local landscape.
- No signs of oil spills from field transformers.

Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
6	H6	The mining of rock from a dolerite dyke may destroy sensitive or unique vegetative features.	Maintain biodiversity relating to vegetation communities.	Avoid the loss of any sensitive or unique vegetative features directly resulting from the location and orientation of	The borrow pit shall be located outside any sensitive or unique vegetative features directly resulting from the location and orientation of the dyke within the local landscape.	Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
				the dyke within the local landscape.				
7	H6	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
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

Alternative Site No. 1 (preferred)

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

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07	L	L	M	-I	M	L	0	M	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

Residual Risk (feeds back into "Mitigations"):

- The residual risk of loss of unique vegetation communities (**06**) after mitigation is assumed to be Low.
- Whilst effective against a damaged transformer leaking oil, the transformer containment bund (**07**) 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".

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 No.	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
2	NA	NA	**Impact:** **(1)** Construction will require the abstraction of water from boreholes for mixing concrete, dust suppression and potable usage. Uncontrolled abstraction of groundwater from an underground aquifer could deplete the ecological reserve and affect other water users' rights to domestic use **Consequence:** - Less water in an underground aquifer means less water for other water users, including for reasonable domestic use and livestock watering (direct). **(2)** 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. **(3)** Water scarcity is expected to be exacerbated by drought, reduced run-off, and increased evaporation. According to the District Municipality's Climate Change Response Plan there are increased risks to *inter alia* water availability for irrigation and drinking in an arid District dependent on groundwater. (indirect) **Consequences:** - A lack of sufficient locally available water for future operation could be a fatal flaw of the proposed development.	quantity	**08**
2	NA	NA	**Impact:** **(1)** Disturbance of aquatic or terrestrial habitat can favour the recruitment of alien invasive plants. **Consequence:**	quantity	**08**

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Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
			- threat to local and national water security (indirect). Note: The impact of alien plant recruitment on water security is adequately mitigated elsewhere (under "Terrestrial Ecosystems")		
5	Dust Suppression	Water Usage	**Impact:** 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 m^3 of water for dust suppression or control. **Consequences:** -- Less water in an underground aquifer means less water for other water users, including for reasonable domestic use and livestock watering (direct).	quantity	**08**
6	Water infrastructure (Supply)	Groundwater abstraction, purification, and storage	**Impact:** The yield from a new borehole may not be viable. **Consequences:** Wasted resources	quantity	**08**
3	Solar PV Facility	NA	**Impact:** Water scarcity is expected to be exacerbated by drought, reduced run-off, and increased evaporation. According to the District Municipality's Climate Change Response Plan there are increased risks to *inter alia* 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 a nuisance in personal hygiene, and harmful to livestock. - High salt content in water used to clean solar panels will leave marks or streaks that interfere with operational efficiency. **Mitigations:** • Establish deionization plants at each borehole. **Management Outcome:** Reduce deterioration in water quality due to increased salt concentrations in dams, wetlands and soil/plant systems from enhanced evaporation.	quality	**09**

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Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
6	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	**09**
6	Effluent Infrastructure (Sanitation)	Effluent disposal	**Impact:** Groundwater is vulnerable to pollution from on-site effluent disposal facilities. **Consequence:** - Abstraction of polluted groundwater is harmful to human health.	quality	**09**
6	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	**09**
6	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	**09**
2	NA	NA	**Impact:** **(1)** Construction at the road crossings 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	**10**
2	NA	NA	**Impact:** **(1)** Construction at the road crossings 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	**10**
2	NA	NA	**Impact:** **(1)** Construction activities will alter the physical characteristics of the terrain.	behaviour	**10**

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Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
			Consequence: - Altered surface stormwater run-off patterns, e.g., from sheet flow to channelled flow, can cause erosion (direct).		
6	Stormwater Outlets	NA	**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). **Mitigation:** (1) Culverts 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. (2) Box culverts are preferred to stormwater pipes. (3) Sufficient box culverts shall be incorporated into the design to span the width of the active channel. Management outcome: Preserve stream or river channel hydrological pattern.	behaviour	**10**

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

Impact 08 (Groundwater - Geohydrology)

- De Aar is dependent on groundwater for agriculture and drinking water (District Municipality's Climate Change Response Plan).
- 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). (Social Scoping Report)
- 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)

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- 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)

Impact 08 (Permissible Abstraction Rates in terms of a GA)

- The affected properties fall within the D62D catchment. The General Authorisation (GN 538, GG 40243, 02nd September 2016) allows for the abstraction of 45 m^3 per hectare per year of groundwater (but no more than 40 000 m^3 of ground water may be taken per year on a property).
- A borehole (Borehole No. 4) is located on the Remainder of Farm Goede Hoop 26C. This farm is 1 502,8325 hectares. Consequently, the landowner is entitled to abstract no more than 40 000 m^3 of groundwater per year (or **109 m^3 per day**) on the Remainder of Farm Goede Hoop 26C.
- A second borehole (Borehole No. 5) is located on Portion 3 of Farm Goede Hoop 26C. This farm is 1015,9683 Morgen (SG Diagram) or 870,380 ha (1 South African morgen = 0.8567 hectare). Consequently, the landowner is entitled to abstract 39 167,1 m^3 of groundwater per year (or **107 m^3 per day**) on Portion 3.
- As such, the total permissible abstraction for the project area, that is both properties combined is 109 +107 = 216 m^3 per day. – **provided abstraction falls within the limits and conditions prescribed in the GA.**

Impact 09 (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-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.

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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)
- 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).

Impact 09 (*Rainwater Harvesting*)

- 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 (m^2) 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 10 (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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- 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)

Impact 10 (Construction Period)

- The three phases will be built sequentially. There may be some overlap. Once civil works on Phase 1 are complete the civils' team would move onto Phase 2. Furthermore, each phase would be built sequentially, e.g., Phase 3 will be built in 4 x 100 MW blocks. That way it is possible to limit the amount of people on site, as well as mitigate the need for massive amounts of equipment, storage etc.
- There will also be some overlap between construction and operation. In other words, once the first 100 MW block is complete, it will start feeding electricity into the national grid while the second and subsequent 100 MW blocks are being built. Consequently, construction items from fencing and roads to the on-site substation and operational offices must be completed first under the civil construction phase, usually no more than 4 months. Subsequent construction of each 100 MW block typically takes 12 to 15 months from start to finish (pers. comm. JP De Villiers, Managing Director, Soventix).

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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
08	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
09	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
10	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):

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- 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:

- ~~Sand Mine Guideline for South Africa for water use authorisation of sand mining/ gravel extraction in terms of impacts on characteristics of watercourses. Department of Water and Sanitation, South Africa, September 2014.~~
- 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 Scoping Report prepared by Equispectives Research & Consulting Services dated April 2022
- Screening Report
- Hydrological Assessment (Version – Final 2) 11 April 2022 GCS Project Number: 22-0076 by Hendrik Botha
- General Authorisation for S21(a) and (b) published in GN 538 of GG 40243 on 02nd September 2016
- Plan of Study prepared by Dr Andrew Deacon (Aquatic Specialist)
- 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):

- 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.
- Avoid a nuisance in personal hygiene.
- Water is safe for drinking and non-potable usage.

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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.
- Avoidance of surface water pollution.
- 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 No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
8	H6	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: Geohydrological Assessment Report	Undertake a Geohydrological assessment to determine whether the proposed development can meet its requirements in terms of groundwater during construction (and operation) without detrimentally impacting on the ecological reserve of the underground aquifer as well as other water users now and into the future under drought	EAP	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					events/ projected climate change scenarios.			
8	H6	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: A third borehole within the project area.	If it is financially and environmentally (dependent on outcome of Geohydrological Assessment) feasible, drill an additional borehole within proximity to the operational area but further than a 500 m radius from the boundary of a wetland, and a 100 m radius from the delineated riparian edge of a watercourse.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
8	H5, H? and C?	Uncontrolled abstraction of groundwater from an underground aquifer could deplete the ecological reserve and affect other water users' rights to	Protection and Restoration of a Strategic Water Source Area	Preserve the underground aquifer, that is abstracting without depleting: Borehole water quality and yield results.	Establish background pH, Electrical Conductivity (EC)/Total Dissolved Solids (TDS), Temperature, water levels and abstraction yield for boreholes as per the Surface Water	Holder, Water Quality Monitor or SEO or ECO	Planning and Design Phase Pre-construction	Compliance to be verified by ECO and IEA.

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		domestic use and livestock watering.			Monitoring Plan in **Section 8** (page 36) of the Hydrology Assessment Report before the contractor arrives on site.			
8	H? and C?	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: SEO's site diary – findings relating to quarterly results.	The SEO or other water quality monitor shall implement Phase 2 of the Surface Water Monitoring Plan as per **Section 8** (page 36) of the Hydrology Assessment Report as it pertains to borehole monitoring.	Holder, Water Quality Monitor or SEO or ECO	Quarterly during and up to 2 years after the completion of the development.	Compliance to be verified by ECO and IEA.
8	H6	The yield from a new borehole may not be viable, resulting in wasted resources.	Protection and Restoration of a Strategic Water Source Area	Preserve the underground aquifer, that is abstracting without depleting: Tests	Tests should be conducted to estimate the likely yield before drilling a borehole to ensure viability.	Holder, Driller	Pre-construction: site establishment.	Compliance to be verified by ECO and IEA.
8	H6	The yield from a new borehole may not be viable,	Protection and Restoration of a Strategic	Preserve the underground aquifer, that is	The drilling should be executed in accordance with the South African	Holder, Driller	Pre-construction: site establishment.	Compliance to be verified by

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		resulting in wasted resources.	Water Source Area	abstracting without depleting: Show compliance with Standard.	National Standard, development, maintenance and management of groundwater resources - Part 4 Test Pumping of water boreholes.			ECO and IEA.
8	H6	The yield from a new borehole may not be viable, resulting in wasted resources.	Protection and Restoration of a Strategic Water Source Area	Preserve the underground aquifer, that is abstracting without depleting: Proof of registration.	A reputable driller registered with the Borehole Water Association of South Africa (BWASA) should be used to drill the borehole.	Holder, Driller	Pre-construction: site establishment.	Compliance to be verified by ECO and IEA.
8	H6	The yield from a new borehole may not be viable, resulting in wasted resources.	Protection and Restoration of a Strategic Water Source Area	Preserve the underground aquifer, that is abstracting without depleting: An employee with knowledge on borehole maintenance. Maintenance records.	An employee should be trained to maintain the borehole and borehole pump and to alert management when major breakdowns occur.	Holder	Planning and Design Phase Continuous	Compliance to be monitored by SEO and verified by ECO and IEA.
8	H6 and H?	Uncontrolled abstraction of groundwater	Protection and restoration of	Preserve the underground	Install flow metres at all abstraction points (boreholes). Water	Holder, Engineer, Water Quality	Planning and Design Phase	Water usage is to be metered

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		from an underground aquifer could deplete the ecological reserve and affect other water users' rights to domestic use and livestock watering.	a Strategic Water Source Area.	aquifer, that is abstracting without depleting: Flow metres observed at all boreholes.	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.	Monitor or SEO or ECO	Pre-construction: site establishment. Continuous	and monitored by the SEO. Compliance to be verified by ECO and IEA.
8	H? and C?	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: SEO's site diary – findings relating to quarterly results.	Borehole water level measurements should be taken regularly and recorded to ensure the pump is always submerged and to provide early warning of source depletion.	Holder, Water Quality Monitor or SEO or ECO	Weekly	Compliance to be verified by ECO and IEA.
8	H6	Uncontrolled abstraction of groundwater from an underground	Protection and restoration of a Strategic	Preserve the underground aquifer, that is abstracting	Reduce water consumption during operation by incorporating wise water use strategies	Holder, Engineer	Planning and Design Phase Continuous	Water usage is to be metered and

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		aquifer could deplete the ecological reserve and affect other water users' rights to domestic use and livestock watering.	Water Source Area.	without depleting: Save water through wise water use – evidence of a strategy and research.	and/or technologies into the design of the facility, behaviour of employees, and operational procedures. Continually research the adoption of new water saving technologies in the solar PV field.			monitored by the SEO. Compliance to be verified by ECO and IEA.
8	H6	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.	Examples of wise water use strategies and/or technologies include (a) Minimise the gravel road network. (b) Supplement non-potable water by harvesting rainwater runoff from the roof of the main building at the operational area unless non-potable usage doesn't warrant it. (c) Reuse treated wastewater generated by a waterwork (e.g., a wastewater treatment package plant) for non-	Holder, Engineer	Planning and Design Phase Continuous	Water usage is to be metered and monitored by the SEO. Compliance to be verified by ECO and IEA.

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					potable usage, e.g., dust suppression. (d) 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).			
8	C?	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 water consumption during construction by incorporating wise use strategies and/or technologies into the behaviour of employees and operational procedures. For example, closing taps, repairing leaks, reducing driving speed and using environmentally friendly chemical alternatives to control dust on main gravel access roads	Contractor	Continuous	Water usage is to be metered and monitored by the SEO. Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					as opposed to only water.			
8	H5 and C?	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.	Avoid or 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.
9	H3, H6	Climate Change poses an increased risks to decreased quality of drinking water in an arid District dependent on ground water (with a high salt content).	Avoid adverse economic implications of excessive hardness as well as a nuisance in personal hygiene.	A functional water treatment plant at applicable water sources. Total hardness for domestic use should be limited to between 50 - 100 mg/• as	Establish water treatment, e.g., deionization plants at water sources used for washing solar modules and domestic use (potable water).	Holder	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.

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				$CaCO_3$, where possible.				
9	H6	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 important consideration.	Holder	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
9	H6	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.
9	H6	Groundwater is vulnerable to pollution.	Safe drinking water.	Avoidance of groundwater pollution: Design includes	Ensure the design and development of the NewGen100 treatment plant includes *inter alia* a	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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				points of reuse and subsurface discharge.	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.			
9	H6	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 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.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
9	H6	Groundwater is vulnerable to pollution.	Safe drinking water.	Avoidance of groundwater pollution: Design includes	Ensure the design and development of the Multirock 60 treatment plant includes *inter alia* discharge piping	Holder, Engineer	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.

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				a subsurface discharge point.	from the storage tanks at the point of reuse (e.g., dust control) to a sub-surface soakaway at the point of discharge.			
9	H6	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.
9	H6	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	Holder, Engineer	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					information is included in Annexure A of SANS 10252-2.			
9	H6	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.
9	H6	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.
9	H6	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 at the points of reuse or discharge.	Holder	Continuous	Compliance to be monitored by SEO and verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
9	H6	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.
9	H6	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.
9	H6	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	If rainwater harvesting is a feasible option to supplement non-potable usage during operation, then some mechanism (e.g., a first-flush diverter)	Holder, Engineer	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
				diverter or similar mechanism.	should be installed to discard the first flush of rainwater from a roof.			
9	H6	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 debri, as well as insects and rodents.	Holder, Engineer	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
9	H6	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.
9	C?	Overflowing chemical toilets can contaminate soil and surface water.	Safe drinking water.	Avoidance of surface water pollution: The holding tanks are not overfilled.	The sewerage shall be removed regularly (dependant on usage) from the holding tank of portable chemical	Contractor, SEO	Continuous	Compliance to be monitored by the SEO and verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
				Municipal disposal bills.	toilets and conveyed to a municipal treatment or disposal facility.			
10	C?	Altered surface water flow pattern causing sedimentation and/or erosion.	Protection and restoration of a Strategic Water Source Area	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 of the active channel bank must be verified by the ECO.	Engineer, Contractor, ECO	Before clearing and grubbing operations	Compliance to be verified by ECO and IEA.
10	C?	Altered surface water flow pattern causing sedimentation and/or erosion.	Protection and restoration of a Strategic Water Source Area	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.	Engineer, Contractor, SEO	Before clearing and grubbing operations	Compliance to be verified by ECO and IEA.
10	C?	Altered surface water flow pattern causing sedimentation and/or erosion.	Protection and restoration of a Strategic Water Source Area	Preserve in-stream hydrological pattern: SEO's site diary – findings relating to monitoring river diversion works.	The river diversion works must be monitored daily by the SEO for signs of scouring.	Contractor, SEO	Daily	Compliance to be monitored by SEO and verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
10	C?	Altered surface water flow pattern causing sedimentation and/or erosion.	Protection and restoration of a Strategic Water Source Area	Preserve in-stream hydrological pattern: Appropriate remediation measures.	Any signs of scouring caused by a river diversion works must be immediately rectified and remediated.	Engineer, Contractor.	When required.	Compliance to be verified by ECO and IEA.
10	C?	Altered surface water flow pattern causing sedimentation and/or erosion.	Protection and restoration of a Strategic Water Source Area	Preserve river channel 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.
10	C?	Altered surface water flow pattern causing sedimentation and/or erosion.	Protection and restoration of a Strategic Water Source Area	Preserve river channel hydrological pattern: Shaped to natural forms.	The levelling of the disturbed area should not significantly alter the flow characteristics of the watercourse during periods of high flows, e.g., shaped to natural forms that blend in with pre-construction topography.	Engineer, Contractor.	Upon completion of upgrading the road crossing.	Compliance to be verified by ECO and IEA.
10	C?	Altered surface water	Protection and	Preserve river channel	Ensure re-instatement of the	Engineer, Contractor.	Upon completion of	Compliance to be

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		flow pattern causing sedimentation and/or erosion.	restoration of a Strategic Water Source Area	hydrological pattern: Shaped to natural forms.	original aquatic landscape levels.		upgrading a road crossing	verified by ECO and IEA.
10	H6	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: Observed stabilization measures.	Culverts 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	Planning and Design Phase	Compliance to be verified by ECO and IEA.
10	H6	Culverts or stormwater outlets tend to concentrate and increase the velocity of surface water	Protection and restoration of a Strategic Water Source Area	Preserve river channel hydrological pattern: Observed box culverts.	Box culverts are preferred to stormwater pipes.	Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		flow, changing the surface water hydrology or flow patterns.						
10	H6	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.	Sufficient box culverts shall be incorporated into the design to span the width of the active channel.	Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
10	C?	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.
10	C?	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	The levelling of disturbed areas should not significantly alter the flow characteristics of stormwater run-	Contractor.	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		flow, can cause erosion.		mounds of earth.	off, e.g., shaped to natural pre-existing forms that retain sheet flow.			
10	C?	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
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

Alternative Site No. 1 (preferred)

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

Residual Risk (feeds back into "Mitigations"):

- **The residual risk of abstracting groundwater on the underground aquifer (08) after effective water saving measures can only be calculated once the Geohydrological Assessment is completed.**
- The residual risk of surface and groundwater pollution (**09**) after mitigation is assumed to be Low.
- The residual risk of erosion caused by changed surface water flow patterns (**10**) after mitigation is assumed to be Low.

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Receiving Environment: Atmosphere

Description of potential impacts:

Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
6	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	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	**11**

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

Impact 11

- 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)

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- 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.
- 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)

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)

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

Mitigations:

Impact Management Outcome(s):

- Increased ecosystem resilience to atmospheric warming.

Targets:

- Reduced potential PV "heat island" (PVHI) effect.

Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
11	H?	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	Holder	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					climatic uncertainty - restore all bare patches of soil with vegetation.			
11	H?	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.
11	H? and C?	The PV "heat island" (PVHI) effect.	Increased ecosystem resilience to atmospheric warming.	Reduce the potential PVHI: Natural vegetation retained underneath solar PV modules.	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.
11	H6	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.
11	H6	The PV "heat island" (PVHI) effect.	Increased ecosystem resilience to	Reduce the potential PVHI:	Solar panel arrays should be spaced	Holder, Engineer	Planning and Design Phase	Compliance to be verified by

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
			atmospheric warming.	Adequate spacing between solar arrays.	approximately 7,4 m apart.			ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
11	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
11	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 (**11**) 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.

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Receiving Environment: Terrestrial Ecosystem

Description of potential impacts:

Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
2	NA	NA	**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	**12**
5	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	**12**
2	NA	NA	**Impact:** Disturbance of terrestrial habitat can favour the recruitment of pioneer species and alien invasive plants, threatening individuals, habitats and alter the composition, structure and functioning of ecosystems. **Consequence:** - reduced productivity and carrying capacity (indirect). - reduced capacity to produce ecosystem goods and services (indirect).	transformation	**12**
2	NA	NA	**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 terrestrial species effectively isolating fragmented patches (or "islands"). This can result in species extinction and biodiversity loss due to decreased colonization and population size.	fragmentation	**12**
3	Solar PV Facility	NA	**Impacts:** According to the District Municipality's Climate Change Response Plan there are increased risks to *inter alia*	transformation	**13**

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Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
			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. The additional income stream from leasing the land to Soventix SA (Pty) Ltd will help offset productivity and sales losses from reduced stocking densities when drought periods dictate lower carrying capacities (CC adaption), whilst ensuring good ecological management and maintenance of ecosystem integrity (CC mitigation). (**positive**) **Consequences:** - Maintenance of ecosystem integrity increases resilience to climate change.		
4	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	NA	**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	**14**
5	Commencement	NA	**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	**14**

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Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
6	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	**14**
6	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	**15**

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

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

Impact 12 (Terrestrial Biodiversity)

- The **Very High** Terrestrial Biodiversity theme according to the Screening Report and owing to the study area being within an ESA – Northern Cape CBA Map (2016) (SANBI BGIS), was confirmed in the Site Sensitivity Verification Report. ESAs must be in a systematic biodiversity plan adopted by the CA or a bioregional plan. The Critical Biodiversity Areas of the Northern Cape: Technical Report (2016) by Dr Stephen Holness

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& Enrico Oosthuysen, has been adopted (pers. comm. Elsabe Swart, DENC). There is no Bioregional Plan for the Pixley Ka Seme District Municipality District (pers. comm. Elsabe Swart, DENC).

- ESAs are meant to support the ecological functioning of CBAs through its provision of supporting ecological processes (along ecological process pathways) or even meet biodiversity targets for ecological processes that have not been met in the CBA. So, ESAs and CBAs are inextricably linked. Logically then, the nature and life history strategies of the biodiversity features (- that are the subject of the biodiversity targets, which need to be met in a CBA) will influence the nature of the supporting ecological processes that need to be protected in the ESA. The Northern Cape CBA Map is based on spatial analysis of planning units. The following biodiversity and ecological features are found in the planning units that occur on the Phase 3 study area (Unit ID: 5605, 5701, 5702, 5798 and 5895):
    - Eastern upper Karoo veg type
    - Northern Cape Upper Karoo veg type
    - IBA area
    - NFEPA wetlands and rivers
    - FEPA catchment
- ESAs should be managed to **maintain near natural landscapes with minimal loss in ecosystem integrity and functioning. Spatially explicit corridors must be managed to maintain function and structure, especially for aquatic systems. Buffers are to be managed to limit transformation with particular emphasis on maintaining ecological process that require large areas.** ESAs currently in good or fair ecological condition must be maintained in at least a fair (semi-natural) condition, whereas ESAs currently in severely modified ecological condition should not be exposed to any further deterioration in ecological condition (e.g., through intensification of land use).
- The Terrestrial Assessment identified … alien and invasive plants within the study area, namely … (NEMBA Category 1b).
- There are no sedentary or rooted threatened or keystone species in the project area.
- Imported material (aggregate) is a potential source of contaminant (seed of alien invasive plants).

Impact 12 (Ecosystem/Vegetation Type)

- The De Aar area falls within the Nama Karoo biome.
- Not a critically endangered or endangered ecosystem in terms of SANBI's latest NBA (2018). The ecosystem threat status as per the NBA 2018 data provides a holistic view of the vegetation type, the threatened species associated with the ecosystem and the overall land use currently in the area. The National vegetation type is Northern Upper Karoo and is considered Least Threatened in the National List of Threatened Ecosystems (NBA, 2018). However, the Ecosystem Protection Level for the Northern Upper Karoo is categorised as Poorly Protected Ecosystem (NBA, 2018). Less than 2,9% of the area is statutorily conserved (protected), compared with the national conservation target of 21%. Although none of this vegetation type is conserved in statutory conservation areas, very little has been cleared for cultivation or irreversibly transformed (99,7% Remaining) through human settlement or infrastructure development. (Visual Assessment)

Impact 12 (Important Bird Area)

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- 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.

Impact 12 (Bats)

- The layout of the solar footprint could fall into sensitive bat areas which should be avoided or mitigated. Limited data has indicated that bat activity over a solar development was lower than over the natural areas. The impact of the development extends beyond the alteration of habitat and available resources that would affect bat activity, abundance and diversity but during the operational phase, the impacts of artificial light pollution (flood lights for security reasons), associated with the solar project, could change behaviour and abundances of bat species within the bat community including alteration of commuting routes and preferred foraging habitat. (Plan of Study prepared by Dr Dawn Cory-Toussaint)

Impact 12 (Wetlands)

- The study area is not within an area identified in terms of an international convention, such as a RAMSAR site.
- The project area contains (National Freshwater Ecosystem Priority Areas) “Wetlands and Estuaries” (Screening Report). Based on available National Wetland Freshwater Ecosystem Priority Areas (NFEPA) (Van Deventer, 2018) the non-perennial drainage streams associated with the site are classified as riverine wetland systems (to be confirmed by the wetland assessment report – not part of this study). (Hydrology Assessment)

Impact 14 (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**.

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- 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.

Impact 15 (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 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

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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	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
13	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
14	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
15	H	M	M	-I	H	H	1	H	H	1
Reversibility	H	**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>

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- 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:

- CARA Regulations published in Government Notice R1048 in Government Gazette 9238, dated 25 May 1984.
    - **15A. Combating of category 1 plants** (1) Category 1 plants may not occur on any land or inland water surface other than in biological control reserves. (2) A land user shall control any category 1 plants that occur on any land or inland water surface in contravention of the provisions of sub-regulation (1) by means of the methods prescribed in regulation 15E.
    - **15B. Combating of category 2 plants** (1) Category 2 plants may not occur on any land or inland water surface other than a demarcated area or a biological control reserve. (8) A land user shall control any category 2 plants that occur on any land or inland water surface in contravention of the provisions of sub-regulation (1) by means of the methods prescribed in regulation 15E.
    - **15C. Combating of category 3 plants** (1) Category 3 plants shall not occur on any land or inland water surface other than in a biological control reserve. 3(c) A land user must take all reasonable steps to curtail the spreading of propagating material of category 3 plants.
- 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 - 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.
    - Alien and Invasive Species Lists published in GN No.599, amended in GN No. 1003 of GG No. 43726 on 18 September 2020
- Visual Assessment
- BirdLife website (https://www.birdlife.org.za/iba-directory/platberg-karoo-conservancy - page last updated Friday 13th February 2015)
- Plan of Study prepared by Dr Dawn Cory-Toussaint
- Screening Report
- Hydrology Assessment
- National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds, Commonwealth of Australia 2020

Mitigations:

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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.
- Reduce potential for the recruitment of alien invasive plants.
- 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).
- No construction creep.
- Sensitive vegetation units remain intact.
- No adult or reproductively mature alien invasive plants observed on site.
- Maintain ecological, massing, and visual sensitivity buffers.
- Limit Fragmentation
- Maintain ecosystem integrity and resilience to climate change.
- Minimise erosion.
- Minimise the effects of artificial light on wildlife (and humans).

Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
12	H6 and C?	Loss of terrestrial habitat cleared for	Ensure the protection of undisturbed or sensitive vegetation units.	Natural vegetation is retained between	With the exception of the borrow pit and construction	Holder, Engineer, Contractor, SEO	Planning and Design Phase Continuous	Compliance to be monitored by SEO and

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		the development footprint and construction camp.		structures and infrastructure.	camp, vegetation clearance will be restricted to the physical footprint of structures and infrastructure associated with the solar PV facility.			verified by ECO and IEA.
12	C?	Loss of terrestrial habitat cleared for the development footprint and construction camp.	Ensure the protection of undisturbed or sensitive vegetation units.	No construction creep beyond demarcated boundaries.	Construction creep, particularly into the adjacent buffers or No-Go Areas, shall be avoided by (a) reinforcing this in an induction and/or toolbox talk, (b) clearly demarcating the working servitude at the road crossings (up to 3m on either side of the development footprint) and construction camp boundaries, as well as (c) regular	Contractor, SEO, ECO	Continuous	Compliance to be monitored by SEO and verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					supervision by the SEO.			
12	C?	Loss of terrestrial habitat cleared for the development footprint and construction camp.	Ensure the protection of undisturbed or sensitive vegetation units.	No construction-related activities within buffers and No-Go Areas.	All construction personnel and construction-related activities shall remain outside buffers and No-Go Areas.	Contractor, SEO	Continuous	Compliance to be monitored by SEO and verified by ECO and IEA.
12	C?	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	H6 and C?	Loss of terrestrial habitat cleared for the development footprint and construction camp.	Ensure the protection of undisturbed or sensitive vegetation units.	Construction camp, including laydown area and future operational area, shall not exceed 4 ha.	Place the construction camp in the same area where the operational area will be located.	Holder, Engineer, Contractor.	Planning and Design Phase Site Establishment	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
12	C?	Loss of terrestrial habitat cleared for the development footprint and construction camp.	Ensure the protection of undisturbed or sensitive vegetation units.	No disturbance of undisturbed or sensitive vegetation units.	The site office, ablutions, overnight parking of machinery, waste storage area, concrete mixing area (batching site), cement, topsoil and aggregate stockpiles, and laydown area shall be confined to the construction camp and/or borrow pit.	Contractor	Ongoing	Compliance to be verified by ECO and IEA.
12	C?	Recruitment of alien invasive plants.	Reduce the potential for the recruitment of alien invasive plants.	No adult or reproductively mature alien invasive plants observed on site.	As far as is practical use local (from within the same property) materials (aggregate).	Applicant, Engineer, Contractor.	When sourcing materials.	Compliance to be verified by ECO and IEA.
12	C?	Recruitment of alien invasive plants.	Reduce the potential for the recruitment of alien invasive plants.	No adult or reproductively mature alien invasive plants observed on site.	The ECO must, upon identifying an alien invasive plant on site, such as …, report it to the Contractor or SEO.	ECO	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
12	C?	Recruitment of alien invasive plants.	Reduce the potential for the recruitment of alien invasive plants.	No adult or reproductively mature alien invasive plants observed on site.	Immediately uproot and destroy any alien invasive plant in its entirety (including propagating material) upon being identified on site.	Contractor, SEO	Continuous	Compliance to be verified by ECO and IEA.
12	C?	Recruitment of alien invasive plants.	Reduce the potential for the recruitment of alien invasive plants.	No adult or reproductively mature alien invasive plants observed on site.	Commence with rehabilitation immediately upon the cessation of construction in disturbed areas.	Contractor	Continuous	Compliance to be verified by ECO and IEA.
12	H? and C?	Recruitment of alien invasive plants.	Reduce the potential for the recruitment of alien invasive plants.	No adult or reproductively mature alien invasive plants observed on site.	Monitor for the recruitment of alien invasive plants on rehabilitated sites, and immediately remove any identified plants.	Holder, Contractor, SEO	Every two weeks, during the growing season for 2 successive growing seasons after rehabilitation.	Compliance to be verified by ECO and IEA.
12	H6	Fragmenting the local landscape.	Maintain connectivity, particularly terrestrial and aquatic ecological process pathways within the local landscape/Protection	Maintain ecological, massing, and visual sensitivity buffers: The solar PV	The design of the solar PV facility shall incorporate the ecological, massing and visual sensitivity buffers identified	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
			and restoration of a Strategic Water Source Area	facility is fragmented into three separate but interconnected blocks by pre-determined buffers.	by the relevant specialists.			
12	H6	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 aquatic ecosystem will be reduced by fencing two or more separate areas north and south of the ephemeral drainage line running through the project area (an unnamed tributary to the D62D – 05610 tributary with its confluence just downstream of the project area).	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
12	H6	Fragmenting the local landscape.	Maintenance of connectivity, particularly terrestrial and aquatic ecological process	Limit fragmentation: A perimeter fence does not intersect an	Fencing shall remain outside the delineated edge of ecological	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
			pathways within the local landscape.	ecological buffer.	buffers inclusive of the riparian or other 'High' sensitive habitats.			
12	H6	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 connecting these 'High' sensitive habitats.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
13	H6 and H?	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	Holder, Engineer, Landowner	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					generation.			
13	H6 and H?	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 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 does not exceed recommended stocking densities and ensure adequate vegetation cover necessary for the maintenance of ecosystem services. soil with vegetation.	Holder, Landowner	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
13	H?	Diversification by changing the current land-use (Agriculture) to an Agrivoltaic system is potentially a	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	Holder, Landowner	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		powerful climate resilient land-use			climatic uncertainty - restore all bare patches of soil with vegetation.			
13	H?	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.
14	H6 and H?	Overgrazing can cause erosion.	Preserve the agricultural potential and maintain or improve the agricultural productivity of the land.	Minimise erosion: soil maps and veld condition assessments to determine grazing capacity.	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	Holder, Landowner	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					densities and ensure adequate vegetation cover necessary for the maintenance of ecosystem services.			
14	H6 and C?	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: civil construction is during the winter months.	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.
14	H6	Access roads, including the two-track service roads between the solar panel arrays, will increase surface water run-off, causing erosion and sedimentation of	Maintenance of near natural landscapes with minimal loss in ecosystem integrity and functioning	Minimise erosion: berms and mitre drains on access roads.	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.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		watercourses.						
15	H6	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.
15	H6	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 timing, intensity and colour, (c) Light only the object or area intended – keep lights close to the	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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

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

Assessment with mitigation:

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

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

Alternative Site No. 1 (preferred)

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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	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
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

Residual Risk (feeds back into “Mitigations”):

- Habitat may be disturbed by construction creep beyond the footprint.
- Alien invasive plant recruitment may take place on rehabilitated sites after the contractor has left site.
- The residual risk of losing terrestrial ecosystems, including through fragmentation (**12**) after mitigation is assumed to be Low.
- The residual risk of lost biodiversity from a change of land use (**13**) after mitigation is assumed to be zero.
- The residual risk of lost biodiversity from erosion (**14**) after mitigation is assumed to be Low.
- The residual risk of disrupted life cycles from artificial lighting (**15**) after mitigation is assumed to be Low.

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Receiving Environment: Aquatic Ecosystem

Description of potential impacts:

Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
2	NA	NA	**Impact:** **(1)** The road, underground cables, pipeline and fence line crossings will result in the loss of aquatic or river habitat equivalent to the size of the development footprint. **Consequence:** - reduced habitat for aquatic fauna and Aves (direct) - reduced productivity and carrying capacity (direct)	quantity	**16**
6	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	**16**
2	NA	NA	**Impact:** **(1)** 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). **(2)** Hydrocarbon spills, during construction in the watercourse may temporarily reduce the quality of the water.	transformation	**16**

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Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
			Consequence: - Alter feeding and breeding behaviour (lowering vigour and reproductivity), species composition and aquatic ecosystem functioning (indirect).		
3	Solar PV Facility	NA	**Impacts:** **(1)** 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	**16**
6	Access Roads	NA	**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	**16**
2	NA	NA	**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	**16**
6	Installing Perimeter Fence and Access Control	Aquatic 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	**16**

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Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
6	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 could cause insect population declines, a change in biodiversity pattern, and reduced ecosystem regulating services such as pollination (indirect)	transformation	**17**

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

Impact 16 (Aquatic Biodiversity)

- The **Very High** Aquatic Biodiversity theme according to the Screening Report and owing to the study area being within a Strategic Water Source Area, as well as (National Freshwater Ecosystem Priority Areas) “Wetlands and Estuaries”, was confirmed in the Site Sensitivity Verification Report.

Impact 16 (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)

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- 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 16 (Wetlands)

- The study area is not within an area identified in terms of an international convention, such as a RAMSAR site.
- The project area contains (National Freshwater Ecosystem Priority Areas) “Wetlands and Estuaries” (Screening Report). Based on available National Wetland Freshwater Ecosystem Priority Areas (NFEPA) (Van Deventer, 2018) the non-perennial drainage streams associated with the site are classified as riverine wetland systems (to be confirmed by the wetland assessment report – not part of this study). (Hydrology Assessment)
- “NFEPA Wetlands” are important or sensitive wetlands and wetland clusters that are required to achieve biodiversity targets. Their FEPA status indicates that they should remain in a good condition to contribute to national biodiversity goals and support sustainable use of water resources. Wetland FEPAs currently in a good ecological condition **should be managed to maintain this condition**. Those currently not in a good condition **should be rehabilitated to the best attainable ecological condition**.

Impact 17 (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)

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

Alternative Site No. 1 (preferred)

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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):

- 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:

- Screening Report
- Site Sensitivity Verification Report
- Hydrology Assessment
- Plan of Study
- 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.
- ~~Sand Mine Guideline for South Africa for water use authorisation of sand mining/ gravel extraction in terms of impacts on characteristics of watercourses. Department of Water and Sanitation, South Africa, September 2014.~~
- ~~Department of Water Affairs and Forestry, 1996. South African Water Quality Guidelines. Volume 7: Aquatic Ecosystems~~

Mitigations:

Impact Management Outcome(s):

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

Targets:

- Avoid extensive aquatic habitat loss in localised areas.
- Remediate disturbed areas.
- Avoid erosion from water storage tanks.
- Minimise sedimentation and turbidity.
- Avoid hydrocarbon spills.
- Limit transformation of Wetland FEPAs.
- Maintain ecological, massing, and visual sensitivity buffers.
- Limit Fragmentation

Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
16	C?	Altered aquatic ecosystem, composition, structure, and function.	Protection and Restoration of a Strategic Water Source Area/ Preservation of aquatic ecosystem, composition, structure, and function.	Avoid extensive aquatic habitat loss in localised areas: No construction creep beyond demarcated boundaries.	Restrict clearing of the vegetation to the physical footprint of the structures or infrastructure (e.g., road crossing, fencing posts, and trenches for underground cables and pipelines) and only where necessary up to the edge of the working	Engineer, Contractor	Prior to clearing and grubbing operations	Compliance to be verified by ECO and IEA.

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					servitude, that is 3m on either side of a road crossing or 2m on either side of a trench.			
16	C?	Altered aquatic ecosystem structure and function.	Protection and Restoration of a Strategic Water Source Area/ Preservation of aquatic ecosystem, composition, structure, and function.	Avoid extensive aquatic habitat loss in localised areas: No driving through a watercourse, unless at a designated crossing.	Construction vehicles shall use only the existing gravel road approaches and river crossings.	Contractor	Continuous	Compliance to be verified by ECO and IEA.
16	C?	Altered aquatic ecosystem, composition, structure, and function.	Protection and Restoration of a Strategic Water Source Area/ Preservation of aquatic ecosystem, composition, structure, and function.	Remediate disturbed areas: disturbed areas are rehabilitated and revegetated.	Immediately rehabilitate and revegetate disturbed areas upon completion of construction activities in those areas.	Contractor	Immediately upon completion of a constructing activity (- not the project)	Compliance to be verified by ECO and IEA.
16	H6	Overflow from water storage tanks can cause erosion of receiving environment.	Protection and Restoration of a Strategic Water Source Area/ Preservation	Avoid erosion from water storage tanks: no muds, Water storage tanks are on a	Place water tanks on solid foundations, platforms or stands to ensure that they are level, will not fall over and are above	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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			of aquatic ecosystem, composition, structure, and function.	solid foundation, platform or stand.	the ground in order to build up the necessary water pressure for the outlet.			
16	H6	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 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, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
16	H6	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.
16	H6	Overflow from water storage tanks can cause erosion of receiving environment.	Protection and Restoration of a Strategic Water Source Area/ Preservation	Avoid erosion from water storage tanks: no muds, Design includes an	Each water storage tank or series of water storage tanks should have an overflow pipe to prevent water being	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
			of aquatic ecosystem, composition, structure, and function.	overflow pipe to a soakaway.	forced out of the inlet when the tank is full. The overflow pipe should be diverted to a soakaway.			
16	H6	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.
16	H5, H? and C?	Altered aquatic ecosystem, composition, structure, and function.	Protection and Restoration of a Strategic Water Source Area/ Preservation of aquatic ecosystem, composition, structure, and function.	Minimise sedimentation and turbidity: Water Quality Sampling Results.	Establish background pH, Electrical Conductivity (EC)/Total Dissolved Solids (TDS), Temperature, TSS and Turbidity levels of surface water as per the Surface Water Monitoring Plan in **Section 8** (page 36) of the Hydrology Assessment Report.	Holder, Water Quality Monitor or SEO or ECO	Planning and Design Phase Pre-construction - shortly after rainfall/storm events before the contractor arrives on site	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
16	H? and C?	Altered aquatic ecosystem, composition, structure, and function.	Protection and Restoration of a Strategic Water Source Area/ Preservation of aquatic ecosystem, composition, structure, and function.	Minimise sedimentation and turbidity: SEO's site diary – findings relating to monthly field observations.	The SEO shall implement Phase 1 of the Surface Water Monitoring Plan as per **Section 8** (page 36) of the Hydrology Assessment Report; visual observations of the banks associated with the non-perennial streams and rivers and the general conditions of the areas cleared, should be adequate to determine if there is any sediment runoff taking place or erosion.	Holder, Contractor, SEO	Monthly inspections and shortly after rainfall events during development and up to 2 yrs after the completion of development.	Compliance to be verified by ECO and IEA.
16	H? and C?	Altered aquatic ecosystem, composition, structure, and function.	Protection and Restoration of a Strategic Water Source Area/ Preservation of aquatic ecosystem, composition, structure, and function.	Minimise sedimentation and turbidity: SEO's site diary – findings relating to biannual results.	The SEO or other water quality monitor shall implement Phase 2 of the Surface Water Monitoring Plan as per **Section 8** (page 36) of the Hydrology Assessment Report as it pertains to surface water sampling.	Holder, Water Quality Monitor or SEO or ECO	Biannual sampling shortly after rainfall/storm events (if possible) during development and up to 2 yrs after the completion of development.	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
16	H5 and C?	Altered aquatic ecosystem structure and function.	Protection and Restoration of a Strategic Water Source Area/ Preservation of aquatic ecosystem, composition, structure, and function.	Minimise sedimentation and turbidity: No visibly turbid, cloudy, or milky plumes of suspended sediment in the river.	The construction of watercourse crossings (e.g., roads, underground cables and pipelines, fence line) 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.
16	H5 and C?	Altered aquatic ecosystem structure and function.	Protection and Restoration of a Strategic Water Source Area/ Preservation of aquatic ecosystem, composition, structure, and function.	Minimise sedimentation and turbidity: No visibly turbid, cloudy, or milky plumes of suspended sediment in the river.	No open trenches are permitted within a watercourse; construction activities shall be planned to ensure that trenches for laying underground cables or pipelines through a watercourse are excavated and closed within no more than 2 consecutive days.	Holder, Engineer, Contractor	Planning and Design Phase	Compliance to be verified by ECO and IEA.
16	C?	Altered aquatic ecosystem structure and function.	Protection and Restoration of a Strategic Water Source Area/	Minimise sedimentation and turbidity: No visibly turbid, cloudy,	Aggregate used in the construction of any river diversion works shall not be in direct contact with	Engineer, Contractor	Continuous	Compliance to be verified by ECO and IEA.

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			Preservation of aquatic ecosystem, composition, structure, and function.	or milky plumes of suspended sediment in the river.	flowing water, by using for example, plastic sheets, sandbags, culverts, or pipes.			
16	C?	Altered aquatic ecosystem structure and function.	Protection and Restoration of a Strategic Water Source Area/ Preservation of aquatic ecosystem, composition, structure, and function.	Minimise sedimentation and turbidity: No visibly turbid, cloudy, or milky plumes of suspended sediment in the river.	Aggregate used in the construction of any river diversion works shall not include dispersive soils.	Engineer, Contractor	Continuous	Compliance to be verified by ECO and IEA.
16	C?	Altered aquatic ecosystem structure and function.	Protection and Restoration of a Strategic Water Source Area/ Preservation of aquatic ecosystem, composition, structure, and function.	Minimise sedimentation and turbidity: No Stockpiles within the ecological buffer of a watercourse. River channel topsoil is stored separately from terrestrial topsoil.	Topsoil from the physical footprints of the road crossings must be stored separately from the terrestrial topsoil, in the construction camp or borrow pit, for the rehabilitation of aquatic ecosystems.	Contractor	Continuous	Compliance to be verified by ECO and IEA.
16	C?	Altered aquatic ecosystem	Protection and Restoration of a Strategic	Minimise sedimentation and turbidity:	Aggregate (sand or crushed rock) stockpiles must be	Contractor	Continuous	Compliance to be verified by

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		structure and function.	Water Source Area/ Preservation of aquatic ecosystem, composition, structure, and function.	No Stockpiles within the ecological buffer of a watercourse.	stored in the construction camp or borrow pit.			ECO and IEA.
16	C?	Altered aquatic ecosystem structure and function.	Protection and Restoration of a Strategic Water Source Area/ Preservation of aquatic ecosystem, composition, structure, and function.	Avoid hydrocarbon spills: No washing of vehicles and other equipment in or within proximity to the river.	Construction vehicles and other equipment shall be washed only at the designated service area in the construction camp.	Contractor	Continuous	Compliance to be verified by ECO and IEA.
16	C?	Altered aquatic ecosystem structure and function.	Protection and Restoration of a Strategic Water Source Area/ Preservation of aquatic ecosystem, composition, structure, and function.	Avoid hydrocarbon spills: Vehicles or plant are in good working order, e.g., not leaking oil, no black exhaust fumes, etc.	Only construction vehicles and plant that are in good working order are permitted on site.	Contractor, SEO	Continuous	Compliance to be monitored by the SEO and to be verified by ECO and IEA.
16	C?	Altered aquatic ecosystem	Protection and Restoration of a Strategic	Avoid hydrocarbon spills: Drip	Drip trays must be strategically placed under any stationary	Contractor, SEO	Continuous	Compliance to be monitored

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		structure and function.	Water Source Area/ Preservation of aquatic ecosystem, composition, structure, and function.	trays observed under construction vehicles or other plant.	construction vehicle or plant.			by the SEO and to be verified by ECO and IEA.
16	H6	According to the District Municipality's Climate Change Response Plan there are increased risks to loss of priority wetlands and river ecosystems.	Persistence of Wetland FEPAs in good ecological condition.	Limit transformation of Wetland FEPAs: Delineated ecological buffers. Demarcated ecological buffers at working areas.	Identify, describe, delineate, and demarcate ecological buffers around watercourses, including wetlands.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
16	H6	According to the District Municipality's Climate Change Response Plan there are increased risks to loss of priority wetlands and	Persistence of Wetland FEPAs in good ecological condition.	Limit transformation of Wetland FEPAs: Box culvert road crossings.	Upgrade some or all of the three existing dirt road crossings with box culvert structures to ensure year-round access to all parts of the veld (for livestock management) and facility (for operational management) and	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		river ecosystems.			avoid vehicles getting stuck and damaging the watercourse.			
16	H6	According to the District Municipality's Climate Change Response Plan there are increased risks to loss of priority wetlands and river ecosystems.	Persistence of Wetland FEPAs in good ecological condition.	Limit transformation of Wetland FEPAs: No more than 3 existing dirt road crossings are upgraded.	Minimise watercourse crossings to upgrading the three existing dirt road crossings only.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
16	H6, C?	According to the District Municipality's Climate Change Response Plan there are increased risks to loss of priority wetlands and river ecosystems.	Persistence of Wetland FEPAs in good ecological condition.	Limit transformation of Wetland FEPAs: No discharge of untreated wastewater into natural wetlands.	Avoid discharges of untreated wastewater into natural wetlands.	Holder, Engineer, Contractor	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
16	H6	According to the District Municipality's	Persistence of Wetland FEPAs in	Limit transformation of Wetland	Restrict point source discharges of storm water into natural	Holder, Engineer	Planning and Design Phase	Compliance to be verified by

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		Climate Change Response Plan there are increased risks to loss of priority wetlands and river ecosystems.	good ecological condition.	FEPAs: Restricted concentrated discharge of stormwater run-off into natural wetlands.	wetlands by relying on free drainage.			ECO and IEA.
16	H6	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: Box culvert road crossings.	Ensure box culverts are used for any dedicated stream crossing.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
16	H6	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: Box culverts are the correct size.	Box culverts should be sized to accommodate at least 1:100-year flood events.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
16	H6	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: Box culverts span the width of the active channel.	Sufficient box culverts shall be incorporated into the design to span the width of the active channel.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
16	H6	Fragmenting the local landscape.	Maintenance of connectivity, particularly terrestrial and aquatic ecological process pathways within the local landscape.	Maintain ecological, massing, and visual sensitivity buffers: The solar PV facility is fragmented into three separate but interconnected blocks by pre-determined buffers.	The design of the solar PV facility shall incorporate the ecological, massing and visual sensitivity buffers identified by the relevant specialists.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
16	H6	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 reduced by fencing two or more separate areas north and south of the ephemeral drainage line running through the project area (an unnamed tributary to the D62D – 05610 tributary with its confluence just downstream of the project area).	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
16	H6	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.
16	H6	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 connecting these 'High' sensitive habitats.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
17	H6	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.

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Assessment with mitigation:

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

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.
- The residual risk of transformation or fragmentation of the aquatic ecosystem (**16**) after mitigation is assumed to be Low to zero.
- The residual risk of disrupted life cycles from artificial lighting (**17**) after mitigation is assumed to be zero.

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Receiving Environment: Economical

Description of potential impacts:

Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
2	NA	NA	**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 (https://www.thesouthafrican.com/news/how-long-load-shedding-monday-9-december-when-eskom-floods/).	NA	**18**
3	Solar PV Facility	NA	**Impact:** **(1)** 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). **(2)** The additional income stream from leasing the land to Soventix SA (Pty) Ltd will help offset productivity and sales losses from reduced stocking densities when drought periods dictate lower carrying capacities (CC adaption), ensuring good ecological management and maintenance of ecosystem integrity (CC mitigation) (positive). **Consequences:** - Livestock mortality will reduce commercial exports and revenue for the farmer.	NA	**18**
4	NA	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.	NA	**19**

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Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
6	Lighting	NA	**Impact:** Energy Waste. **Consequences:** - Increased running cost.	NA	**19**
6	Distribution Lines	NA	**Impact:** The fitting of the marking devices is typically done from a helicopter, which adds considerably to the cost of any project. **Consequence**: - Reduced financial feasibility	NA	**19**
6	Water infrastructure (Supply)	Groundwater abstraction from boreholes	**Impact:** 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 tank. **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 unesthetic, leading in the long term to the marking of enamel surfaces of baths and handbasins. - Aggressive attack of pipework will result in costly maintenance.	NA	**19**
6	Water infrastructure (Supply)	Groundwater abstraction from boreholes	**Impact:** High salt content in washing water can leave watermarks on the surface of the solar modules. **Consequences:** - Watermarks can reduce electrical output with considerable economic implications.	NA	**19**
4	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.	NA	**20**

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Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
			- Less financial leverage linked to a lower asset value for securing bank loans.		
4	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.	NA	**20**
4	Increased traffic on District Gravel Road during construction	Development of potholes, corrugations, and puddles	**Impacts:** Damage to vehicles. **Consequences:** - Increased maintenance costs	NA	**20**

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

Impact 18 (Energy Generation)

- Apart from load shedding, creating an awareness of and implementing power saving initiatives to reduce demand, no alternative exists other than "*to rapidly expand our energy generation capacity*" (President Cyril Ramaphosa).

Impact 19 (Damage to Property)

- "*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 19 (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-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.

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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 20 (Property Values)

- "*Property value. It is reasonable to anticipate that the proposed development will negatively impact the value of my primary asset, for many years to come. My view is that the appeal of this unspoiled stock farm will be diminished as a direct result of the proximity of this huge industrial development.*" (Richard Vimpany)
- There is no evidence to show that Solar PV facilities will affect rural agricultural property values (to be verified in socio-economic assessment). Furthermore, 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 (SPLUMA, 2013 (Act No. 16 of 2013)).

Impact 20 (Damage to vehicles)

- "*Road damage. The district gravel roads are not maintained by the local municipality and the inevitable increased traffic is likely to result in significant degradation of this sensitive infrastructure.*" (Richard Vimpany)

General (Agriculture)

- 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)
- The **Medium** Agriculture theme according to the Screening Report was disputed in the Site Sensitivity Verification Report in so far as an Agriculture Agro-Ecosystem Specialist Assessment shall be undertaken instead of a Compliance Statement, to make management recommendations that will benefit current agricultural activities as it is the applicant and landowners' intention to undertake an 'Agrivoltaic' system that combines extensive grazing (or sheep) and solar farming.

<u>Assessment without mitigation:</u>

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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
18	H	H	M	+I	H	H	Significant positive	L	H	Significant positive
Reversibility	NA		**Irreplaceability**	NA		**Mitigatory Potential**	L			

Alternative Site No. 1 (preferred)

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

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

- None

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

- 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.
- 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 Scoping Report prepared by Equispectives Research & Consulting Services dated April 2022
- Screening Report
- Site Sensitivity Verification Report

Mitigations:

Impact Management Outcome(s):

- Rapid expansion of the country's energy generation capacity (**18**).
- 'Building' climate change resilience (**18**).
- The Solar PV facility is energy efficient and financially feasible (**19**).
- Limited risk of financial losses to neighbouring farmers (**20**).

Targets:

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- 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.

Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
18	H2, H3, H6 and H?	This solar PV facility (400 MW) together with Phases 1 and 2 will make a significant contribution (1 GW in total) to our country's power deficit.	Rapidly expand the country's energy generation capacity/ 'Building' climate change resilience.	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.
18	H3 and H?	Climate change positively offset by additional income stream and lower carrying capacities	'Building' climate change resilience.	Good ecological (grazing) management: Soil Maps. Recommended stocking densities. Good vegetation cover.	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	Holder, Landowner	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		during drought.			stocking densities and ensure adequate vegetation cover necessary for the maintenance of ecosystem services.			
18	H3 and H?	Climate change positively offset by additional income stream and lower carrying capacities during drought.	'Building' climate change resilience.	Good ecological (grazing) management: Restoration work on 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.
18	H3 and H?	Climate change positively offset by additional income stream and lower carrying capacities during drought.	'Building' climate change resilience.	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.
19	H4 and H?	Periodic hunting or culling of	The Solar PV facility is financially	Minimise maintenance costs and	Improve the safety of the Solar PV facility including its staff and	Neighbouring Landowners	Continuous	Compliance to be verified by

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		game on neighbouring farms may result in damages to property.	feasible and energy efficient.	energy consumption: Zero damage to property from hunting on adjacent farms.	property during the hunting season, such as identifying no shooting zones, notifying neighbouring properties of imminent hunts, hunters taking out the appropriate insurances, etc.			ECO and IEA.
19	H6 and H?	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 fluorescent, or metal-halide (MH) bulbs are more energy-efficient than those using incandescent, halogen, or mercury-vapour bulbs.	Holder, Engineer	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
19	H6 and H?	Wasted energy from	The Solar PV facility is energy	Minimise maintenance costs and	When purchasing energy efficient alternatives to	Holder, Engineer	Planning and Design Phase	Compliance to be verified by

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		inefficient lighting.	efficient and financially feasible.	energy consumption: Wattage is lower than traditional candescent bulbs.	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.		Continuous	ECO and IEA.
19	H6	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.	These 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.
19	H6	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. Typical concerns relate to pH stability and whether the	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					water will lead to excessive scaling in or aggressive attack of pipework.			
19	H6	Poor water quality can adversely affect generation capacity.	The Solar PV facility is energy efficient and financially feasible.	Maintain optimum generation capacity of solar modules: Water treatment plants at applicable water sources. no water marks on solar panels.	Establish water treatment, e.g., deionization plants at water sources used for washing the solar modules.	Holder, Engineer	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
20	H4 and H6	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.
20	H4, C?	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	Open fires are prohibited.	Contractor	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
				observed on site.				
20	H4 and H?, C?	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: A firebreak is present.	Maintain a firebreak around the perimeter of the solar PV facility.	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.
20	H4 and H?, C?	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: A firebreak is present.	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.
20	H4 and H?, C?	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: A designated team with knowledge of firefighting.	A team of designated firefighting personal shall be trained and readily available to immediately deal with any runaway veld fires.	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.
20	H4 and H?, C?	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: A readily available list of contact details.	Immediately notify neighbouring landowners upon confirming a runaway fire.	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.
20	H4 and H?, C?	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	Holder, Contractor	Continuous	Compliance to be monitored by SEO and verified by

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					increased traffic during construction.			ECO and IEA.
20	H4 and H?, C?	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.
20	H4 and H?, C?	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.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
18	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
18	H	H	H	-I	H	H	1	H	H	1

Alternative Site No. 1 (preferred)

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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

Residual Risk (feeds back into “Mitigations”):

- The residual risk of damage to property during the hunting season (**19**) lies with the adjacent farmers 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 (**19**) 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 (**20**) after mitigation is assumed to be Moderate to Low. If the findings of the socio-economic assessment cannot find evidence to support reduced property values, then the residual risk after mitigation is assumed to be Low.

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Reg: 2006/023163/23

Receiving Environment: Social

Description of potential impacts:

Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Impact No.
2	NA	NA	**Impact:** **(1)** 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 impacting human well-being.	**21**
5	Labour	Job Creation	**Impact:** (1) Finding the required skills in the area might be a challenge and using local labour might be a challenge (due to the low education levels). (2) Expectations regarding creation of opportunities (Jobs etc.) **Consequences:** - Applicant and community frustrations.	**22**
5	Space	Magnitude of physical disturbance	**Impact:** Impacts of construction camp – HIV/AIDS, movement of people etc. on local farming community. **Consequences:** - Disruption.	**23**

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

Impact 21

- 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.**

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

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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 Scoping 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 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 Scoping 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 Scoping 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 Scoping 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				

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Reg: 2006/023163/23

Alternative Site No. 1 (preferred)

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

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
22	M	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
23	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):

- ...

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

- Social Scoping Report prepared by Equispectives Research & Consulting Services dated April 2022

Mitigations:

Impact Management Outcome(s):

- Local community upliftment (through skill development) (**22**).
- Community expectations are realistic (**22**).

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- Good relations with local farming community (**23**)

Targets:

- Trained local labour.
- Avoid misinformation.
- Avoid disturbance to local farming community.

Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
22	H5 and C?	Finding the required skills and using local labour might be a challenge (due to the low education levels)	Local community upliftment through skill development.	Trained local labour: Evidence of a skills development component.	The lack of required skills in the local labour market must be taken into consideration when planning the project and it may be necessary to include a skills development component.	Holder, Contractor	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
22	H5 and C?	Expectations regarding creation of opportunities (Jobs etc.)	Community expectations are realistic.	Avoid misinformation: A recruitment communication strategy is in place.	A communication strategy must be in place that will communicate in an open and honest way what kind of jobs will be created, who will qualify and how the recruitment process will work.	Holder, Contractor	Planning and Design Phase	Compliance to be verified by ECO and IEA.
23	H5	Impacts of construction camp – HIV/AIDS, movement of	Good relations with local farming community.	Avoid disturbance to local farming community: written	The location of the construction camp must be agreed on with surrounding neighbours.	Holder	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		people etc. on local farming community.		acceptance of proposed location from affected neighbour.				
23	H5 and C?	Impacts of construction camp – HIV/AIDS, movement of people etc. on local farming community.	Good relations with local farming community.	Avoid disturbance to local farming community: no accommodation facilities on site.	No accommodation facilities for overnighting shall be provided in the constriction camp.	Holder, 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
21	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
21	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
22	L	L	L	neutral	L	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
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	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
23	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- The residual risk of low skill levels and misinformation on both developer and community expectations (**22**) after mitigation is estimated to be Low to zero.
- The residual risk of the construction camp on local farmers (**23**) after mitigation is estimated to be Low to zero.

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Reg: 2006/023163/23

Receiving Environment: Property

Description of potential impacts:

Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Impact No.
4	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.	**24**
6	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.	**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.**

Assessment without mitigation:

Legend

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

- ...

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

- ...

Mitigations:

Impact Management Outcome(s):

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

Targets:

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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- Reduce risk of lightning strikes to infrastructure.

Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
25	H6	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.

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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Receiving Environment: Land Use

Description of potential impacts:

Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Impact No.
4	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)	**26**

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

- …

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				

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

+I/R	Positive Impact/Risk				

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):

- ...

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

- ...

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.

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Reg: 2006/023163/23

Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
26	H4	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 ensure minimal reduction (if any) on agricultural potential of the land as well as a management tool to control vegetation growth.	Holder, Engineer, Landowner	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
26	H4	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	Holder	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 No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					and carrying capacity.			

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

Residual Risk (feeds back into “Mitigations”):

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

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Reg: 2006/023163/23

Receiving Environment: Health and Safety

Description of potential impacts:

Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Impact No.
2	NA	NA	**Impact:** 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).	**27**
6	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.	**28**
2	NA	NA	**Impact:** Sand bed crossings pose a risk to human life (driver and passengers) during strong flows. **Consequences:** - low-level crossings or bridges allow safe passage across rivers (positive Impact).	**29**
4	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).	**30**
4	Uncertainty (SIA)	Fires	**Impact:** Risk of veld fires caused by workers during the construction of the facility. **Consequence:** - Injury or loss of life (direct)	**31**

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

Impact 27 (Surface water Quality)

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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- Turbidity is visible and may be objectionable to domestic water users at levels above 5 NTU. Some chance of transmission of disease by micro-organisms associated with particulate matter, particularly for agents with a low infective dose such as viruses and protozoan parasites (DWAF, 1996 Volume 1)
- Total Suspend Solids (TSS) concentration of 50 to 100 mg/litre can cause slight to moderate problems with the clogging of drip irrigation emitters (DWAF, 1996 Volume 4)
- De Aar is dependent on groundwater for agriculture and drinking water (District Municipality's Climate Change Response Plan**) – it is therefore assumed that any suspended sediment (or turbidity) during construction in the watercourse cannot have a significant influence water quality for agricultural or domestic use.**
- (At least) Three small capacity in-stream dams occur within the development area (Hydrology Assessment), but the drainage line running through the project area is an ephemeral unnamed tributary to the D62D – 05610 tributary with its confluence just downstream of the project area (Plan of Study prepared by Dr Andrew Deacon) and the Mean Annual Evaporation (2 000 – 2 150 mm/yr) exceeds the Mean Annual Precipitation (averaging 320 mm/yr) by about 85%, so non-perennial streams and rivers will only have water when there are flooding events (Hydrology Assessment) – **it is therefore assumed that limiting construction to the dry winter months of the year will adequately avoid the risk of sedimentation on dams. Further the impacts of sedimentation on the aquatic ecosystem are adequately assessed and mitigated under "Receiving Environment: Aquatic Ecosystem" and therefore do not need to be repeated here.**

Impact 28 (Groundwater Quality)

- 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).
- The natural hardness of water is influenced by the geology of the catchment and the presence of soluble calcium and magnesium minerals. Total hardness for domestic use should be limited to between 50 - 100 mg/• as $CaCO_3$, where possible. (DWAF Water Quality Guidelines)

Impact 30

- 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 31

- 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.**

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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
27	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
28	M	L	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
29	H	L	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):

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Reg: 2006/023163/23

- 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.
- Construct flooding indicator blocks on the bridge decks.

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

- 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.
- District Municipality's Climate Change Response Plan
- Hydrology Assessment
- Plan of Study prepared by Dr Andrew Deacon
- 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):

- Ensure water quality (specifically turbidity, TSS and hardness) is fit for domestic water use and agricultural use (irrigation) (**27**).
- Safe drinking water (**28**)
- Enhance safety when using the low-level crossings (**29**).

Targets:

- Minimise sedimentation and turbidity
    - Turbidity must not exceed 5 NTU (no turbidity visible, a slight chance of adverse aesthetic effects and infectious disease transmission exists)
    - TSS must be below 50mg/litre to prevent problems with the clogging of drip irrigation emitters.
- Potable water is treated to standard.
    - Total hardness for domestic use should be limited to between 50 - 100 mg/• as $CaCO_3$ if possible.

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

- Water crossing designs include flooding indicator blocks.

Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
27	H5 and C?	Sedimentation can influence water quality for agricultural and domestic use.	Ensure water quality (specifically turbidity and TSS) is fit for domestic water use and agricultural use (irrigation).	Minimise sedimentation and turbidity: Civil works are undertaken during the dry winter months.	The construction of watercourse crossings (e.g., roads, underground cables and pipelines, fence line) 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.
27	H5, H? and C?	Sedimentation can influence water quality for agricultural and domestic use.	Ensure water quality (specifically turbidity and TSS) is fit for domestic water use and agricultural use (irrigation).	Minimise sedimentation and turbidity: Water Quality Sampling Results.	Establish background pH, Electrical Conductivity (EC)/Total Dissolved Solids (TDS), Temperature, TSS and Turbidity levels of surface water as per the Surface Water Monitoring Plan in **Section 8** (page 36) of the Hydrology Assessment Report.	Holder, Water Quality Monitor or SEO or ECO	Planning and Design Phase Pre-construction - shortly after rainfall/storm events before the contractor arrives on site	Compliance to be verified by ECO and IEA.
27	H? and C?	Sedimentation can influence water quality for agricultural	Ensure water quality (specifically turbidity and	Minimise sedimentation and turbidity: Turbidity must	The SEO or other water quality monitor shall implement Phase 2 of the	Holder, Water Quality Monitor or SEO or ECO	Biannual sampling shortly after rainfall/storm	Compliance to be verified by

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		and domestic use.	TSS) is fit for domestic water use and agricultural use (irrigation).	not exceed 5 NTU (no turbidity visible, a slight chance of adverse aesthetic effects and infectious disease transmission exists). TSS < 50mg/litre to prevent problems with the clogging of drip irrigation emitters.	Surface Water Monitoring Plan as per **Section 8** (page 36) of the Hydrology Assessment Report as it pertains to surface water sampling.		events (if possible) during development and up to 2 yrs after the completion of development.	ECO and IEA.
28	H6	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.
28	H6	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.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
28	H6	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.
28	H6	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.
29	H6	Low-level crossings or bridges allow safe passage across rivers.	Enhance safety when using the low-level crossings.	Final Design, including flooding indicator blocks.	Provide flooding indicator blocks on the bridge decks.	Engineer	During Final Design.	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
27	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
27	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
28	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
28	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
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	H	L	H	-R	H	L	0	H	L	0

Residual Risk (feeds back into “Mitigations”):

- The residual risk of sedimentation on agricultural or domestic use (**27**) after mitigation is assumed to be Low.
- The residual risk of poor-quality groundwater on human health (**28**) after mitigation is assumed to be Low.
- Low-level crossings still pose a risk to life during major flood events (**29**).
- The residual risk of harm to humans during the hunting season (**30**) lies with the adjacent farmers and their willingness to take responsibility for their own actions, adopt reasonable precautions and comply with the applicable legislation.

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Receiving Environment: Security

Description of potential impacts:

Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Impact No.
5	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	**32**
6	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.	**33**

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

Impact 32

- *"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)

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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-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	M	L	-R	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
33	L	M	M	-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):

- ...

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

- Richard Vimpany (Neighbouring landowner and registered Interested and Affected Party).

Mitigations:

Impact Management Outcome(s):

- A safe local farming community (**32**).
- A secure solar PV facility (**33**).

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Targets:

- Reduce risk of criminal activity.

Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
32	H5	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.
32	H5, C?	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: perimeter fences are amongst the first to be developed.	Security during construction will be mitigated by erecting the perimeter fences at the onset of construction to prevent any movement out of the development footprint.	Holder, Engineer, Contractor	Planning and Design Phase Site Establishment	Compliance to be verified by ECO and IEA.
32	H6, C?	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.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
33	H?	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.
33	H6	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: facility is fenced with security access control.	The facility should be fenced off with a 2.5 m high wire mesh security fence with controlled access using a security gate.	Holder, Engineer	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
33	H6	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.

Assessment with mitigation:

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Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
32	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
32	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
33	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
33	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into “Mitigations”):

- The residual risk of criminal activity during construction (**32**) and operation (**33**) after mitigation is estimated to be Low.

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Receiving Environment: Public services

Description of potential impacts:

Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Impact No.
2	NA	NA	**Impact:** **(1)** 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).	**34**

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

Impact 34

- (At least) Three small capacity in-stream dams occur within the development area (Hydrology Assessment), but the drainage line running through the project area is an ephemeral unnamed tributary to the D62D – 05610 tributary with its confluence just downstream of the project area (Plan of Study prepared by Dr Andrew Deacon) and the Mean Annual Evaporation (2 000 – 2 150 mm/yr) exceeds the Mean Annual Precipitation (averaging 320 mm/yr) by about 85%, so non-perennial streams and rivers will only have water when there are flooding events (Hydrology Assessment) – **it is therefore assumed that limiting construction to the dry winter months of the year will adequately avoid the risk of sedimentation on dams. Further the impacts of sedimentation on the aquatic ecosystem are adequately assessed and mitigated under "Receiving Environment: Aquatic Ecosystem" and therefore do not need to be repeated here.**
- Besides, De Aar is dependent on groundwater for drinking water (District Municipality's Climate Change Response Plan**) – it is therefore assumed that any suspended sediment (or turbidity) during construction in the watercourse cannot have a significant influence on the cost of treating drinking water.**

Assessment without mitigation:

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

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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	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
34	L	L	L	neutral	L	L	0	L	L	0

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:

- Hydrology Assessment
- District Municipality's Climate Change Response Plan

Mitigations:

- Not necessary.

Residual Risk (feeds back into "Mitigations"):

- None

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

Description of potential impacts:

Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Impact No.
2	NA	NA	**Impact:** **(1)** 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).	**35**
6	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.	**36**
6	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.	**37**
6	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 over	**38**

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Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Impact No.
			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.	

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

Impact 35

- The impact of alien invasive plant recruitment on visual aesthetic values is adequately mitigated under "Receiving Environment: Terrestrial ecosystem" and therefore does not need to be repeated here.

Impact 38 (Visual)

- The **Very High** Landscape (Solar) theme according to the Screening Report and owing to the eastern-most corner of the study area falling within "mountain tops and high ridges" was confirmed in the Site Sensitivity Verification Report.
- 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)

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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-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
35	H	M	H	-R	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
36	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
37	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
38	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:

- Screening Report.

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- Site Sensitivity Verification Report.
- Richard Vimpany (Neighbouring landowner and registered Interested and Affected Party).
- VIA Scoping Report.

Mitigations:

Impact Management Outcome(s):

- Retain the existing rural dark sky night landscape (**36**).
- A less dominant landscape change to local or neighbouring receptors (**37** and **38**).

Targets:

- Effective light management.
- Avoid obtrusive fence lines.

Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
36	H6	(1) Light directed uselessly above the horizon creates murky skyglow. (2) Light trespass or spillage from poor outdoor lighting shines onto neighbours' properties.	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	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		(3) Glare from exposed light bulbs can be distracting.			New England Light Pollution Advisory Group (NELPAG) and Sky Publishing Corp in 14.2).			
36	H6	(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.
36	H6	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	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					impact on the targeted area whilst minimizing their impact elsewhere.			
36	H6	Light trespass or spillage from poor outdoor lighting shines onto neighbours' properties.	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.
36	H6	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.
37	H6	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 area.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
38	H6	**(1)** 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.	**(1)** Minimise the Zone of Visual Influence (visual extent or viewshed).	**(1)** 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.
38	H6	**(1)** 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.	**(1)** Minimise the Zone of Visual Influence (visual extent or viewshed).	**(1)** 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.
38	H6	**(2)** Neighbours who are sensitive to landscape change; receptor sensitivity to the landscape changes to the existing rural agricultural	A less dominant landscape change to local or neighbouring receptors.	**(2)** A less dominant landscape change/maintain visual quality by visually buffering adjacent land uses/farms along north- and south-eastern property boundary (as	**(2)** Reduction: A 200 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 /	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		landscape character, particularly by neighbouring landowners located to the north- and south-east of the development site.		these owners have indicated concern regarding the semi-industrial type development in a deep rural setting).	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)			
38	H6	**(2)** Neighbours who are sensitive to landscape change; receptor sensitivity to the landscape changes to the existing rural agricultural	A less dominant landscape change to local or neighbouring receptors.	**(2)** A less dominant landscape change/maintain visual quality by visually buffering adjacent land uses/farms along north- and south-eastern property boundary (as	**(2)** 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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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		landscape character, particularly by neighbouring landowners located to the north- and south-east of the development site.		these owners have indicated concern regarding the semi-industrial type development in a deep rural setting).				
38	H6	**(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).	A less dominant landscape change to local or neighbouring receptors.	**(3)** 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.	**(3)** 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.
38	H6	**(3)** Massing effects created by large scale	A less dominant landscape change to	**(3)** Breaking of massing effects created by large scale coverage	**(3)** Reduction: Reduce the massing effects by establishing a	Holder, Engineer	Planning and Design Phase	Compliance to be verified by

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		coverage or expanses of solar PV panels in a rural agricultural landscape setting (with medium to high levels of Scenic Quality).	local or neighbouring receptors.	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.	'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.			ECO and IEA.
38	H6	**(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).	A less dominant landscape change to local or neighbouring receptors.	**(3)** 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.	**(3)** 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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Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
35	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
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	-I	L	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

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
37	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
37	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

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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38	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
38	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- The residual risk of alien invasive plant infestations (**35**) on visual aesthetic values after mitigation is estimated to be Low.
- The residual risk of light pollution (**36**), fencing (**37**) and massing effects (**38**) on visual aesthetic values after mitigation is estimated to be Medium to Low, but generally acceptable.

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Receiving Environment: Heritage and Culture

Description of potential impacts:

Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Impact No.
2	NA	NA	**Impact:** **(1)** Earthmoving activities could damage or destroy artefacts. **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).	**39**

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

Impact 39 (Archaeology)

- The study area is not within a World Heritage Site or within 10 km of a World Heritage Site according to the PAR.
- The **Low** Archaeological and Cultural Heritage theme according to the Screening Report was disputed in the Site Sensitivity Verification Report as being **High**.
- Previous archaeological and heritage assessments for Phase 1 recorded a fairly large number of cultural heritage (archaeological & historical) resources of varying extent and significance in the area. These include scatters of open-air surface Stone Age sites, rock engravings, later agro-pastoralist stone-walled sites, as well as historical Anglo-Boer War (18990-1902) sites. These findings are clear evidence of the intrinsic heritage value of the area and the fact that further assessments would be required. (Plan of Study prepared by Anton Pelser)

Impact 39 (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

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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
39	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):

- ...

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

- Protected Areas Register (PAR)
- Screening Assessment
- Site Sensitivity Verification Report
- Plan of Study prepared by Anton Pelser of APELSER Archaeological Consulting dated 18 March 2022

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- *Dr. John Almond, NATURA VIVA cc Palaeontological Impact Assessments & Heritage Management, Natural History Education, Tourism, Research Budget Proposal dated 20 January 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.

Targets:

- Avoid unnecessary damage or destruction of heritage resources.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
39	C?	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	Avoid unnecessary damage or destruction of heritage resources: Vigilance is observed.	The bulk of archaeological 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.
39	C?	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	Avoid unnecessary damage or destruction of heritage resources: Supervision when clearing and grubbing, and excavating	The SEO shall supervise all clearing and grubbing, as well as excavation activities. Examples of cultural or archaeological objects include *inter alia* (a) skeletal remains (bones) in middens (refuse heaps) or graves, (b) burned hut clay or other hut debris, (c) broken pieces of ceramic pottery (potsherds), (d) large quantities of iron smelting slag or sub-surface charcoal and ash deposits, etc.	Contractor, SEO	During clearing and grubbing operations and excavations.	Compliance to be monitored by the SEO and verified by ECO and IEA.
39	C?	Damage or destruction	Protection and preservation	Avoid unnecessary damage or	The SEO or ECO must give a cursory inspection of the	Contractor, SEO, ECO	After clearing and grubbing	Compliance to be verified by

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		of heritage resources.	of heritage resources.	destruction of heritage resources: Written findings or photographs of cursory inspection.	bedrock after clearing and before drilling, in this case for small marine invertebrates and/or trace fossils (e.g., footprints, trails, burrows, etc.).		of bedrock in river.	ECO and IEA.
39	C?	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	Avoid unnecessary damage or destruction of heritage resources: Construction has ceased at a site of discovery.	If any evidence of archaeological sites or remains (e.g., remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, 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,	Contractor, SEO or ECO.	Chance Find Protocol - artefacts	Compliance to be monitored by the SEO and verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
					2. **notify** the SEO or ECO, and 3. **don't** tamper with the finds.			
39	C?	Damage or destruction of heritage resources.	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. Access to construction staff shall be prohibited until further notice by the SEO or ECO.	Contractor, SEO or ECO.	Chance Find Protocol - artefacts	Compliance to be monitored by the SEO and verified by ECO and IEA.
39	C?	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	Avoid unnecessary damage or destruction of heritage resources: A written response from the LIHRA.	The SEO or ECO shall alert the Provincial Heritage Authority and if necessary, arrange for a registered heritage specialist to assess the significance of the discovery and advise on further actions.	SEO or ECO, Heritage Specialist.	Chance Find Protocol - artefacts	Compliance to be verified by ECO and IEA.
39	C?	Damage or destruction of heritage resources.	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 SEO or ECO shall also alert the local police.	SEO or ECO.	Chance Find Protocol - artefacts	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
39	H? and C?	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	Avoid unnecessary damage or destruction of heritage resources: Permits issued by LIHRA.	If the newly discovered heritage resources prove to be of archaeological or paleontological significance, a Phase 2 rescue operation may be required subject to permits issued by either the Provincial or National Resources Authority.	Holder, Heritage Specialist.	Chance Find Protocol - artefacts Prior to a Phase 2 rescue operation.	Compliance to be verified by ECO and IEA.
39	C?	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	Avoid unnecessary damage or destruction of heritage resources: Site of discovery has been cordoned off.	Ensure the heritage site remains safeguarded until clearance is given by the Heritage Resources Authority for work to resume.	Contractor, SEO or ECO.	Chance Find Protocol - artefacts	Compliance to be verified by ECO and IEA.
39	C?	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	Avoid unnecessary damage or destruction of heritage resources: Protected fossiliferous material, photographs, and a preliminary assessment.	If possible, any fossiliferous material should be put aside in a suitably protected place and photographs of putative fossils should be sent to a palaeontologist for a preliminary assessment.	Contractor, SEO	Chance Find Protocol - fossils	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
39	H?	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	Avoid unnecessary damage or destruction of heritage resources: Palaeontologist's findings of site visit.	If necessary, the palaeontologist should visit the site to inspect the fossiliferous material.	Holder, Palaeontologist	Chance Find Protocol - fossils	Compliance to be verified by ECO and IEA.
39	H?	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	Avoid unnecessary damage or destruction of heritage resources: SAHRA permit	Fossil plants or vertebrates that are of good quality or Scientific interest by the palaeontologist must be removed, catalogued, and housed in a suitable institution where they can be made available for further study. A SAHRA permit must be obtained first.	Holder, Palaeontologist	Chance Find Protocol - fossils	Compliance to be verified by ECO and IEA.
39	H?	Damage or destruction of heritage resources.	Protection and preservation of heritage resources.	Avoid unnecessary damage or destruction of heritage resources: A Final Report	A final report by the palaeontologist must be sent to the SAHRA once the project has been completed and only if there are fossils.	Holder, Palaeontologist	Chance Find Protocol - fossils	Compliance to be verified by ECO and IEA.

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.)
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39	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
39	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 (**39**) after mitigation is estimated to be Low to zero.

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