Preferred Alternative Impact Assessment

Construction Phase

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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

3(1) A basic assessment report… must include –

(h) a full description of the process followed to reach the proposed preferred alternative within the site, including – (v) ***the impacts and risks identified for each alternative, including*** *the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts - (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated; (vii)* ***positive and negative impacts that the proposed activity and alternatives will have*** *on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; (viii)* ***the possible mitigation measures*** *that could be applied and level of residual risk.*

Appendix 1 (Basic Assessment Report) of the EIA Regulations, 2014 as amended

Assessment of Preferred Alternative

The identified impacts, comments received from I&APs and findings contained in specialist assessments, were assigned to the applicable phases of development (planning and design, pre-construction, construction, and post-construction) and aspects of the receiving environment so that they can be logically managed /mitigated for by the responsible role players at the appropriate time.

The receiving environment referred to as "environmental attributes" or "aspects" in Appendix 1 of the EIA Regulations, 2014 as amended, includes:

(1) Legal System, (2) Terrestrial fauna, (3) Terrestrial flora, (4) Aquatic fauna, (5) Aquatic flora, (6) Soil and Rock, (7) Ground and Surface Water, (8) Atmosphere, (9) Terrestrial and Avian ecosystem, (10) Aquatic ecosystem, (11) Economical, (12) Social, (13) Property, (14) Land use, (15) Health and Safety, (16) Security, (17) Public services, (18) Visual aesthetics and (19) Heritage and Culture.

Similar impacts, those are impacts resulting in the same response from the receiving environment are assessed collectively as cumulative impacts.

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Construction Phase

Receiving Environment: Legal System

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
General and Hazardous Waste Management	Handling and Collection (incl. chemical toilets & concrete slurry)	Contamination	**Impact:** Risk of non-compliance **Consequence:** An offence	NA	01
General and Hazardous Waste Management	Storage	Contamination	**Impact:** Risk of non-compliance **Consequence:** An offence	NA	01
General and Hazardous Waste Management	Transport	Contamination	**Impact:** Risk of non-compliance **Consequence:** An Offence	NA	01
General and Hazardous Waste Management	Disposal	Contamination	**Impact:** Risk of non-compliance **Consequence:** An offence	NA	01
Health and Safety	Importing aggregate	NA	**Impact:** Illegal mining of road material (aggregate). **Consequence:** An offence.	NA	01
Stockpiling and Storing (Laydown)	NA	Dust, Noise & Fly rock generation	**Impact:** Blasting without a permit. **Consequence:** illegal activities constitute an offence.	NA	01

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

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

Impact 01 (Mining)

- **Road material or aggregate will be purchased from a licensed commercial source.**

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- A Section 53 application was lodged via SAMRAD on 21 February 2023 (ref no: NC30/5/4/2/11505SU).

Impact 01 (Waste)

- It is anticipated that both general and hazardous waste types will be generated during construction. Except for domestic wastewater (1,8 m3/day), volumes cannot be known. The principal sanitation system during construction shall either be containerised toilets connected to a conservancy tank and/or a sewerage treatment package plant, as well as chemical toilets.

Assessment without mitigation:

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

Alternative Site No. 1 (preferred)

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

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

- The proposed activities do not include operational aspects. Consequently, the environmental authorization is required for development only, including the following phases: planning and design, pre-construction, construction, and post-construction (rehabilitation and monitoring).The validity period of the environmental authorisation shall be the maximum permissible period given the scale of the project, anticipated time to complete construction, and the uncertainty of when a water use license will be granted.

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

- Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
- 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

Mitigations:

Impact Management Outcome(s):

- Compliance
- Compliance with waste handling and storage

Targets:

- Integrated waste management plan.
- Registration with SAWIS, if required.
- Records of waste management.
- Waste is separated.
- Labelled and records of waste storage.
- Licensed service provider used.
- Safety Data Sheets
- Waste classification
- Waste does not accumulate longer than 18 months.
- A copy of the mining permit or license.
- Existing barrow pit material used on same property.
- Licensed contractor
- Permit
- Written approval from the chief inspector of occupational health and safety.
- Bylaws are applied.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
01	General and Hazardous Waste Management	Risk of non-compliance	Compliance with waste handling and storage	Integrated waste management plan.	Waste shall be managed in accordance with the integrated waste management plan.	Contractor, SEO	Construction and continuous	Compliance to be verified by ECO and IEA.
01	General and Hazardous Waste Management	Risk of non-compliance	Compliance with waste handling and storage	Registration with SAWIS, if required.	The contractor(s) must determine whether he/she needs to register a waste management activity on the South African Waste Information System (SAWIS) using the South African Waste Information Centre's website, e.g., generators of hazardous waste in excess of 20kg per day must register.	Contractor	Construction	Compliance to be verified by ECO and IEA.
01	General and Hazardous Waste Management	Risk of non-compliance	Compliance with waste handling and storage	Records of waste management.	The waste generator must keep accurate and up to date records of the management of the waste they generate including records that reflect: • The classification of the wastes (General waste, including domestic, business, building and demolition waste not containing hazardous waste/chemicals is listed in Annexure 1 of the Waste Classification and Management Regulations, 2013 and therefore do not require formal classification and assessment in terms of the same Regulations); • The quantity of each	Contractor	Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					waste generated, expressed in tons or cubic metres per month; • The quantities of each waste that has either been reused, recycled, recovered, treated, or disposed of; and • By whom the waste was managed.			
01	General and Hazardous Waste	Risk of non-compliance	Compliance with waste handling and storage	Waste is separated	Separate waste into recyclable (glass, metals, paper, plastic) and non-recyclable waste.	Contractor	Construction and continuous	Compliance to be verified by ECO and IEA
01	General and Hazardous Waste	Risk of non-compliance	Compliance with waste handling and storage	Labelled waste storage	Any container or storage impoundment holding waste must be labelled. If labelling is not possible, then records must be kept.	Contractor	Construction and continuous	Compliance to be verified by ECO and IEA
01	General and Hazardous Waste	Risk of non-compliance	Compliance with waste handling and storage	Records of waste storage	Labels and records need to reflect: (a) The date on which the waste was first placed into the container; (b) The date on which the last bit of waste was placed into the container before it was filled, closed, sealed or covered; (c) The dates when, and quantities of, waste added, and waste removed from containers or storage impoundments (if relevant); (d) The specific category or categories of waste in the container or storage	Contractor	Construction and continuous	Compliance to be verified by ECO and IEA

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					impoundment as identified in terms of the National Waste Information Regulations (2012); and (e) The classification of the waste once it has been completed.			
01	General and Hazardous Waste	Risk of non-compliance	Compliance with waste handling and storage	Licensed service provider used	Given the overwhelming legal requirements governing the transport of Hazardous Chemical Substances (HCS) or dangerous goods, and therefore hazardous waste, it is recommended that the services of a licensed service provider be employed to undertake this activity. None the less, the consignor or person who dispatches the hazardous waste remains responsible to ensure that hazardous waste is packaged, transported, treated and disposed of in terms of the legal requirements and that there is an auditable record of the steps involved in storing, collecting and transporting the waste.	Contractor	Construction and continuous	Compliance to be verified by ECO and IEA
01	General and Hazardous Waste	Risk of non-compliance	Compliance with waste handling and storage	Safety Data Sheets	A Safety Data Sheet (SDS) and Waste Manifest must accompany a load of hazardous waste transported from the point	Contractor	Construction and continuous	Compliance to be verified by ECO and IEA

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					of generation to the waste management facility.			
01	General and Hazardous Waste	Risk of non-compliance	Compliance with waste handling and storage	Waste classification	Waste transporters may not accept waste that has not been classified in terms of SANS10234, unless it is listed in Annexure 1 of the Waste Classification and Management Regulations, 2013.	Contractor	Construction and continuous	Compliance to be verified by ECO and IEA
01	General and Hazardous Waste	Risk of non-compliance	Compliance with waste handling and storage	Waste does not accumulate longer than 18 months.	Waste generators must ensure that their waste is reused, recycled, recovered, treated and/or disposed of within 18 months of generation.	Contractor	Within 18 months of generation.	Compliance to be verified by ECO and IEA
01	Health and Safety	Illegal mining of road material (aggregate).	Compliance	A copy of the mining permit or license.	If Road material or aggregate will be purchased from a commercial source, then it must be licensed.	Contractor	Construction	Compliance to be verified by ECO and IEA
01	Stockpiling and storing (laydown)	Blasting without a permit.	Compliance	Licensed contractor	Any blasting activity must be conducted by a suitably licensed blasting contractor.	Contractor	Construction	Compliance to be verified by ECO and IEA
01	Stockpiling and storing (laydown)	Blasting without a permit.	Compliance	Permit	The contractor carrying out the blasting work shall hold and be in possession of a permit authorizing such use in terms of the Explosives Act, 2003 (Act No. 15 of 2003), unless the activity relates to occupational health or occupational safety, in which case the matter is regulated under the Occupational Health	Contractor	Construction	Compliance to be verified by ECO and IEA

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					and Safety Act, 1993 (Act No. 85 of 1993).			
01	Stockpiling and storing (laydown)	Blasting without a permit.	Compliance	Written approval from the chief inspector of occupational health and safety	If the explosive to be used is defined in terms of the Occupational Health and Safety Act, 1993 (any substance or article as listed in Class 1: Explosives in the South African Bureau of Standards Code of Practice for the Identification and Classification of Dangerous Substances and Goods, SABS 0228), the contractor carrying out the blasting work shall apply in writing to the chief inspector of occupational health and safety for written approval to use the explosive in the workplace.	Contractor	Prior to blasting	Compliance to be verified by ECO and IEA
01	Stockpiling and storing (laydown)	Blasting without a permit.	Compliance	Bylaws are applied.	Adhere to any local bylaws and regulations regarding the generation of noise.	Contractor	Construction	Compliance to be verified by ECO and IEA

Assessment with mitigation:

Alternative Site No. 1 (preferred)

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

Residual Risk (feeds back into "Mitigations"):

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- 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	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Employee Management	Communicating	Noise generation	**Impact:** Disturbance during construction can cause active mammals and birds to temporarily evade or emigrate from the area. **Consequence:** - Forced redistribution out of home ranges or territories can cause stress and conflict. Conflict can lead to injury or death of individuals (indirect).	quantity	02
Plant Management	Driving & Transport	Speed (en route to & from site)	**Impact:** Bird mortalities during the construction phase due to vehicle collisions or collisions with infrastructure. Disturbance to breeding or destruction of bird roosts during the construction phase. **Consequence:** Decrease in avifauna population (directly) due to loss of offspring/breeding pairs for generation (indirectly). Forced redistribution out of home ranges or territories can cause stress and conflict, leading to injury or death of individuals (indirect). The loss of threatened (Red Data) species may result in a loss of biodiversity and ecosystem resilience to climate change (direct). The loss of threatened keystone species may alter the functioning of an ecosystem (direct).	quantity	02
Plant Management	Driving & Transport	Speed (en route to & from site)	**Impact:** Loss of sedentary or active fauna when driving. **Consequences:** Loss/injury to fauna.	quantity	02

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Plant Management	Driving & Transport	Generating emissions incl. noise and dust	**Impact:** Disturbance (including of nesting SCC) due to noise, such as machinery movements and maintenance operations, causing active mammals and birds to temporarily evade or emigrate from the area. **Consequence:** - Forced redistribution out of home ranges or territories can cause stress and conflict. Conflict can lead to injury or death of individuals (indirect). Decrease in avifauna population due to loss of offspring/breeding pairs for generation.	quantity	02
Plant Management	Operating & Parking Plant	Generating emissions incl. noise and dust	**Impacts:** Disturbance during construction at both sites can cause active mammals to temporarily emigrate from the area. **Consequence:** Forced redistribution out of home ranges or territories can cause stress and conflict.	quantity	02
General and Hazardous Waste Management	Handling and Collection (incl. chemical toilets & concrete slurry)	Contamination	**Impact:** Littering is harmful to fauna. **Consequence:** loss of fauna	quantity	02
General and Hazardous Waste Management	Handling and Collection (incl. chemical toilets & concrete slurry)	Contamination	**Impact:** Cement bags disposed of around the site where fauna could come into contact with the waste. **Consequence:** Fauna could get injured/death if bags are eaten.	quantity	02
General and Hazardous Waste Management	Storage	Contamination	**Impacts:** Loss of fauna if inorganic waste is ingested. **Consequences:** death/injury to fauna.	quantity	02
General and Hazardous Waste Management	Disposal	Contamination	**Impact:** Burning of waste as a disposal method increases the risk of veld fires caused by workers during the construction of the facility. **Consequence:** - Veld fires result in a loss of fauna (direct) - Veld fires reduce the carrying capacity and therefore productivity of land (indirect)	quantity	02

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Linear Infrastructure Crossings	Underground Pipelines	Importing material/ Trenching/Diversion Works/Sedimentation /Erosion	**Impact:** Direct loss of fauna through earthworks during construction activities by falling into open excavations. Animals such as tortoises could get trapped inside trenches. **Consequence:** Injury or loss of wildlife or livestock	quantity	02
Clearing/Grubbing and Grading	Access Road, pipeline, construction camp & staging area	Removal of vegetation	**Impact:** Sedentary mammals or nesting birds could be injured or killed, resulting in a direct loss of terrestrial animals or aves from construction footprint. **Consequence:** - the loss of threatened (Red Data) species may result in a loss of biodiversity and ecosystem resilience to climate change. - the loss of threatened keystone species may alter the functioning of an ecosystem.	quantity	02
Earthworks	Excavations/Trenching	NA	**Impact:** Direct loss of fauna through earthworks during construction activities by falling into open excavations. Animals such as tortoises could get trapped inside trenches. **Consequence:** Injury or loss of wildlife or livestock	quantity	02
Stockpiling and Storing (Laydown)	Mulch, topsoil, aggregate, spoil and infrastructure	Burying, smothering, impeding, sedimentation, emitting	**Impact:** Direct loss of local sedentary or burrowing fauna and Aves through burial. **Consequence:** - the loss of threatened (Red Data) species may result in a loss of biodiversity and ecosystem resilience to climate change (direct). - the loss of threatened keystone species may alter the functioning of an ecosystem (direct).	quantity	02
Security	NA	Influx of contractors and workers into the area.	**Impact:** Farm gates being left open, or not being closed properly by construction teams. **Consequence:** Loss of livestock	quantity	03
Plant Management	Driving & Transport	Damage to the roads or environment	**Impact:** The construction of an access road will lead to an increase in roadkill **Consequence:** Change of land use can potentially impact negatively on the livelihood of the affected farmer, which is sheep farming. Loss/injury to faunal species	quantity	03

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Employee Management	Harvesting muthi plants, collecting firewood and/or poaching	Removal of medicinal plants, dead wood and/or wildlife	**Impact:** Economic losses due to theft of livestock or game through poaching. Loss of fauna and/or injury to construction staff caused by potentially dangerous animals such as snakes. **Consequence:** Loss/injury to fauna and staff.	quantity	03

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

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

Impact 02 (Animal species)

- The site lies within the range of 63 terrestrial mammals, including three listed species (EWT & SANBI, Red Data Book of Mammals of South Africa, Lesotho and Swaziland, 2016). The five listed species are the Brown Hyaena Hyaena brunnea (NT), South African Hedgehog Atelerix frontalis (NT), the African White-tailed Rat Mystromys albicaudatus (VU), the Black-footed Cat Felis nigripes (VU) and the Serval Leptailrus serval (NT). While the Hedgehog and Black-footed Cat are likely to occur in the broad area, the Brown Hyaena is less likely to be present due to naturally low population density as well as persecution from farmers. Adequate cover and water are essential habitat requirements for the Serval and given the sparse cover at the site this species is unlikely to occur here and the area is not viewed as important habitat for this species which favours tall grassland.
- Sedentary animals pose a higher risk of harm than active animals.
- Faunal diversity in the area is quite high and a wide array of species were directly or indirectly observed during the site visit. The majority of species observed are medium sized mammals, typical of the area and no particularly rare or notable species were observed. Species that were observed in the area include Cape Porcupine Hystrix africaeaustralis, Steenbok Raphicerus campestris, Duiker Sylvicapra grimmia, Springbok Antidorcas marsupialis, Aardvark Orycteropus afer, Rock Hyrax Procavia capensis, Cape Hare Lepus capensis, Hewitt's Red Rock Rabbit Pronologus saundersiae, South African Ground Squirrel Xerus inauris, Springhare Pedetes capensis, Namaqua Rock Mouse Aethomys namaquensis, Black-backed Jackal Canis mesomelas, Bat-eared Fox Otocyon megalotis, Yellow Mongoose Cynictis penicillata and African Wild Cat Felis silvestris.
- Impacts on mammals are likely to be restricted largely to disturbance during the construction phase and habitat loss during the operational phase. Although this is relatively low in the context of the landscape, impacts on habitat fragmentation and landscape connectivity are likely to be increasingly significant as the landscape becomes increasingly transformed as a result of the large number of the developments in the area. The Brak River is likely of significance in terms of landscape connectivity for fauna and it would be important to maintain this clear of development to ensure that it retains this function.

Impact 02 (Important Bird Area)

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- The study area occurs in the Platberg-Karoo Conservancy (SA037) Important Bird and Biodiversity Area (IBA).
- 84 bird species were observed within and around the Combined Project Area out of an expected total of 104 species, based on previous surveys, the SABAP Pentad analysis and habitat suitability, based Probability of Occurrences.
- IBA trigger species are the Globally threatened Blue Crane, Ludwig's Bustard, Kori Bustard, Secretary bird, Martial Eagle, Blue Korhaan, Black Harrier and Denham's Bustard. Regionally threatened species are Black Stork, Lanner Falcon, Tawny Eagle, Karoo Korhaan and Verreauxs' Eagle (BirdLife website, 2015).
- The most significant breeding habitat recorded during the survey were the active Verreaux's Eagle and Tawny Eagle nests. The nesting site is at this stage the highest sensitivity found within proximity of the study area. A portion of the preferred Alternative Route No. 1, specifically existing farm tracks that will be rebuilt to Eskom specification, are within the 1 km buffer of the Verreaux Eagle's nest (Avifauna Final EIA Report, 2022).
- Verreaux's Eagles breed with one partner for their entire life, and only replace a partner in the event of death. **Mating takes place all year round and egg-laying season is between April and July** (Verreaux's Eagle - SANBI, 2014).
- Essentially, all habitat attractants should be eliminated so that avifaunal populations will not embedded themselves within the infrastructure over time.
- Significant risks are associated with the likelihood of project vehicles flushing birds into fencing infrastructure.
- Impacts due to bird mortalities during the operational phase are practically unavoidable for any large facility, but with the appropriate mitigation measures these impacts can be minimised. It is likely that most of the avifaunal populations will be largely displaced from the majority of the project infrastructure, although significant risks are associated with the likelihood of project vehicles flushing birds into fencing infrastructure as well as collisions of large bodied species with powerlines. Although the current overall bird activity qualifies the proposed solar development boundary as a high-density area, there are certain times of the year (and day) when it appears that large flocks of birds (such as cranes bustards and large birds of prey) are far more prevalent.

Impact 03 (Damage to property/livestock)

- During the construction phase all livestock would need to be moved to different parts of the farm as the construction activities may be distressing for the animals.
- The movement of workers and vehicles on the site could cause damage to farm infrastructure (e.g., fencing, water troughs and gates), during construction and operation.
- Farm owners are concerned about the impact of fences on water flow during heavy rain. If fences are not kept clear of debris, there is a risk that it can affect the waterflow into dams in the area, which is critical in a dry area like the Karoo.

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- There are concerns that poaching incidents may increase, especially when the fencing is erected and when a number of construction teams are active in the area.
- Construction traffic may impact on the movement of the livestock around the farm.
- There is a risk of stock loss due to farm gates being left open, or not being closed properly by construction teams

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					

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

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

- None

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

- Avifauna Specialist Assessment (Final) prepared by Enviro-Insight CC (Sam Laurence and A.E. van Wyk) dated October 2022).
- (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).
- Verreaux's Eagle - SANBI article prepared by Mandisa Kondlo and Thato Moeketsane of Walter Sisulu National Botanical Garden on September 2014.
- Environmental Impact Assessment for the proposed Soventix Solar PV Project, De Aar, Northern Cape: Fauna & Flora Specialist EIA Report prepared by Simon Todd Consulting dated May 2017.
  BirdLife website (https://www.birdlife.org.za/iba-directory/platberg-karoo-conservancy - page last updated Friday 13th February 2015)
  Avifauna Final EIA Report prepared by Enviro-Insight CC (Sam Laurence and A.E. van Wyk) dated October 2022.
- Access Road and Part 2 Amendment Addendum to Social Impact Assessment Report prepared by Equispectives Research & Consulting Services dated January 2023.

Mitigations:

Impact Management Outcome(s):

- Compliance
- Ensure least impact on animal behaviour.
- Good waste storage and management
- Minimize Road collisions with fauna.
- Ensure the protection of Aves.
- Ensure least impact on behaviour and breeding, e.g., bird roosts and nests are not disturbed.
- No harm to wildlife and people.
- Minimize change in livelihoods of surrounding communities.
- Minimize loss of livestock.

Targets:

- Low noise levels
- No waste is burned.
- No waste or litter on site

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- Waste storage area
- No empty cement bags on site
- A low-speed limit (30km/h max) is implemented
- Minimal bird injuries & mortalities recorded.
- Least impact on breeding, e.g., bird roosts and nests are not disturbed.
- No unnecessarily loud noise that is a nuisance to wildlife
- Trenches are not left open for extended periods.
- Preservation of Species of Conservation Concern (SCC).
- Search for fauna prior to stockpiling
- Relocate fauna
- No hunting or harvesting of fauna
- SAPS Case number
- No construction creep
- Potentially dangerous animals are safely removed from the construction site.
- Logbook
- No harm to livestock or other fauna.
- In the case of harm to or loss of livestock, the farmer is compensated according to accepted protocols and procedures.
- Boundary gates are closed/locked.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
02	Employee Management	Disturbance during construction can cause active mammals and birds to temporarily evade or emigrate from the area.	Ensure least impact on animal behaviour.	Low noise levels	Keep noise levels as low as practically possible when working, e.g. no unnecessary shouting, loud music or revving of engines.	Contractor, SEO	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
02	General and Hazardous Waste Management	Burning of waste as a disposal method increases the risk of veld fires caused by workers during the construction of the facility.	Ensure least impact on animal behaviour.	No waste is burned	Burning of waste is prohibited.	Contractor, SEO	Continuous	Compliance to be verified by ECO and IEA.
02	General and Hazardous Waste Management	Loss of fauna if inorganic waste is ingested.	Good waste storage and management	No litter	General waste, such as food packaging and cement bags shall be immediately disposed of in the designated receptacles, e.g., scavenger proof bins, and removed from the construction site overnight.	Contractor	Continuous	Compliance to be verified by ECO and IEA.
02	General and hazardous waste management	Cement bags disposed of around the site where fauna could come into contact with the waste.	Good waste storage and management	Waste storage area	Designate and contain a temporary waste storage area within the construction camp (e.g., covered skips, scavenger proof bins, etc.)	Contractor	Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
02	General and hazardous waste management	Cement bags disposed of around the site where fauna could come into contact with the waste.	Good waste storage and management	No empty cement bags on site	Empty cement bags should be collected and removed from site to the designated waste storage area in the construction camp at the end of each work day.	Contractor, SEO	Construction and Continuous	Compliance to be verified by ECO and IEA.
02	General and hazardous waste management	Loss of fauna if inorganic waste is ingested.	Good waste storage and management	No waste on site	No waste or waste receptacles must remain on the construction site overnight, but returned to the designated waste storage area in the construction camp at the end of each work day.	Contractor	Continuous	Compliance to be verified by ECO and IEA.
02	Plant Management	Loss of sedentary or active fauna when driving.	Minimize Road collisions with fauna.	A low-speed limit (30km/h max) is implemented	All vehicles accessing the site should adhere to a low-speed limit (30km/h max) to avoid collisions with susceptible species such as snakes and tortoises.	Contractor	Continuous	Compliance to be verified by ECO and IEA.
02	Plant management	Bird mortalities during the construction phase due to vehicle collisions or	Ensure the protection of Aves.	Minimal bird injuries & mortalities recorded.	Drivers must adhere to the speed limit (30 km/hr) and slow down when approaching	Contractor	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		collisions with infrastructure. Disturbance to breeding or destruction of bird roosts during the construction phase.			animals. This is to be included in the induction.			
02	Plant management	Bird mortalities during the construction phase due to vehicle collisions or collisions with infrastructure. Disturbance to breeding or destruction of bird roosts during the construction phase.	Ensure the protection of Aves.	Minimal bird injuries & mortalities recorded.	Drivers must be vigilant and on the lookout for animals.	Contractor	Continuous	Compliance to be verified by ECO and IEA.
02	Plant management	Bird mortalities during the construction phase due to vehicle collisions or collisions with infrastructure. Disturbance to breeding or destruction of bird roosts	Ensure the protection of Aves.	Minimal bird injuries & mortalities recorded.	A log should be kept detailing all fauna-related incidences or mortalities that occur on site, including roadkill, electrocutions etc. during construction and operation. These should be reviewed annually	Holder, Contractor, SEO, ECO	Continuous and reviewed annually	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		during the construction phase.			and used to inform operational management and mitigation measures.			
02	Plant Management	Disturbance (including of nesting SCC) due to noise, such as machinery movements and maintenance operations, causing active mammals and birds to temporarily evade or emigrate from the area.	Ensure the protection of Aves.	No unnecessarily loud noise that is a nuisance to wildlife	Construction plant, machinery and equipment must be regularly serviced and well maintained to reduce noise levels.	Contractor	Continuous	Compliance to be verified by ECO and IEA.
02	Plant Management	Disturbance (including of nesting SCC) due to noise, such as machinery movements and maintenance operations, causing active mammals and birds to	Ensure least impact on behaviour and breeding, e.g., bird roosts and nests are not disturbed.	Least impact on breeding, e.g., bird roosts and nests are not disturbed.	If work is to be undertaken in the vicinity of nest or roosts of species of conservation concern the scheduling of work should as far as practical be planned outside of the breeding season of the nesting bird and/or	Contractor, SEO, ECO	Construction outside of the breeding season of the nesting bird.	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		temporarily evade or emigrate from the area.			buffers to be observed.			
02	Plant Management	Disturbance (including of nesting SCC) due to noise, such as machinery movements and maintenance operations, causing active mammals and birds to temporarily evade or emigrate from the area.	Ensure the protection of Aves.	No unnecessarily loud noise that is a nuisance to wildlife	Keep noise levels as low as practically possible when working, e.g. no unnecessary shouting, loud music or revving of engines.	Contractor	Continuous	Compliance to be verified by ECO and IEA.
02	Linear Infrastructure and Earthworks	Direct loss of fauna through earthworks during construction activities by falling into open excavations. Animals such as tortoises could get trapped inside trenches.	No harm to wildlife.	Trenches are not left open for extended periods.	Demarcate open excavations with preferably netting, construction fencing or similar to prevent any persons or animals falling in the excavations.	Contractor, SEO	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
02	Linear Infrastructure and Earthworks	Direct loss of fauna through earthworks during construction activities by falling into open excavations. Animals such as tortoises could get trapped inside trenches.	No harm to wildlife.	Trenches are not left open for extended periods.	Fill open excavations as soon as possible after excavation.	Contractor	Continuous	Compliance to be verified by ECO and IEA.
02	Linear Infrastructure and Earthworks	Direct loss of fauna through earthworks during construction activities by falling into open excavations. Animals such as tortoises could get trapped inside trenches.	No harm to wildlife.	Trenches are not left open for extended periods.	Check excavations daily for trapped animals and release them. Do not kill any animal.	Contractor, SEO	Continuous and daily	Compliance to be verified by ECO and IEA.
02	Linear Infrastructure and Earthworks	Direct loss of fauna through earthworks during construction activities by falling into open	No harm to wildlife.	Trenches are not left open for extended periods.	Demarcate open excavations with netting to prevent any persons or animals falling in the excavations.	Contractor	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		excavations. Animals such as tortoises could get trapped inside trenches.						
02	Linear Infrastructure and Earthworks	Direct loss of fauna through earthworks during construction activities by falling into open excavations. Animals such as tortoises could get trapped inside trenches.	No harm to wildlife.	Trenches are not left open for extended periods.	If an animal is trapped, construct an earthen (soil) ramp at both ends of the excavation to allow trapped animals to escape.	Contractor	Continuous	Compliance to be verified by ECO and IEA.
02	Clearing/Grubbing and Grading	Sedentary mammals or nesting birds could be injured or killed, resulting in a direct loss of terrestrial animals or aves from construction footprint.	Compliance	Preservation of Species of Conservation Concern (SCC).	Pre-construction walk-through of the access road, pipeline routes and other construction footprints (e.g., camp and staging areas) in order to locate species of conservation concern (e.g., endemic, threatened and/or protected fauna), particularly local sedentary or	Contractor	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
					burrowing fauna as well as ground nesting birds that can be translocated..			
02	Clearing/Grubbing and Grading	Sedentary mammals or nesting birds could be injured or killed, resulting in a direct loss of terrestrial animals or aves from construction footprint.	Compliance	Preservation of Species of Conservation Concern (SCC).	If any sedentary animals or ground nesting birds are found, then these are to be relocated to a suitable distance and habitat by the ECO, and only if it is not possible to relocate the footprint.	Contractor, SEO, ECO	Pre-construction and Continuous	Compliance to be verified by ECO and IEA.
02	Clearing/Grubbing and Grading	Sedentary mammals or nesting birds could be injured or killed, resulting in a direct loss of terrestrial animals or aves from construction footprint.	Compliance	Preservation of Species of Conservation Concern (SCC).	Vegetation clearing to commence only after walk through has been conducted, the necessary permits and/or license have been obtained, and sedentary animals/aves have been safely translocated.	Contractor	Continuous	Compliance to be verified by ECO and IEA.
02	Clearing/Grubbing and Grading	Sedentary mammals or nesting birds could be injured or killed, resulting	Compliance	Preservation of Species of Conservation Concern (SCC).	ECO to provide supervision and oversight of vegetation clearing activities within sensitive areas	ECO	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		in a direct loss of terrestrial animals or aves from construction footprint.			such as near drainage areas.			
02	Stockpiling and storing (Laydown)	Direct loss of local sedentary or burrowing fauna and Aves through burial.	Ensure least impact to animals	Search for fauna prior to stockpiling	Undertake a search for local sedentary or burrowing fauna as well as ground nesting birds on the area designated for stockpiles prior to stockpiling.	Contractor, SEO, ECO	Prior to stockpiling	Compliance to be verified by ECO and IEA.
02	Stockpiling and storing (Laydown)	Direct loss of local sedentary or burrowing fauna and Aves through burial.	Ensure least impact to animals	Relocate fauna	If any sedentary animals or ground nesting birds are found, then these are to be relocated to a suitable distance and habitat by the ECO, and only if it is not possible to relocate the footprint.	ECO	Prior to stockpiling	Compliance to be verified by ECO and IEA.
03	Employee Management	Economic losses due to theft of livestock or game through poaching. Loss of fauna and/or injury to construction staff caused by potentially	No harm to wildlife and people.	No hunting or harvesting of fauna	The collection, hunting or harvesting of any animals at the site is strictly forbidden.	Contractor, SEO, ECO	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		dangerous animals such as snakes.						
03	Employee Management	Economic losses due to theft of livestock or game through poaching. Loss of fauna and/or injury to construction staff caused by potentially dangerous animals such as snakes.	No harm to wildlife and people.	No poaching	SAE must have a zero-tolerance policy regarding poaching, and make it clear what the punishment and consequences would be.	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.
03	Employee Management	Economic losses due to theft of livestock or game through poaching. Loss of fauna and/or injury to construction staff caused by potentially dangerous animals such as snakes.	No harm to wildlife and people.	SAPS Case number	All poaching incidences must be reported to the local police.	Contractor, SEO, ECO	Continuous	Compliance to be verified by ECO and IEA.
03	Employee Management	Economic losses due to theft of livestock or game through	No harm to wildlife and people.	No construction creep	Except for the designated staging area and construction camp, all other	Contractor	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		poaching. Loss of fauna and/or injury to construction staff caused by potentially dangerous animals such as snakes.			construction activities are restricted to within the fenced road servitude.			
03	Employee Management	Economic losses due to theft of livestock or game through poaching. Loss of fauna and/or injury to construction staff caused by potentially dangerous animals such as snakes.	No harm to wildlife and people.	Potentially dangerous animals are safely removed from the construction site.	Any potentially dangerous fauna such as snakes or fauna threatened by the construction activities should be removed to a safe location by an experienced handler.	Contractor, SEO, ECO, Snake handler	Continuous	Compliance to be verified by ECO and IEA.
03	Plant Management	The construction of an access road will lead to an increase in roadkill	Minimize change in livelihoods of surrounding communities.	No harm to livestock or other fauna	Livestock must have right of way.	Contractor, SEO	Continuous	Compliance to be verified by ECO and IEA.
03	Plant Management	The construction of an access road will lead to an increase in roadkill	Minimize change in livelihoods of surrounding communities.	No harm to livestock or other fauna	Construction vehicles must wait for the animals to cross before they continue with their journey.	Contractor	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
03	Plant Management	The construction of an access road will lead to an increase in roadkill	Minimize change in livelihoods of surrounding communities.	Logbook	A log should be kept detailing all fauna-related incidences or mortalities that occur on site, including roadkill, electrocutions etc. during construction and operation. These should be reviewed annually and used to inform operational management and mitigation measures.	Contractor, SEO, ECO	Continuous and reviewed annually	Compliance to be verified by ECO and IEA.
03	Plant Management	The construction of an access road will lead to an increase in roadkill	Minimize change in livelihoods of surrounding communities.	No harm to livestock or other fauna.	Except for the designated staging area and construction camp, all other construction activities are restricted to within the fenced road servitude or pipeline.	Contractor, SEO	Continuous	Compliance to be verified by ECO and IEA.
03	Plant Management	The construction of an access road will lead to an increase in roadkill	Minimize change in livelihoods of surrounding communities.	In the case of harm to or loss of livestock, the farmer is compensated according to accepted	The contractor must compensate the farmer for any losses of livestock due to irresponsible behaviour by the construction teams.	Contractor	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
				protocols and procedures.				
03	Security	Farm gates being left open, or not being closed properly by construction teams.	Minimize loss of livestock.	Boundary gates are closed/locked.	Farm gates being left open, or not being closed properly by construction teams. Inspections of boundary gates (must be closed/locked) should be done on a daily basis in areas where there are activities.	Contractor	Continuous and daily inspections	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Route No. 1 (preferred)

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

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"):

- Although the development footprint is small relative to animal home rages and territories, sound can travel further, beyond the boundaries of the footprint.

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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.

Receiving Environment: Terrestrial Flora

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Employee Management	Keeping warm or cooking	Starting fires	**Impact:** Risk of veld fires caused by workers during the construction of the facility. **Consequence:** - Runaway fires on neighbouring properties will result in a loss of grazing for livestock and/or wild game, increasing the running costs to provide supplementary feed.	quantity	04
Employee Management	Harvesting muthi plants, collecting firewood and/or poaching	Removal of medicinal plants, dead wood and/or wildlife	**Impact:** Collection or harvesting of flora. **Consequence:** - the loss of threatened (Red Data) species may result in a loss of biodiversity and ecosystem resilience to climate change (direct). - the loss of threatened keystone species may alter the functioning of an ecosystem (direct).	quantity	04
Plant Management	Driving & Transport	Generating emissions incl. noise and dust	**Impact:** Increase in sedimentation/dust covering flora species. **Consequence:** reduced photosynthetic functioning	quantity	04
Plant Management	Driving & Transport	Damage to the roads or environment	**Impact:** Trampling and removal of vegetation Loss in plant basal cover **Consequence:** Altered surface water flow patterns, increased runoff and soil erosion.	quantity	04
General and Hazardous Waste	Disposal	Contamination	**Impact:** Burning of waste as a disposal method increases the risk of veld fires caused by workers during the construction of the facility. **Consequence:** - Veld fires result in a loss of flora (direct)	quantity	04

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Fire Management	Wildfires	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.	quantity	04
Clearing/Grubbing and Grading	Access Road, pipeline, construction camp & staging area	Removal of vegetation	**Impact:** Direct loss of terrestrial plants from construction activities on land, including clearing and grubbing. **Consequence:** - the loss of threatened (Red Data) species may result in a loss of biodiversity and ecosystem resilience to climate change (direct). - the loss of threatened keystone species may alter the functioning of an ecosystem (direct).	quantity	04
Stockpiling and Storing (Laydown)	Mulch, topsoil, aggregate, spoil and infrastructure	Burying, smothering, impeding, sedimentation, emitting	**Impact:** Direct loss of terrestrial plants from construction activities on land, including stockpiling. **Consequence:** - the loss of threatened (Red Data) species may result in a loss of biodiversity and ecosystem resilience to climate change (direct). - the loss of threatened keystone species may alter the functioning of an ecosystem (direct).	quantity	04
Linear Infrastructure Crossings	Roads	Grading existing & new roads/Removal of Vegetation /Sedimentation	**Impact:** Direct loss of terrestrial plants from construction activities on land, including clearing and grubbing. **Consequence:** - the loss of threatened (Red Data) species may result in a loss of biodiversity and ecosystem resilience to climate change (direct). - the loss of threatened keystone species may alter the functioning of an ecosystem (direct).	quantity	05
Linear Infrastructure Crossings	Underground Pipelines	Clearing & Grubbing/Removal of Vegetation/Sedimentation	**Impact:** Direct loss of terrestrial plants from construction activities on land, including clearing and grubbing. **Consequence:** - the loss of threatened (Red Data) species may result in a loss of biodiversity and ecosystem resilience to climate change (direct). - the loss of threatened keystone species may alter the functioning of an ecosystem (direct).	quantity	05

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Alien Plant Management	Disturbance to natural areas	Favourable conditions for alien plant/animal recruitment.	**Impact:** Alien invasive plants: Prevent the cleared areas from degrading, as invasive non-native plants will spread into degraded areas. **Consequence:** Loss of biodiversity, invasive species compete with indigenous plant species.	quantity	06

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

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

Impact 04 (Fire)

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

Impact 04 (Protected Plants)

- According to the SIBIS database, a total of 407 plant species are found in the QDS 3024, of which only four red data-listed plant species are represented, Chasmatophyllum maninum and Chasmatophyllum rouxii (listed as DDD (data deficient, insufficient information)), Cynodon polevansii, which is listed DDT (Data Deficient – Taxonomically Problematic), and Rapanea melanophloeos, which is listed as Declining. The Chasmatophyllum species are associated with rocky flats and areas of exposed bedrock and Chasmatophyllum maninum is confirmed present at the site. Rapanea is associated with forest patches that usually occur around the base or in small kloofs of sandstone outcrops in vegetation types such as Besemkaree Koppies Shrubland and as it was not observed at the site and it is highly unlikely to be present.
- Other species of significance observed at the site include Stomatium pluridens and Euphorbia crassipes, which are regional endemics and provincially protected, while other protected species include Aloe broomii var. broomii, Aloe claviflora, Pachypodium succulentum, Ammocharis coranica, and Boscia albitrunca.

Impact 05 (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

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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.
- The area falls within a summer rainfall area, receiving more rainfall in the high-sun half of the year (October through March). The average rainfall is in the order of 320 mm/yr. The MAE (2 000 to 2 150 mm/yr) far exceeds the MAP for the site, which implies greater evaporative losses when compared to incident rainfall. Due to evaporation being about 85% more than local rainfall, non-perennial streams and rivers will only have water when there are flooding events (e.g., 1:2, 1:5, 1:50 and 1:100-year flood events). Runoff from natural (unmodified) catchments in Catchment D62D is 3.1 mm/yr, which is approximately 0.9% of the MAP and amounts to approximately 7.4 Mm^3/yr over the surface of the quaternary catchment. Average monthly rainfall peaks from October to May, whereas average monthly run-off peaks from December to April.
- Average rainfall over the combined surface of the sub-catchments is in the order of 192.47 Mm^3/yr (50% of the total water budget).
- Average runoff accounts for a volume in the order of 1.87 Mm^3/yr (0.5% of the total water budget).
- The average groundwater contribution to baseflow to rivers/wetlands/streams is in the order of 0 Mm^3/yr (0% of the total water budget).
- Evaporation accounts for a volume in the order of 182.69 Mm^3/yr (47.5% of the total water budget).

Impact 06 (Alien Invasive Species)

- The disturbance created during construction is likely to encourage the invasion of the disturbed areas by alien species. Although there were not a lot of alien species present in the area, problem species such as Prosopis are present in the area and it is possible that such species will colonise the disturbed areas if given the opportunity (Environmental Impact Assessment for the proposed Soventix Solar PV Project, De Aar, Northern Cape: Fauna & Flora Specialist EIA Report prepared by Simon Todd Consulting dated May 2017).
- Mexican Poppy Argemone mexicana was observed along the verge of the public road (Site Sensitivity Verification report prepared by Ecoleges dated February 2023).

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

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

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
06	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:

- NCNCA, 2009 (Act No.09 of 2009) section 51(3) No person may collect firewood or pick, transport or remove an indigenous plant on land of which such person is not the owner without the owner's written permission.
- Environmental Impact Assessment for the proposed Soventix Solar PV Project, De Aar, Northern Cape: Fauna & Flora Specialist EIA Report prepared by Simon Todd Consulting dated May 2017.
- Solar-Africa Energy project in the Hanover District, Northern Cape (De Aar/Hanover area) agro-ecosystem specialist assessment for: Upgrading & development of an access road from the N10/'Burgerville' District Road (2448) turn-off into the Farm Riet Fountain No. 39C and to the switching station and main transmission substation on Sun Central Cluster 1 (300 MW) solar PV facility between De Aar & Hanover,

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Emthanjeni Local Municipality, Pixley Ka Seme District Municipality, Northern Cape province, South Africa prepared by D. V. F. Arnoldi, H. M. van den Berg and F. Botha dated 20 January 2023.

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

Mitigations:

Impact Management Outcome(s):

- Minimise risk of runaway fires
- No illegal harvesting of flora or fauna
- Minimize dust generation.
- Minimize damage to vegetation and potential for soil erosion.
- Responsible waste management
- Fire management
- Avoid the unnecessary loss of or harm to terrestrial plants, particularly SCC, e.g., endemic, threatened and/or protected plants.
- Preserve SCC
- Reduce invasive alien plant recruitment.

Targets:

- Illegal harvesting is forbidden.
- No offloading in windy conditions and vehicles are covered.
- Limited new routes
- No signs of off-road driving
- No burning of waste or open fires.
- Risk analysis
- Membership of the local Fire Protection Association
- PPE and maintained Firefighting equipment.
- Responsible person appointed.
- Firefighting personal
- No construction creep.
- Search for protected flora
- Permit/s
- SCC translocated.

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- Vegetation sods removed and stored.
- Correct removal, replanting and storage of sods.
- Walk through.
- Supervision by ECO
- Stockpiles of cleared vegetation.
- Active rehabilitation
- No-go areas are cordoned off.
- Roads and pipelines avoid sensitive areas/species.
- Unused roads are rehabilitated.
- No alien invasive species
- Bare areas are loosened and protected.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
04	Employee Management	Risk of veld fires caused by workers during the construction of the facility.	Minimise risk of runaway fires	No open fires.	Open fires are prohibited.	Contractor	Construction	Compliance to be verified by ECO and IEA.
04	Employee Management	Collection or harvesting of flora.	No illegal harvesting of flora or fauna	Illegal harvesting is forbidden	The collection or harvesting of any plant or plant part, irrespective of whether it is dead or alive, is strictly prohibited.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
04	Plant Management	Increase in sedimentation/dust covering flora species.	Minimize dust generation	Vehicles are covered	Vehicles transporting dispersive materials shall be covered.	Contractor	Construction	Compliance to be verified by ECO and IEA.
04	Plant Management	Increase in sedimentation/dust covering flora species.	Minimize dust generation	No offloading in windy conditions	Offloading of dispersive materials should be	Contractor	Construction	Compliance to be verified by

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					avoided during windy conditions.			ECO and IEA.
04	Plant Management	Trampling and removal of vegetation Loss in plant basal cover	Minimize damage to vegetation and potential for soil erosion.	No construction creep	Avoid moving too far from the access road or pipeline trench with vehicles during the construction period.	Contractor	Construction	Compliance to be verified by ECO and IEA.
04	Plant Management	Trampling and removal of vegetation Loss in plant basal cover	Minimize damage to vegetation and potential for soil erosion.	Limited new routes	Limit the number of new routes through the veld, especially with the development of the digging of the trenches for the pipelines to reduce the mechanical impact on the veld.	Contractor	Construction	Compliance to be verified by ECO and IEA.
04	Plant Management	Trampling and removal of vegetation Loss in plant basal cover	Minimize damage to vegetation and potential for soil erosion.	No signs of off-road driving	All construction vehicles should adhere to clearly defined and demarcated roads. No off-road driving to be allowed outside of the construction area.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
04	General and Hazardous waste	Burning of waste as a disposal method increases the risk of veld fires caused by workers during the construction of the facility.	Responsible waste management	No burning of waste.	Burning of waste is prohibited.	Contractor	Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
04	Fire management	Risk of veld fires caused by workers during the construction of the facility.	Fire management	Risk analysis	Undertake a risk analysis to determine inter alia the probability and frequency of a wildfire during construction and operation and prepare a fire management plan accordingly.	Holder	Construction	Compliance to be verified by ECO and IEA.
04	Fire management	Risk of veld fires caused by workers during the construction of the facility.	Fire management	Membership of the local Fire Protection Association	Join the local Fire Protection Association if there is one and abide by their minimum requirements, as well as any agreements entered into with the Minister or other FPAs to provide mutual assistance in fighting and extinguishing fires.	Holder	Continuous	Compliance to be verified by ECO and IEA.
04	Fire management	Risk of veld fires caused by workers during the construction of the facility.	Fire management	PPE	Obtain the necessary PPE for firefighting personnel.	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.
04	Fire management	Risk of veld fires caused by workers during the construction of the facility.	Fire management	Firefighting equipment	Obtain such firefighting equipment as would be reasonably	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					required in the circumstances, that is proportional to the risk.			
04	Fire management	Risk of veld fires caused by workers during the construction of the facility.	Fire management	Maintained firefighting equipment	Firefighting equipment shall be maintained and readily available during construction (and operation) - regularly test and service equipment	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.
04	Fire management	Risk of veld fires caused by workers during the construction of the facility.	Fire management	Responsible person appointed	Appoint a responsible person (or agent) who will extinguish a fire, or assist in doing so, and take all reasonable steps to alert the owners of adjoining land and the relevant Fire Protection Association, if any.	Holder, Contractor	Construction	Compliance to be verified by ECO and IEA.
04	Fire management	Risk of veld fires caused by workers during the construction of the facility.	Fire management	Firefighting personal	If no agent is appointed, a team of designated firefighting personal shall be trained and readily available to immediately deal with any runaway veld fires.	Holder, Contractor	Construction	Compliance to be verified by ECO and IEA.
04	Clearing/grubbing and Grading	Direct loss of terrestrial plants from construction	Avoid the unnecessary loss of or	No construction creep	Vehicular or pedestrian access is prohibited in	Contractor, SEO, ECO	Construction	Compliance to be verified by

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		activities on land, including clearing and grubbing.	harm to terrestrial plants, particularly SCC, e.g., endemic, threatened and/or protected plants.		natural areas beyond the demarcated (fenced) boundary of the construction site (road servitude or pipeline corridor).			ECO and IEA.
04	Clearing/grubbing and Grading	Direct loss of terrestrial plants from construction activities on land, including clearing and grubbing.	Avoid the unnecessary loss of or harm to terrestrial plants, particularly SCC, e.g., endemic, threatened and/or protected plants.	Search for protected flora	Perform a search for any threatened and/or protected flora in those areas that will be disturbed by the road and pipeline alignments and associated construction activities, including but not limited to the construction camp and staging area.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
04	Clearing/grubbing and Grading	Direct loss of terrestrial plants from construction activities on land, including clearing and grubbing.	Avoid the unnecessary loss of or harm to terrestrial plants, particularly SCC, e.g., endemic, threatened and/or	Permit/s	Only apply for permit(s) and/or a license to "pick" a threatened or protected plant if it is not possible to relocate the physical footprint.	Holder	Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
			protected plants.					
04	Clearing/grubbing and Grading	Direct loss of terrestrial plants from construction activities on land, including clearing and grubbing.	Avoid the unnecessary loss of or harm to terrestrial plants, particularly SCC, e.g., endemic, threatened and/or protected plants.	SCC translocated	Any plant Species of Conservation Concern (SCC) within the development footprint area must be translocated to safety and returned to the road verge during rehabilitation of the site or replanted to the same or similar micro habitat.	Contractor, SEO. ECO	Construction	Compliance to be verified by ECO and IEA.
04	Clearing/grubbing and Grading	Direct loss of terrestrial plants from construction activities on land, including clearing and grubbing.	Avoid the unnecessary loss of or harm to terrestrial plants, particularly SCC, e.g., endemic, threatened and/or protected plants.	Vegetation sods removed and stored	Vegetation cover can be removed as sods (for rehabilitation) and stored within transformed vegetation (alien invasive vegetation must be removed prior to storing the grassland sods).	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
04	Clearing/grubbing and Grading	Direct loss of terrestrial plants from construction activities on land, including clearing and grubbing.	Avoid the unnecessary loss of or harm to terrestrial plants, particularly	Correct removal, replanting and storage of sods	The sods should preferably be removed during the winter months and be replanted by latest springtime. The sods should	Contractor, SEO, ECO	Construction Removed during the winter months and replanted by latest springtime	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
			SCC, e.g., endemic, threatened and/or protected plants.		not be stacked on top of each other.			
04	Clearing/grubbing and Grading	Direct loss of terrestrial plants from construction activities on land, including clearing and grubbing.	Avoid the unnecessary loss of or harm to terrestrial plants, particularly SCC, e.g., endemic, threatened and/or protected plants.	Walk through	Vegetation clearing to commence only after walk through has been conducted, the necessary permits and/or license have been obtained, and the visibility flags have been erected and/or applicable plants have been safely translocated in line with permits obtained.	Contractor, SEO, ECO	After walk through	Compliance to be verified by ECO and IEA.
04	Clearing/grubbing and Grading	Direct loss of terrestrial plants from construction activities on land, including clearing and grubbing.	Avoid the unnecessary loss of or harm to terrestrial plants, particularly SCC, e.g., endemic, threatened and/or protected plants.	Supervision by ECO	ECO to provide supervision and oversight of vegetation clearing activities within sensitive areas such as near drainage areas.	ECO	Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
04	Clearing/grubbing and Grading	Direct loss of terrestrial plants from construction activities on land, including clearing and grubbing.	Avoid the unnecessary loss of or harm to terrestrial plants, particularly SCC, e.g., endemic, threatened and/or protected plants.	Stockpiles of cleared vegetation	Cleared vegetation from the construction camp, staging area and other footprints shall be stockpiled separately within the same areas for use as mulch during rehabilitation.	Contractor	Construction	Compliance to be verified by ECO and IEA.
04	Clearing/grubbing and Grading	Direct loss of terrestrial plants from construction activities on land, including clearing and grubbing.	Avoid the unnecessary loss of or harm to terrestrial plants, particularly SCC, e.g., endemic, threatened and/or protected plants.	Active rehabilitation	Conduct active rehabilitation during the construction activities according to a rehabilitation plan and/or implement the Bare Patch Restoration Protocol (Appendix C) that will restore the natural vegetation to what it was prior to construction so that the long-term impact could be negligible.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.
04	Clearing/grubbing and Grading	Direct loss of terrestrial plants from construction activities on land, including clearing and grubbing.	Avoid the unnecessary loss of or harm to terrestrial plants,	No-go areas are cordoned off	Cordon off areas under rehabilitation as "no-go areas" to prevent vehicular, pedestrian and livestock access.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
			particularly SCC, e.g., endemic, threatened and/or protected plants.					
04	Stockpiling and Storing (Laydown)	Direct loss of terrestrial plants from construction activities on land, including stockpiling.	Avoid the unnecessary loss of or harm to terrestrial plants, particularly protected or threatened plants	Search for protected flora	Perform a search for any threatened or protected flora in those areas that will be disturbed by stockpiling material.	Contractor, SEO, ECO	Prior to stockpiling material	Compliance to be verified by ECO and IEA.
04	Stockpiling and Storing (Laydown)	Direct loss of terrestrial plants from construction activities on land, including stockpiling.	Avoid the unnecessary loss of or harm to terrestrial plants, particularly protected or threatened plants	Alternative areas to avoid sensitive areas/species	Identify alternative areas in order to avoid plants of conservation concern, significant vegetation communities, natural features and sites of cultural and historical significance that are located within the route. These deviations must be approved by the ECO.	Contractor, ECO	Continuous	Compliance to be verified by ECO and IEA.
05	Linear Infrastructure Crossings	Direct loss of terrestrial plants from construction	Preserve SCC	Roads and pipelines avoid	Slight deviations of roads and other route alignments	Contractor, ECO	Continuous	Compliance to be verified by

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		activities on land, including clearing and grubbing.		sensitive areas/species	must be permitted in order to avoid plants of conservation concern, significant vegetation communities, natural features and sites of cultural and historical significance located within the route. These deviations must be approved by the ECO.			ECO and IEA.
05	Linear Infrastructure Crossings	Direct loss of terrestrial plants from construction activities on land, including clearing and grubbing.	Preserve SCC	No construction creep	The width of the construction corridor should be kept to a minimum.	Contractor, SEO, ECO	Continuous	Compliance to be verified by ECO and IEA.
05	Linear Infrastructure Crossings	Direct loss of terrestrial plants from construction activities on land, including clearing and grubbing.	Preserve SCC	Unused roads are rehabilitated.	Where new roads need to be constructed, the existing road infrastructure should be rationalised and any unnecessary roads decommissioned and rehabilitated to reduce the disturbance of the area in the river beds.	Contractor, SEO, ECO	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
06	Alien Plant Management	Alien invasive plants: Prevent the cleared areas from degrading, as invasive non-native plants will spread into degraded areas.	Reduce invasive alien plant recruitment	No alien invasive species	Clearing of invasive alien plants must take place coupled with the sowing of seeds of indigenous species to stabilise disturbed habitats. Re-vegetation with appropriate indigenous species (to prevent dust and erosion, as well as establishment of alien species).	Contractor, SEO, ECO	Continuous	Compliance to be verified by ECO and IEA.
06	Alien Plant Management	Alien invasive plants: Prevent the cleared areas from degrading, as invasive non-native plants will spread into degraded areas.	Reduce invasive alien plant recruitment	Bare areas are loosened and protected	Compacted bare ground should be loosened and pitted and covered with branches or stones. This will improve the ability of the surfaces to trap seeds and to absorb rainwater, thereby hastening vegetation recovery.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

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

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04	L	M	L	-I	M	L	0	L	L	0

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

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

Residual Risk (feeds back into "Mitigations"):

- None.

Receiving Environment: Aquatic fauna

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Linear Infrastructure Crossings	Underground Pipelines and Roads	Clearing & Grubbing/Removal of Vegetation/Sedimentation	**Impact:** A direct loss of aquatic macro and microfauna by construction activities in a watercourse. **Consequence:** - The loss of threatened (Red Data) species may result in a loss of biodiversity and ecosystem resilience to climate change (direct). - The loss of a threatened keystone species may alter the functioning of the aquatic ecosystem (direct).	quantity	07

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

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

Impact 07 (General)

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- The more seasonal and ephemeral ecosystems provide aquatic habitat to a diverse array of faunal species that depend on brief periods of inundation for hatching, mating, feeding and refuge. Cracks and scour holes in the silts and clays on the floodplains can hold floodwaters long enough for tadpole development. For instance, many frogs of the Karoo region breed in temporary pools associated with watercourses and wetlands, this includes the Karoo Toad Vandijkophrynus gariepensis and Karoo Dainty Frog Cacosternum Karooicum. Frogs have developed the ability to avoid the heat and dryness by burrowing underground in the alluvial soils for extended periods. Bullfrogs and rain frogs will bury into the soft alluvium of the drainage lines and floodplains to aestivate.
- The habitat type mostly available in temporary rivers is pools, in which invertebrates can survive the dry period and from where they can recolonise the stream as flow returns. The rich biodiversity of the invertebrate populations associated with ephemeral, intermittent, and headwater tributaries are important contributions to the biological integrity of river networks.
- Certain crustaceans e.g., copepods, ostracods, and cladocerans (including tadpole and fairy shrimps) can survive in temporary waters in ephemeral biotopes. These species can complete their life cycle in days during summer. As cysts, these creatures can dry with the mud and rehydrate later when water returns, hatching hours after hydration. Copepods, ostracods, and cladocerans are a food source for birds, especially for migrating species.
- A great number of other organisms are not confined to these temporary systems, but derive crucial benefits from them, like migratory birds and many invertebrates that migrate from permanent to temporary habitats on a regular basis.
- Although ephemeral streams only temporarily support fish, they indirectly support fish populations by helping to deliver required nutrients and other materials to the perennial segments.

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
07	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):

- Construction of linear infrastructure across parts of the ephemeral drainage system, should be restricted to the dry winter months (e.g., May to September), that is commence with such activities as clearing or grading, excavating and importing material at the end of the wet season/beginning of the dry season whilst the soil is still moist and as far as is practical, be completed in, the dry winter months.

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

- Aquatic Biodiversity Impact Assessment, Section 21(c) & (i) Risk Assessment and Wetland Delineation Verification, prepared by Dr Andrew Deacon and dated January 2023.

Mitigations:

Impact Management Outcome(s):

- Ensure the protection of aquatic fauna.

Targets:

- Construction during dry winter months.
- No unnecessary physical harm to aquatic fauna.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
07	Linear Infrastructure crossings	A direct loss of aquatic macro and microfauna by construction activities in a watercourse.	Ensure the protection of aquatic fauna	Construction during dry winter months	The construction of linear infrastructure across parts of the large ephemeral tributary and wetlands, should to the extent possible be restricted to	Holder, Contractor	Construction during dry winter months	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					the dry winter months (e.g., May to September), that is commence with such activities as clearing or grading, excavating and importing material at the end of the wet season/beginning of the dry season whilst the soil is still moist and as far as is practical, be completed in, the dry winter months.			
07	Linear Infrastructure crossings	A direct loss of aquatic macro and microfauna by construction activities in a watercourse.	Ensure the protection of aquatic fauna	No unnecessary physical harm to aquatic fauna	The ECO shall undertake a cursory inspection of the physical footprint prior to clearing and when grading or excavating in the large ephemeral tributary and wetlands for signs of frogs, and if found, relocate them to a suitable habitat out of harms way.	ECO	Prior to clearing, grubbing or grading	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

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"):

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- Although the drainage lines are ephemeral, amphibians may be present in localised low-lying depressions that collect rainwater in the rainy season.

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Receiving Environment: Aquatic flora

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Linear Infrastructure Crossings	Underground Pipelines and Roads	Clearing & Grubbing/Removal of Vegetation/ Sedimentation	**Impact:** A direct loss of local aquatic plants by construction activities in a watercourse. Loss of riparian systems and disturbance of the alluvial water courses. **Consequences**: - The loss of threatened (Red Data) species may result in a loss of biodiversity and ecosystem resilience to climate change (direct). - The loss of a threatened keystone species may alter the functioning of the aquatic ecosystem (direct).	Quantity	08

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

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

Impact 08 (General)

- The common reed Phragmites australis dominates the instream habitat along the Brak River, while there is very little discernible riparian vegetation. The ephemeral streams have no visible aquatic vegetation. Phragmites australis reeds grow in the beds of several of the ephemeral rivers.

Assessment without mitigation:

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

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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	L	L	L	-I	L	L	0	L	L	0
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

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

- None

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

- Aquatic Biodiversity Impact Assessment, Section 21(c) & (i) Risk Assessment and Wetland Delineation Verification, prepared by Dr Andrew Deacon and dated January 2023.

Mitigations:

Impact Management Outcome(s):

- Avoid the unnecessary loss of or harm to aquatic plants, particularly protected or threatened plants.

Targets:

- Unused roads are rehabilitated.
- No construction creep.
- Boundaries are respected.
- Search undertaken.
- Roads and pipelines avoid sensitive areas/species.
- Permit/s
- SCC translocated.

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- Vegetation sods removed and stored.
- Correct removal, replanting and storage of sods.
- Walk through.
- Supervision by ECO
- Stockpiles of cleared vegetation.
- Active rehabilitation
- No-go areas are cordoned off.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
08	Linear Infrastructure Crossings	Direct loss of terrestrial plants from construction activities on land, including clearing and grubbing.	Avoid the unnecessary loss of or harm to terrestrial plants, particularly SCC, e.g., endemic, threatened and/or protected plants.	No construction creep	The width of the construction corridor should be kept to a minimum.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
08	Linear Infrastructure Crossings	Direct loss of terrestrial plants from construction activities on land, including clearing and grubbing.	Avoid the unnecessary loss of or harm to terrestrial plants, particularly SCC, e.g., endemic, threatened and/or protected plants.	Boundaries are respected	Vehicular or pedestrian access is prohibited in natural areas beyond the demarcated (fenced) boundary of the construction site (pipeline corridor).	Contractor	Construction	Compliance to be verified by ECO and IEA.
08	Linear Infrastructure Crossings	Direct loss of terrestrial plants from	Avoid the unnecessary loss of or harm	Search undertaken	Perform a search for any threatened and/or protected flora in	Contractor, SEO, ECO	Construction prior to clearing/grubbing	Compliance to be verified

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		construction activities on land, including clearing and grubbing.	to terrestrial plants, particularly SCC, e.g., endemic, threatened and/or protected plants.		those areas that will be disturbed by the pipeline alignments and associated construction activities, including but not limited to the construction camp and staging area.			by ECO and IEA.
08	Linear Infrastructure Crossings	Direct loss of terrestrial plants from construction activities on land, including clearing and grubbing.	Avoid the unnecessary loss of or harm to terrestrial plants, particularly SCC, e.g., endemic, threatened and/or protected plants.	Roads and pipelines avoid sensitive areas/species.	Slight deviations of pipeline route alignments must be permitted in order to avoid plants of conservation concern, significant vegetation communities, natural features and sites of cultural and historical significance that are located within the route. These deviations must be approved by the ECO.	Contractor, ECO	Construction	Compliance to be verified by ECO and IEA.
08	Linear Infrastructure Crossings	Direct loss of terrestrial plants from construction activities on land, including clearing and grubbing.	Avoid the unnecessary loss of or harm to terrestrial plants, particularly SCC, e.g., endemic, threatened and/or protected plants.	Permit/s	Only apply for permit(s) and/or a license to "pick" a threatened or protected plant if it is not possible to relocate the physical footprint.	Holder	Construction prior to clearing/grubbing	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
08	Linear Infrastructure Crossings	Direct loss of terrestrial plants from construction activities on land, including clearing and grubbing.	Avoid the unnecessary loss of or harm to terrestrial plants, particularly SCC, e.g., endemic, threatened and/or protected plants.	SCC translocated	Any plant Species of Conservation Concern (SCC) within the development footprint area must be translocated to safety and returned to the road verge during rehabilitation of the site or replanted to the same or similar micro habitat.	Contractor, SEO. ECO	Construction	Compliance to be verified by ECO and IEA.
08	Linear Infrastructure Crossings	Direct loss of terrestrial plants from construction activities on land, including clearing and grubbing.	Avoid the unnecessary loss of or harm to terrestrial plants, particularly SCC, e.g., endemic, threatened and/or protected plants.	Vegetation sods removed and stored	Vegetation cover can be removed as sods (for rehabilitation) and stored within transformed vegetation (alien invasive vegetation must be removed prior to storing the grassland sods).	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
08	Linear Infrastructure Crossings	Direct loss of terrestrial plants from construction activities on land, including clearing and grubbing.	Avoid the unnecessary loss of or harm to terrestrial plants, particularly SCC, e.g., endemic, threatened and/or protected plants.	Correct removal, replanting and storage of sods	The sods should preferably be removed during the winter months and be replanted by latest springtime. The sods should not be stacked on top of each other.	Contractor, SEO, ECO	Construction Removed during the winter months and replanted by latest springtime	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
08	Linear Infrastructure Crossings	Direct loss of terrestrial plants from construction activities on land, including clearing and grubbing.	Avoid the unnecessary loss of or harm to terrestrial plants, particularly SCC, e.g., endemic, threatened and/or protected plants.	Walk through	Vegetation clearing to commence only after walk through has been conducted, the necessary permits and/or license have been obtained, and the visibility flags have been erected and/or applicable plants have been safely translocated in line with permits obtained.	Contractor, SEO, ECO	After walk through	Compliance to be verified by ECO and IEA.
08	Linear Infrastructure Crossings	Direct loss of terrestrial plants from construction activities on land, including clearing and grubbing.	Avoid the unnecessary loss of or harm to terrestrial plants, particularly SCC, e.g., endemic, threatened and/or protected plants.	Supervision by ECO	ECO to provide supervision and oversight of vegetation clearing activities within sensitive areas such as dolerite ridges, the large ephemeral tributary, and wetlands.	ECO	Construction	Compliance to be verified by ECO and IEA.
08	Linear Infrastructure Crossings	Direct loss of terrestrial plants from construction activities on land, including clearing and grubbing.	Avoid the unnecessary loss of or harm to terrestrial plants, particularly SCC, e.g., endemic, threatened and/or	Stockpiles of cleared vegetation	Cleared vegetation from the construction camp, staging area and other footprints shall be stockpiled separately within the same areas for use as mulch during rehabilitation.	Contractor	Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
			protected plants.					
08	Linear Infrastructure Crossings	Direct loss of terrestrial plants from construction activities on land, including clearing and grubbing.	Avoid the unnecessary loss of or harm to terrestrial plants, particularly SCC, e.g., endemic, threatened and/or protected plants.	Active rehabilitation	Conduct active rehabilitation during the construction activities according to a rehabilitation plan and/or implement the Bare Patch Restoration Protocol (Appendix C) that will restore the natural vegetation to what it was prior to construction so that the long-term impact could be negligible.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.
08	Linear Infrastructure Crossings	Direct loss of terrestrial plants from construction activities on land, including clearing and grubbing.	Avoid the unnecessary loss of or harm to terrestrial plants, particularly SCC, e.g., endemic, threatened and/or protected plants.	No-go areas are cordoned off	Cordon off areas under rehabilitation as "no-go areas" to prevent vehicular, pedestrian and livestock access.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

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

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Residual Risk (feeds back into "Mitigations"):

- None.

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Receiving Environment: Soil and Rock

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Employee Management	Abluting	Land contamination	**Impact:** Use of land/surrounding areas for ablutions could result in microbiological pollutants to soil. **Consequence:** loss of microorganisms in the soil (direct)	quality	09
Plant Management	Operating & Parking Plant	Causing spills	**Impact:** Spills from machinery can contaminate the topsoil. **Consequences:** - sterile habitat for fauna and flora (direct).	quality	09
Plant Management	Maintenance	Contamination	**Impact:** (1) Vehicles in poor condition are more prone to breakdowns and/or leaks (Risk). (2) Spills from vehicles undergoing maintenance can contaminate the topsoil. **Consequence:** - sterile habitat for fauna and flora (indirect).	Quality	09
Plant Management	Washing plant	Contamination	**Impact:** Hydrocarbons from washing plant can contaminate the ground. **Consequence:** Decrease in water/land quality due to washing plant.	quality	09
General and Hazardous Waste Management	Handling and Collection (incl. chemical toilets & concrete slurry)	Contamination	**Impact:** Use of land/surrounding areas for ablutions could result in microbiological pollutants to soil. Oil-water separators may overflow and contaminate the land. **Consequence:** loss of microorganisms in the soil (direct)	quality	09
General and Hazardous Waste Management	Reuse, Recycle	Health and safety	**Impact:** Hydrocarbon spills can contaminate topsoil. **Consequence:** Loss of a valuable resource.	Quality	09
General and Hazardous Waste Management	Storage	Contamination	**Impact:** storage of waste in an unbunded area could result in pollution to soil. **Consequence:** Loss of micro-organisms	quality	09

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General and Hazardous Waste Management	Disposal	Contamination	**Impact:** Contamination of soil with hydrocarbons. **Consequence:** - sterile habitat for fauna and flora.	quality	09
Handling Hazardous Substances	Fuel Storage	Contamination	**Impact:** contaminated rainwater may be released from the bund into the environment. **Consequence:** Pollution	quality	09
Handling Hazardous Substances	Refuelling	Causing spills	**Impact:** Spills from mobile fuel bowser can contaminate the topsoil. **Consequences:** - sterile habitat for fauna and flora (direct).	quality	09
Handling Hazardous Substances	Mixing concrete on site	Effluent (cement slurry) discharges and contamination	**Impacts:** Concrete slurry from the batching plant can contaminate the topsoil and form a hardpan layer: **Consequences:** sterile habitat for fauna and flora.	quality	09
Handling Hazardous Substances	Importing Ready Mix/ Concrete Batching Plant	Contamination, emitting	**Impact:** Cleaning residual ready-mixed concrete (RMC) from truck mixers can create hardpan layers. **Consequence:** Effectively sterilising patches of ground (and contaminate water resources).	quality	09
Clearing/Grubbing and Grading	Access Road, pipeline, construction camp & staging area	Removal of vegetation	**Impacts:** Trampling and hydrocarbon or other hazardous material spills can damage or contaminate the topsoil Insufficient topsoil in areas outside floodplains and drainage lines. **Consequence:** Degraded or dysfunctional terrestrial ecosystem and loss of agricultural potential. Poor recovery during rehabilitation.	quality	09
Water management (abstraction, storage and use)	Storage in tanks	Overflow and surface water run-off	**Impact:** Water storage tanks can topple over, leak or overflow. **Consequences:** - Overflowing water storage tanks may cause erosion or degradation of the receiving environment.	quantity	10

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Linear Infrastructure Crossings	Roads	Importing material/ Shaping/Diversion Works/Sedimentation /Erosion	**Impact:** Constructing roads and culverts in dispersive soils can cause erosion. **Consequence:** Construction of roads on dispersive soils is difficult due to their low bearing capacity when wet. Concentrating water in roadside culverts and drains which have been excavated into dispersive soils often leads to erosion and collapse of the road batter adjacent embankments. Any degradation of the soil-terrain complex that undermines its capacity to function - from storing water and recycling nutrients to resisting erosion - will lead to a decline in primary production and diminish energy flow to higher trophic levels. Primary production is an ecosystem supporting service that maintains other ecosystem services, so its harm can lead to ecosystem collapse.	quantity	10
Linear Infrastructure Crossings	Underground Pipelines	Importing material/ Trenching/Diversion Works/Sedimentation /Erosion	**Impact:** Supplying services via trenches in dispersive soils can cause tunnel erosion. **Consequence:** Trenches may be used to supply services such as water and electricity, however in dispersive soils, the increased porosity of repacked spoil within the trench can lead to tunnel erosion and damage to pipes and cables. Any degradation of the soil-terrain complex that undermines its capacity to function - from storing water and recycling nutrients to resisting erosion - will lead to a decline in primary production and diminish energy flow to higher trophic levels. Primary production is an ecosystem supporting service that maintains other ecosystem services, so its harm can lead to ecosystem collapse.	quantity	10
Stormwater Management and Erosion Control	NA	NA	**Impact:** There is a potential for erosion and sedimentation of the surroundings or ephemeral drainage lines from, e.g., excavations, if storm events take place and insufficient vegetation cover is present. **Consequence:** Loss of topsoil, disturbance to the vadose zone, and sedimentation of a watercourse.	quantity	10
Earthworks	Access Road, pipeline, construction camp & staging area	Creating bare surfaces susceptible to erosion, corrugations, potholes and puddles.	**Impact:** Areas cleared or disturbed around site might be affected by erosion of topsoil. **Consequence:** Increased turbidity and siltation in watercourses.	quantity	10

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Earthworks	Access Road, pipeline, construction camp & staging area	Creating bare surfaces susceptible to erosion, corrugations, potholes and puddles.	**Impact:** Constructing roads and culverts in dispersive soils can cause erosion. **Consequence:** Construction of roads on dispersive soils is difficult due to their low bearing capacity when wet. Concentrating water in roadside culverts and drains which have been excavated into dispersive soils often leads to erosion and collapse of the road batter adjacent embankments. Any degradation of the soil-terrain complex that undermines its capacity to function - from storing water and recycling nutrients to resisting erosion - will lead to a decline in primary production and diminish energy flow to higher trophic levels. Primary production is an ecosystem supporting service that maintains other ecosystem services, so its harm can lead to ecosystem collapse.	quantity	10
Earthworks	Excavations/Trenching	NA	**Impact:** Supplying services via trenches in dispersive soils can increase the porosity of repacked soils, and cause tunnel erosion. **Consequence:** Trenches may be used to supply services such as water and electricity, however in dispersive soils, the increased porosity of repacked spoil within the trench can lead to tunnel erosion and damage to pipes and cables. Any degradation of the soil-terrain complex that undermines its capacity to function - from storing water and recycling nutrients to resisting erosion - will lead to a decline in primary production and diminish energy flow to higher trophic levels. Primary production is an ecosystem supporting service that maintains other ecosystem services, so its harm can lead to ecosystem collapse.	quantity	10
Stockpiling and Storing (Laydown)	Mulch, topsoil, aggregate, spoil and infrastructure	Burying, smothering, impeding, sedimentation, emitting	**Impacts:** Erosion of stockpiles due to unforeseen circumstances (i.e., bad weather). **Consequences:** loss of soil	quantity	10
Water management (abstraction, storage and use)	Storage in tanks	Overflow and surface water run-off	**Impact:** Water storage tanks can topple over, leak or overflow. **Consequences:** - Overflowing water storage tanks may cause erosion or degradation of the receiving environment.	quantity	10

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

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

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Impact 09 (Soil contamination)

- During the rainy season terrain mobility on high clay soils in low lying areas with drainage lines will be difficult and might increase soil erosion when drainage lines are disturbed.
- The soil profile is generally thin, less than 1m within the area and the nature of the bedrock is consistent across the footprint.
- Electricity for the construction camp will be sourced from two (2) 50 kVA (minimum) mobile generators with an integrated diesel tank (fuel capacity ± 200 litres), e.g., one will be used as backup during service periods and allow the other to rest. The integrated diesel tanks will be supplied fuel from a bunded 5 to 10 m3 aboveground diesel tank. A filling station alongside the aboveground diesel tank and/or a mobile fuel bowser will supply plant on site for general use. The generators, aboveground fuel tank and filling station will be located at the construction camp.
- The concrete batching plant, which may or may not be in the construction camp, shall contain a washing facility for containing only the waste concrete slurry cleaned out of the discharge chute(s) and rotating mixing drums of concrete mixer trucks. This washing facility shall contain two adjacent wash bays to allow for continuous operations and minimise the risk of overflow or work stoppage when a bay has reached its capacity and must be emptied.

Impact 10 (Soil Quantity)

- The soil profile is generally thin, less than 1m within the area and the nature of the bedrock is consistent across the footprint.
- From a grassland ecological and soil erosion perspective, the opinion is that the current planned development (and the cumulative effect of 30km from other PV-projects), will not have a significant impact on the current veld condition and potential grazing potential.
- The proposed widening and sealing of the existing access road and new sections of the road (13.7 km in total), the construction of the two parallel 400 kV transmission lines (3,7 km) and the water pipelines (1 km) should have a very limited effect in the long term on soil erosion and rangeland potential.
- Groundwater from Borehole No. 13 will be stored in a typical overhead (OH) pressed steel tank made up of 1 m panels (circa 3 m wide x 4 m long and 3 m high), providing storage of ± 36 m3, will be installed at the point of abstraction inside the Cluster 1 footprint. The tank will be off the ground on column supports to allow gravity filling into water bowsers. The groundwater abstracted from BH13 (or BH14) will be treated with a deionisation (or other suitable) treatment plant if it is going to be used for domestic use and/or cleaning solar panels.
  Groundwater from Solar Borehole No. 4 and No. 5 will be stored in a ± 5 m3 JOJO tank.
- One additional tank (up to 10 m3) will be installed at the construction camp to supply domestic water to the offices and staff.
- No supporting infrastructure has been explicitly provided for Solar Borehole 4, but we have included this into the GA & IWULA
- Erosion and sedimentation are only likely to take place during severe storm events (e.g., 1:2 to 1:100y events). Incidental rainfall will likely not cause sedimentation.

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

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
10	H	M	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

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

- Geotechnical Investigation Report for Sun Central PV project near De Aar, Northern Cape Province – BRC/RP/31/2022 prepared by Bare Rock Consulting (Pty) Ltd dated December 2022.

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- Solar-Africa Energy project in the Hanover District, Northern Cape (De Aar/Hanover area) agro-ecosystem specialist assessment for: Upgrading & development of an access road from the N10/'Burgerville' District Road (2448) turn-off into the Farm Riet Fountain No. 39C and to the switching station and main transmission substation on Sun Central Cluster 1 (300 MW) solar PV facility between De Aar & Hanover, Emthanjeni Local Municipality, Pixley Ka Seme District Municipality, Northern Cape province, South Africa prepared by D. V. F. Arnoldi, H. M. van den Berg and F. Botha dated 20 January 2023.
- Hardie M. (2009), "Dispersive Soils and their Management, Technical Reference Manual." Department of Primary Industries and Water, State of Tasmania, Australia (ISBN 978-0-7246-6774-1).
- Environmental Impact Assessment for the proposed Soventix Solar Pv Project, De Aar, Northern Cape: Fauna & Flora Specialist EIA Report prepared by Simon Todd Consulting dated May 2017.

Mitigations:

Impact Management Outcome(s):

- Avoid contamination of soil
- Responsible storage of effluent for re-use or disposal.
- Responsible storage of hazardous waste
- Minimize loss of topsoil
- Preserve topsoil
- Avoid erosion from water storage tanks.
- Minimise the risk of tunnel erosion in dispersive soils.

Targets:

- No use of the natural areas as ablutions
- No leaking equipment on site
- No overnight parking within 100m of watercourses
- Enough drip trays and drip trays are not overflowing

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- Spill response kits and Waybills
- No servicing/repair of construction plant on site and avoid emergency repairs within 100m of a watercourse
- Emergency protocol
- No contamination of terrestrial or aquatic ecosystems (with effluent).
- Inspection of oil separators. Contaminated soil is treated on site.
- Waste storage of contaminated soil is intact and away from the watercourse
- Designated waste storage area
- Waste storage area is well managed
- Fuel tank is bunded to 110% and roofed
- Mobile fuel bowser parked on bunded area (capacity of 110%) and roofed
- Refuelling station is bunded
- Contaminated soil is removed and stored correctly
- No observed hard pan layers of concrete.
- No residual RMC dumped on site
- Residual RMC stored in a temporary waste storage facility at the workshop area
- Compliance with conditions of the GA for S21(g) in GN 665 of 06 September 2013
- Waste temporarily stored has been removed (by recycling/re-use)
- Residual water is re-used
- Washing the waste concrete slurry from the discharge chute(s) and rotating mixing drums of concrete mixer trucks
- Inspection
- Topsoil stockpiled separately from cleared and excavated areas.

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- No unnecessary removal of vegetation and soil
- Active rehabilitation and revegetation
- Construction during dry months
- Minimise vegetation removal
- Sandbags and berms
- No exposed soils and Covered stockpiles
- Water storage tanks are fastened to the platform or stand.Water pipes are visibly secured.
- Design includes an overflow pipe to a soakaway.
- No signs of erosion around water storage tanks.
- Implementation of 'Roads & Culverts in Dispersive Soils Protocol' (Appendix B2) and 'Trenching in Dispersive Soils Protocol' (Appendix B1).

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
09	Employee Management	Use of land/surrounding areas for ablutions could result in microbiological pollutants to soil.	Avoid contamination of soil	No use of the natural areas as ablutions	Washing and going to the toilet in the wilderness is strictly forbidden	Contractor, SEO	Continuous	Compliance to be verified by ECO and IEA.
09	Plant Management	Spills from machinery can contaminate the topsoil.	Avoid contamination of soil	No leaking equipment on site	Any construction plant, machinery, and equipment which leaks shall not be permitted on site. Undertake visual inspections for any leakages that may	Contractor	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					emanate from any vehicle accessing the site - all vehicles must be in good working order when entering the site.			
09	Plant Management	Spills from machinery can contaminate the topsoil.	Avoid contamination of soil	No overnight parking within 100m of watercourses	No overnight parking of plant (e.g., outside business hours) is permitted within 100 m of the edge of any wetlands or watercourses.	Contractor, SEO	Continuous	Compliance to be verified by ECO and IEA.
09	Plant Management	Spills from machinery can contaminate the topsoil.	Avoid contamination of soil	Drip trays	Drip trays must be placed under all stationary construction plant and equipment that can leak, such as, for example, TLBs, compressors and generators. The volume (litres) of drip trays must be sized according to their application and should be sufficient to hold 110% of the capacity of the reservoir holding the contaminant, e.g., a 100 cm (L) x 100 cm (W) x 10 cm (D) will hold 100 litres. A plastic liner that is at least twice the length and width of the drip tray shall be placed underneath it to the extent that the liner fits comfortably underneath the tray holding the containment.	Contractor	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
09	Plant Management	Spills from machinery can contaminate the topsoil.	Avoid contamination of soil	Drip trays are not overflowing	Drip trays must be inspected regularly and emptied into containers designated for the temporary storage of hazardous waste. Hydrophobic hydrocarbon absorbent material is recommended to avoid contaminated rainwater from overflowing during rainfall events.	Contractor, SEO	Continuous	Compliance to be verified by ECO and IEA.
09	Plant Management	Spills from machinery can contaminate the topsoil.	Avoid contamination of soil	Enough drip trays	Enough drip trays must be available for all construction plant.	Contractor	Continuous	Compliance to be verified by ECO and IEA.
09	Plant Management	Spills from machinery can contaminate the topsoil.	Avoid contamination of soil	Spill response kits	Provide accidental spill response kits at the construction camp and each work front with plant on site.	Contractor	Continuous	Compliance to be verified by ECO and IEA.
09	Plant Management	Spills from machinery can contaminate the topsoil.	Avoid contamination of soil	Waybills	In the event of a spill, immediately remove the contaminated soil to the depth of penetration and temporarily store in a sealed container within the designated waste storage area for on-site bioremediation or disposal at a licensed hazardous waste landfill.	Contractor, SEO	Continuous	Compliance to be verified by ECO and IEA.
09	Plant Management	Vehicles in poor condition are more prone to	Avoid contamination of soil	No servicing/repair	No maintenance/service/repair of construction plant is	Contractor, SEO	Continuous	Compliance to be verified by

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		breakdowns and/or leaks (Risk). Spills from vehicles undergoing maintenance can contaminate the topsoil.		of construction plant on site.	permitted on the construction site (except emergency repairs) or on land outside of the Sun Central Cluster 1 footprint.			ECO and IEA.
09	Plant Management	Vehicles in poor condition are more prone to breakdowns and/or leaks (Risk). Spills from vehicles undergoing maintenance can contaminate the topsoil.	Avoid contamination of soil	Avoid emergency repairs within 100m of a watercourse	As far as practical no emergency maintenance/service/repair is permitted within 100 m of the edge of any wetlands or watercourses.	Contractor, SEO	Continuous	Compliance to be verified by ECO and IEA.
09	Plant Management	Vehicles in poor condition are more prone to breakdowns and/or leaks (Risk). Spills from vehicles undergoing maintenance	Avoid contamination of soil	Emergency protocol	An emergency protocol must be developed that deals with accidents and spills. This must include methods for absorbing chemical spills, as well as the transport and on-site bioremediation or disposal of all contaminated material at a licensed hazardous waste site.	Contractor	Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		can contaminate the topsoil.						
09	Plant Management	Vehicles in poor condition are more prone to breakdowns and/or leaks (Risk). Spills from vehicles undergoing maintenance can contaminate the topsoil.	Avoid contamination of soil	Drip trays with plastic liners and spill kits	Emergency breakdowns must be addressed with immediate and adequate pollution containment measures including but not limited to drip trays with plastic liners and spill kits.	Contractor	Continuous	Compliance to be verified by ECO and IEA.
09	Plant Management	Hydrocarbons from washing plant can contaminate the ground.	Responsible storage of effluent for re-use or disposal.	No contamination of terrestrial or aquatic ecosystems (with effluent).	No washing of plant is permitted on the construction site, within 100 m of the edge of any wetlands or other watercourses, and on land outside of the Sun Central Cluster 1 footprint.	Contractor	Continuous	Compliance to be verified by ECO and IEA.
09	General and Hazardous waste Management	Use of land/surrounding areas for ablutions could result in microbiological pollutants to soil. Oil-water separators may overflow and contaminate the land.	Responsible storage of hazardous waste	Inspection of oil separators	Oil-water separators must be inspected regularly and emptied into containers designated for the temporary storage of hazardous waste, unless the clean water from the oil-water separator at the wash bay can be re-used for washing plant.	Contractor	Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
09	General and Hazardous Waste Management	Hydrocarbon spills can contaminate topsoil.	Avoid contamination of soil through proper waste management	Contaminated soil is treated on site	Soil contaminated with hydrocarbons should as far as is possible be treated on site by bioremediation so that it can be reused for rehabilitation.	Contractor	Construction	Compliance to be verified by ECO and IEA
09	General and Hazardous Waste Management	Hydrocarbon spills can contaminate topsoil.	Avoid contamination of soil through proper waste management	Waste storage of contaminated soil is intact and away from the watercourse	The storage and bioremediation of contaminated soil should take place in intact, impervious, not corroded receptacles within the designated waste storage area of the construction camp at least 100 m away from the outer edge of the ecological buffer.	Contractor	Construction	Compliance to be verified by ECO and IEA
09	General and Hazardous Waste Management	Hydrocarbon spills can contaminate topsoil.	Avoid contamination of soil through proper waste management	Storage complies with the conditions of the GA for S21(g) in GN 665 of 06 September 2013	The temporary storage of contaminated/treated soil for re-use (or rehabilitation) must comply with the limits and conditions of the GA for S21(g) in GN 665 of 06 September 2013, particularly those provisions relating to the location of the waste storage receptacle and incidence reporting.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA
09	General and Hazardous Waste Management	storage of waste in an unbunded area could result in pollution to soil.	Avoid contamination of soil through proper waste management	Designated waste storage area	Designate and contain a temporary waste storage area within the construction camp (e.g.,	Contractor	Construction	Compliance to be verified by ECO and IEA

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					covered skips, scavenger proof bins, etc.).			
09	General and Hazardous Waste Management	storage of waste in an unbunded area could result in pollution to soil.	Avoid contamination of soil through proper waste management	Waste containers are in good condition.	Take steps to ensure that the containers where waste is stored are intact and not corroded and are fit for the storage of waste.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA
09	General and Hazardous Waste Management	storage of waste in an unbunded area could result in pollution to soil.	Avoid contamination of soil through proper waste management	Waste storage area is well managed	Adequate measures must be taken to prevent: • Accidental spillage or leaking. • Waste from blowing away. • Nuisances such as foul odour; visual impact and breeding of vectors. • The pollution of the environment and harm to health.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA
09	General and Hazardous Waste Management	Contamination of soil with hydrocarbons.	Avoid contamination of soil from servicing	Waybill(s) from registered collector.	Any waste oil shall be collected by a registered collector for recycling and reuse or appropriate disposal.	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA
09	Handling Hazardous Substances	Contaminated rainwater may be released from the bund into the environment.	Avoid contamination of soil	Fuel tank is bunded to 110% and roofed	The above ground fuel storage tank must be located on an impervious bund capable of containing 110% of the volume of the fuel storage tank. The fuel tank and bund shall be roofed to prevent ingress of rain. (2) A mobile fuel bowser must be parked (when not being used) on an	Contractor	Construction	Compliance to be verified by ECO and IEA

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					impervious bund capable of containing 110% of the volume of the fuel bowser. The bund for parking the bowser shall be roofed to prevent ingress of rain and include a stormwater diversion system to prevent the ingress of surface water run-off (e.g., a 'speed bump' at the entrance to the bunded bay).			
09	Handling Hazardous Substances	Contaminated rainwater may be released from the bund into the environment.	Avoid contamination of soil	Mobile fuel bowser parked on bunded area (capacity of 110%) and roofed	A mobile fuel bowser must be parked (when not being used) on an impervious bund capable of containing 110% of the volume of the fuel bowser. The bund for parking the bowser shall be roofed to prevent ingress of rain and include a stormwater diversion system to prevent the ingress of surface water run-off (e.g., a 'speed bump' at the entrance to the bunded bay).	Contractor	Construction	Compliance to be verified by ECO and IEA
09	Handling Hazardous Substances	Spills from mobile fuel bowser can contaminate the topsoil.	Avoid contamination of soil	Refuelling station is bunded	The refuelling station alongside the aboveground diesel tank shall be bunded, include a stormwater diversion system to prevent the ingress of surface water run-off (e.g., a 'speed	Contractor	Construction	Compliance to be verified by ECO and IEA

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					bump' at the entrance and exit) and designed with an oil-water separator to remove hydrocarbons (oil, grease, fuel, hydraulic fluid, etc.). If practical, the refuelling station should be roofed to prevent ingress of rain.			
09	Handling Hazardous Substances	Spills from mobile fuel bowser can contaminate the topsoil.	Avoid contamination of soil	Spill kit	An emergency response spill kit must be available at the refuelling station.	Contractor	Construction	Compliance to be verified by ECO and IEA
09	Handling Hazardous Substances	Spills from mobile fuel bowser can contaminate the topsoil.	Avoid contamination of soil	Drip tray	Always use a drip tray when refuelling with a mobile fuel bowser.	Contractor	Construction	Compliance to be verified by ECO and IEA
09	Handling Hazardous Substances	Spills from mobile fuel bowser can contaminate the topsoil.	Avoid contamination of soil	Contaminated soil is removed and stored correctly	In event of a spill, immediately remove the contaminated soil to the depth of penetration and temporarily store in a sealed container within the designated waste storage area for on-site bio-remediation or disposal at a licensed hazardous waste landfill.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA
09	Handling of hazardous substances	Concrete slurry from the batching plant can contaminate the topsoil and	Avoid contamination of soil from concrete	No observed hard pan layers of concrete.	Mix concrete on a mixing tray and not on open ground.	Contractor	Construction	Compliance to be verified by ECO and IEA

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		form a hardpan layer						
09	Handling of hazardous substances	Cleaning residual ready-mixed concrete (RMC) from truck mixers can create hardpan layers.	Avoid contamination of soil from concrete	No residual RMC dumped on site	Mixer trucks should return any residual RMC to their batching plant after the delivery.	Contractor	Construction	Compliance to be verified by ECO and IEA
09	Handling of hazardous substances	Cleaning residual ready-mixed concrete (RMC) from truck mixers can create hardpan layers.	Avoid contamination of soil from concrete	Residual RMC stored in a temporary waste storage facility at the workshop area	If it is not possible for mixer trucks to return the residual RMC to their batching plant after the delivery, then the residual RMC within the truck mixers shall be disposed in a temporary waste storage facility designated for this purpose at the construction camp. Temporary storage means a once off storage of waste for a period not exceeding 90 days.	Contractor	Construction	Compliance to be verified by ECO and IEA
09	Handling of hazardous substances	Cleaning residual ready-mixed concrete (RMC) from truck mixers can create hardpan layers.	Avoid contamination of soil from concrete	A designated and contained, impervious waste storage area	Designated RMC waste storage facilities shall be covered and contained, that is impervious, and shall not detrimentally impact on a water resource (surface and groundwater).	Contractor	Construction	Compliance to be verified by ECO and IEA
09	Handling of hazardous substances	Cleaning residual ready-mixed concrete (RMC) from	Avoid contamination of soil from concrete	Compliance with conditions of the GA for S21(g) in GN	The temporary storage of residual RMC for re-use (or disposal) must comply with the limits and	Contractor	Construction	Compliance to be verified by

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		truck mixers can create hardpan layers.		665 of 06 September 2013	conditions of the GA for S21(g) in GN 665 of 06 September 2013, particularly those provisions relating to the location of the wastewater storage facility and incidence reporting.			ECO and IEA
09	Handling of hazardous substances	Cleaning residual ready-mixed concrete (RMC) from truck mixers can create hardpan layers.	Avoid contamination of soil from concrete	Waste temporarily stored has been removed (by recycling/re-use)	Temporarily stored waste shall be re-used, recycled, and/or disposed of within a period not exceeding 90 days.	Contractor	Construction	Compliance to be verified by ECO and IEA
09	Handling of hazardous substances	Cleaning residual ready-mixed concrete (RMC) from truck mixers can create hardpan layers.	Avoid contamination of soil from concrete	Residual water is re-used	Any residual water in the RMC waste can be re-used, where possible by replacing domestic water for making new mortar or concrete.	Contractor	Construction	Compliance to be verified by ECO and IEA
09	Handling of hazardous substances	Cleaning residual ready-mixed concrete (RMC) from truck mixers can create hardpan layers.	Avoid contamination of soil from concrete	Hardened cement has been removed (by recycling/re-use)	Once hardened, solid waste arising from the concrete mixer truck washing can also be recycled or reused as fill material and/or disposed at the De Aar licensed landfill site.	Contractor	Construction	Compliance to be verified by ECO and IEA
09	Handling of hazardous substances	Cleaning residual ready-mixed concrete (RMC) from truck mixers can	Avoid contamination of soil from concrete	Washing the waste concrete slurry from the discharge chute(s) and rotating mixing	The washing facility at the concrete batching plant shall only be used for washing the waste concrete slurry from the discharge chute(s) and	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		create hardpan layers.		drums of concrete mixer trucks	rotating mixing drums of concrete mixer trucks.			
09	Handling of hazardous substances	Cleaning residual ready-mixed concrete (RMC) from truck mixers can create hardpan layers.	Avoid contamination of soil from concrete	Re-use concrete slurry	Concrete slurry from concrete mixing operations should as far as is possible be reused for mixing future batches of concrete.	Contractor	Construction	Compliance to be verified by ECO and IEA
09	Clearing/grubbing and grading	Trampling and hydrocarbon or other hazardous material spills can damage or contaminate the topsoil Insufficient topsoil in areas outside floodplains and drainage lines	Preserve topsoil.	Topsoil stockpiled separately from cleared and excavated areas.	Wherever excavation is necessary, topsoil should be removed (to a depth of 100 mm), set aside and replaced after construction to encourage natural regeneration of the local indigenous species.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA
09	Clearing/grubbing and grading	Trampling and hydrocarbon or other hazardous material spills can damage or contaminate the topsoil Insufficient topsoil in areas outside floodplains and drainage lines	Preserve topsoil.	Topsoil stockpiled separately from cleared and excavated areas.	Topsoil must be removed from the new road sections, passing lanes, pipeline trench, construction camp and staging area and stockpiled separately within the same areas to be reinstated during rehabilitation of the site	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
09	Clearing/grubbing and grading	Trampling and hydrocarbon or other hazardous material spills can damage or contaminate the topsoil Insufficient topsoil in areas outside floodplains and drainage lines	Preserve topsoil.	Topsoil stockpiled separately from cleared and excavated areas.	Topsoil should be stored in berms not wider than 2 m or higher than 1 m.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA
10	Earthworks	Areas cleared or disturbed around site might be affected by erosion of topsoil.	Minimize loss of topsoil	No unnecessary removal of vegetation and soil	Vegetation and soil should be retained in position for as long as possible, and should only be removed immediately ahead of construction / earthworks in any specific area so that cleared areas are not unnecessarily exposed to erosion for extended periods prior to working in those areas.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA
10	Earthworks	Areas cleared or disturbed around site might be affected by erosion of topsoil.	Minimize loss of topsoil	No unnecessary removal of vegetation and soil	Vegetation clearance must be restricted to the physical footprints of the construction camp, staging area, permanent and temporary roads within the road servitude, and the pipeline corridors only.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA
10	Earthworks	Areas cleared or disturbed around site might be	Minimize loss of topsoil	Active rehabilitation and revegetation	In areas where construction activities have been completed and no further disturbance is	Contractor, SEO, ECO	Construction	Compliance to be verified by

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		affected by erosion of topsoil.			anticipated, rehabilitation and re-vegetation should commence as soon as possible.			ECO and IEA
10	Earthworks	Areas cleared or disturbed around site might be affected by erosion of topsoil.	Minimize loss of topsoil	Repair erosion	Any erosion channels developing during or after the construction period should be appropriately backfilled (and compacted where relevant) and the areas restored to a condition similar to the condition before the erosion occurred.	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA
10	Stormwater Management and Erosion Control	There is a potential for erosion and sedimentation of the surroundings or ephemeral drainage lines from, e.g., excavations, if storm events take place and insufficient vegetation cover is present.	Preserve topsoil	Construction during dry months	Construction should to the extent possible be restricted to the dry winter months (e.g., May to September), that is commence with such activities as clearing or grading, excavating and importing material at the end of the wet season/beginning of the dry season whilst the soil is still moist to reduce dust and as far as is practical, be completed in, the dry winter months with a decreased probability of storm events.	Contractor	Construction during dry winter months	Compliance to be verified by ECO and IEA
10	Stormwater Management and Erosion Control	There is a potential for erosion and sedimentation of	Preserve topsoil	Minimise vegetation removal	All development footprint areas must remain as small as possible and	Contractor, SEO, ECO	Construction	Compliance to be verified by

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		the surroundings or ephemeral drainage lines from, e.g., excavations, if storm events take place and insufficient vegetation cover is present.			vegetation clearing to be limited to what is essential.			ECO and IEA
10	Stormwater Management and Erosion Control	There is a potential for erosion and sedimentation of the surroundings or ephemeral drainage lines from, e.g., excavations, if storm events take place and insufficient vegetation cover is present.	Preserve topsoil	No bare patches	Retain as much indigenous vegetation as possible and re-vegetate cleared or eroded areas to reduce stormwater peak flows.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA
10	Stormwater Management and Erosion Control	There is a potential for erosion and sedimentation of the surroundings or ephemeral drainage lines from, e.g., excavations, if storm events	Preserve topsoil	Sandbags and berms	It is recommended that sandbags and temporary berms be used, to manage stormwater runoff and control erosion.	Contractor	Construction	Compliance to be verified by ECO and IEA

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		take place and insufficient vegetation cover is present.						
10	Stormwater Management and Erosion Control	There is a potential for erosion and sedimentation of the surroundings or ephemeral drainage lines from, e.g., excavations, if storm events take place and insufficient vegetation cover is present.	Preserve topsoil	No exposed soils	Exposed soils to be protected using a suitable covering, e.g., mulch.	Contractor	Construction	Compliance to be verified by ECO and IEA
10	Stormwater Management and Erosion Control and Stockpiling and Storing (Laydown)	There is a potential for erosion and sedimentation of the surroundings or ephemeral drainage lines from, e.g., excavations, if storm events take place and insufficient vegetation cover is present.	Preserve topsoil	Covered stockpiles	Where required, cover soil stockpiles with a temporary liner or sandbag berms to prevent erosion and contamination.	Contractor	Construction	Compliance to be verified by ECO and IEA

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
10	Water management (abstraction, storage and use)	Water storage tanks can topple over, leak or overflow.	Avoid erosion from water storage tanks.	Water storage tanks are on a solid foundation, platform or stand.	Place water tanks on solid foundations, platforms or stands to ensure that they are level, will not fall over and are above the ground in order to build up the necessary water pressure for the outlet.	Contractor	Construction	Compliance to be verified by ECO and IEA.
10	Water management (abstraction, storage and use)	Water storage tanks can topple over, leak or overflow.	Avoid erosion from water storage tanks.	Water storage tanks are fastened to the platform or stand.	The platform or stand for water storage tanks must be level and must have hooks onto which the tank can be anchored or fastened.	Contractor	Construction	Compliance to be verified by ECO and IEA.
10	Water management (abstraction, storage and use)	Water storage tanks can topple over, leak or overflow.	Avoid erosion from water storage tanks.	Water pipes are visibly secured.	The pipes leading to and from the water storage tanks should also be anchored to prevent them from breaking, cracking and leaking.	Contractor	Construction	Compliance to be verified by ECO and IEA.
10	Water management (abstraction, storage and use)	Water storage tanks can topple over, leak or overflow.	Avoid erosion from water storage tanks.	Design includes an overflow pipe to a soakaway.	Each water storage tank or series of water storage tanks should have an overflow pipe to prevent water being forced out of the inlet when the tank is full. The overflow pipe should be diverted to a soakaway.	Contractor	Construction	Compliance to be verified by ECO and IEA.
10	Water management (abstraction, storage and use)	Water storage tanks can topple over, leak or overflow.	Avoid erosion from water storage tanks.	No signs of erosion around water storage tanks.	If water storage tanks are placed on a raised platform or stand, then a layer of gravel should be placed around and/or under the platform or stand	Contractor	Construction	Compliance to be verified by ECO and IEA.

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					to ensure good drainage and to prevent forming mud and puddles.			
10	Linear Infrastructure Crossings and Earthworks	Constructing roads and culverts in dispersive soils can cause erosion.	Minimise the risk of erosion on dispersive soils	Implementation of 'Roads & Culverts in Dispersive Soils Protocol' (Appendix B2).	If roads and culverts are to be constructed in potentially dispersive soils (e.g., bare patches) then implement the 'Roads & Culverts in Dispersive Soils Protocol' (Appendix B2).	Contractor	Construction	Compliance to be verified by ECO and IEA.
10	Linear Infrastructure Crossings and Earthworks	Supplying services via trenches in dispersive soils can cause tunnel erosion.	Minimise the risk of tunnel erosion in dispersive soils.	Implementation of 'Trenching in Dispersive Soils Protocol' (Appendix B1).	If trenching is to be undertaken in potentially dispersive soils (e.g., bare patches) then implement the 'Trenching in Dispersive Soils Protocol' (Appendix B1).	Contractor	Construction	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

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

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"):

- None.

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Receiving Environment: Ground and Surface Water

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Water management (abstraction, storage and use)	Treatment	NA	**Impact:** Hard water is aesthetically unpleasant for domestic use and can result in scaling in piping exposed to heat, or in utensils used to boil water. **Consequences:** Scaling of pipes. Increase costs in replacing piping.	quality	11
Water management (abstraction, storage and use)	Dust suppression	Surface water run-off	**Impact:** Dust suppression with chemical additives or treated effluent may contaminate a watercourse. **Consequence:** Pollution	quality	11
General and Hazardous Waste Management	Wastewater Treatment Plant/ Disposal of domestic wastewater	Contamination	**Impact:** Dust suppression with chemical additives or treated effluent may contaminate a watercourse. **Consequence:** Pollution	quality	11
General and Hazardous Waste Management	Handling and Collection (incl. chemical toilets & concrete slurry)	Contamination	**Impact:** Unsafe disposal, 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. Health risks	quality	11
General and Hazardous Waste Management	Reuse, Recycle	Health and safety	**Impact:** Waste, such as concrete slurry, can contaminate surface water run-off. **Consequence:** Contamination of terrestrial and aquatic ecosystems.	quality	11
General and Hazardous Waste Management	Storage	Contamination	**Impact:** Concrete slurry can contaminate surface water run-off. **Consequence:** Contamination of terrestrial and aquatic ecosystems.	quality	11

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Handling Hazardous Substances	Mixing concrete on site	Effluent (cement slurry) discharges and contamination	**Impact:** Potential pollution due to effluent from infrastructure, including concrete slurry from mixing operations **Consequence:** Seepage from development areas will influence wetlands adversely: the composition and structure of the drainage vegetation (more nutrients and increased ground water seepage) and the quality of the water will deteriorate (dissolved nutrients).	quality	11
Linear Infrastructure Crossings	Roads	Grading existing & new roads/Removal of Vegetation /Sedimentation	**Impacts:** Installation of road culverts may cause temporary sedimentation after storm events. **Consequences:** Sedimentation of watercourses.	quality	11
Linear Infrastructure Crossings	Underground Pipelines	Clearing & Grubbing/Removal of Vegetation/Sedimentation	**Impacts:** Installation of underground pipelines may cause temporary sedimentation after storm events. **Consequences:** Sedimentation of watercourses.	quality	11
Linear Infrastructure Crossings	Roads	Grading existing & new roads/Removal of Vegetation /Sedimentation	**Impact:** Erosion and sedimentation **Consequence:** Loss of topsoil, decrease in water quality.	behaviour	12
Linear Infrastructure Crossings	Roads	Grading existing & new roads/Removal of Vegetation /Sedimentation	**Impact:** Two ephemeral drainage line crossings, associated with the proposed road development can be considered critical stormwater management areas, where there will be an activity that could alter the natural conditions of the rivers/streams, which could lead to sedimentation and erosion if storm events occur during the construction phase. **Consequence:** Alteration of natural drainage lines may lead to ponding or increased runoff patterns (i.e., may cause stagnant water levels or increase erosion).	behaviour	12

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Linear Infrastructure Crossings	Roads	Importing material/ Shaping/Diversion Works/Sedimentation /Erosion	**Impact:** Construction of linear infrastructure across the ephemeral drainage system may involve temporary diversion works, changing the surface water hydrology or flow patterns. **Consequence:** - Altered flow patterns can slow down the stream flow, causing deposition of sediment or increase the velocity and turbulence of the water, causing erosion (direct).	behaviour	12
Linear Infrastructure Crossings	Roads	Importing material/ Shaping/Diversion Works/Sedimentation /Erosion	**Impact:** Construction of linear infrastructure across the dolerite ridge, ephemeral drainage system or wetlands will reshape the ridge, bed and banks of the drainage line or wetland. **Consequence:** -The excavation, removal or moving of sand could change the surface water flow patterns of ridge, drainage line or wetland.	behaviour	12
Linear Infrastructure Crossings	Underground Pipelines	Clearing & Grubbing/Removal of Vegetation/Sedimentation	**Impact:** Alter surface water hydrology. **Consequence:** Erosion and sedimentation of watercourses can lead to dysfunctional aquatic ecosystems.	behaviour	12
Linear Infrastructure Crossings	Underground Pipelines	Clearing & Grubbing/Removal of Vegetation/Sedimentation	**Impact:** Two ephemeral drainage line crossings, associated with the proposed road development can be considered critical stormwater management areas, where there will be an activity that could alter the natural conditions of the rivers/streams, which could lead to sedimentation and erosion if storm events occur during the construction phase. **Consequence:** Alteration of natural drainage lines may lead to ponding or increased runoff patterns (i.e., may cause stagnant water levels or increase erosion).	behaviour	12

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Linear Infrastructure Crossings	Underground Pipelines	Importing material/ Trenching/Diversion Works/Sedimentation /Erosion	**Impact:** Construction of linear infrastructure across the ephemeral drainage system and wetlands 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	12
Linear Infrastructure Crossings	Underground Pipelines	Importing material/ Trenching/Diversion Works/Sedimentation /Erosion	**Impact:** Construction of linear infrastructure across the dolerite ridge, ephemeral drainage system or wetlands will reshape the ridge, bed and banks of the drainage line or wetland. **Consequence:** -The excavation, removal or moving of sand could change the surface water flow patterns of ridge, drainage line or wetland.	behaviour	12
Linear Infrastructure Crossings	Underground Pipelines	Importing material/ Trenching/Diversion Works/Sedimentation /Erosion	**Impact:** Mixed soil horizons **Consequence:** Disruption to the vadose zone can disrupt groundwater recharge.	behaviour	12
Linear Infrastructure Crossings	Underground Pipelines	Importing material/ Trenching/Diversion Works/Sedimentation /Erosion	**Impact:** Construction activities may alter the physical characteristics of the terrain, and surface water hydrology **Consequence:** Altered surface stormwater run-off patterns, e.g., from sheet flow to channelled flow, can cause erosion (direct).	behaviour	12
Earthworks	Access Road, pipeline, construction camp & staging area	Creating bare surfaces susceptible to erosion, corrugations, potholes and puddles.	**Impact:** Construction activities may alter the physical characteristics of the terrain. **Consequence:** - Altered surface stormwater run-off patterns , e.g., changing sheet flow (natural open system) to concentrated or channelled flows leads to erosion. (direct). Increased suspended solids, siltation in watercourses and loss of topsoil.	Behaviour	12
Earthworks	Excavations/Trenching	NA	**Impact:** Mixed soil horizons **Consequence:** Disruption to the vadose zone can disrupt groundwater recharge.	behaviour	12

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Earthworks	Excavations/Trenching	NA	**Impact:** Disturbing vadose zone during excavations activities, contractor laydown areas. Excavations may subject the surroundings to temporary sedimentation during storm events. There is a potential for some erosion if there are storm events. **Consequence:** Erosion, loss of topsoil.	behaviour	12
Stockpiling and Storing (Laydown)	Mulch, topsoil, aggregate, spoil and infrastructure	Burying, smothering, impeding, sedimentation, emitting	**Impact:** Construction activities may alter the physical characteristics of the terrain. **Consequence:** Altered surface stormwater run-off patterns, e.g., from sheet flow to channelled flow, can cause erosion (direct).	Behaviour	12
Water management (abstraction, storage and use)	Monitoring	NA	**Impact:** Over-production from a series of boreholes that are drilled in the same contact, and close to each other (<500 m), may lead to fracture failures as the fractures are simultaneously dewatered. **Consequence:** Fracture failures can lead to borehole collapse, impacting other water users. Less water in the underground aquifer means less water for other water users, including for reasonable domestic use and livestock watering (direct).	quantity	13
Water management (abstraction, storage and use)	Pumping from a borehole	Use of natural resources	**Impact:** Natural Resource depletion (groundwater reserve) - Construction will require the abstraction of water from boreholes for road stabilisation, dust suppression, mixing concrete and potable usage. Uncontrolled abstraction can lead to over pumping boreholes, reduced borehole life, pump failure and depletion of the underground aquifer. **Consequence:** -Depletion of groundwater reserve. Less water in the underground aquifer means less water for other water users, including for reasonable domestic use and livestock watering (direct).	quantity	13

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Water management (abstraction, storage and use)	Pumping from a borehole	Use of natural resources	**Impact:** Over-production from a series of boreholes that are drilled in the same contact, and close to each other (<500 m), may lead to fracture failures as the fractures are simultaneously dewatered. **Consequence:** Fracture failures can lead to borehole collapse, impacting other water users.	behaviour	13
Water management (abstraction, storage and use)	Storage in tanks	Overflow and surface water run-off	**Impact:** Uncontrolled abstraction can lead to over pumping boreholes, reduced borehole life, pump failure and depletion of the underground aquifer. **Consequences:** Over pumping boreholes, reduced borehole life, pump failure and depletion of the underground aquifer.	quantity	13
Water management (abstraction, storage and use)	Dust suppression	Use of natural resources	**Impact:** Natural Resource depletion - Construction will require the abstraction of water from boreholes for dust suppression, mixing concrete and potable usage. Dust suppression using only water is a wasteful use (decrease) of a limited resource. **Consequence:** Inefficient use of water means less water for other users, including for reasonable domestic use and livestock watering, and the ecological reserve.	quantity	13
Alien Plant Management	Disturbance to natural areas	Favourable conditions for alien plant/animal recruitment.	**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:** - threat to local and national water security (indirect). - reduced productivity and carrying capacity (indirect). - reduced capacity to produce ecosystem goods and services (indirect).	quantity	13

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Linear Infrastructure Crossings	Roads	Importing material/ Shaping/Diversion Works/Sedimentation /Erosion	**Impact:** Removal of vegetation and disturbing topsoil by laying underground pipelines at watercourse crossings. **Consequence:** Increased erosion and siltation of watercourse.	quantity	13
Linear Infrastructure Crossings	Underground Pipelines	Importing material/ Trenching/Diversion Works/Sedimentation /Erosion	**Impact:** Removal of vegetation and disturbing topsoil by laying underground pipelines at watercourse crossings. **Consequence:** Increased erosion and siltation of watercourse.	quantity	13

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

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

Impact 11 (Water Quality)

- Ephemeral rivers are particularly vulnerable to changes in hydrology, as they are specifically adapted to brief periods of inundation and flow. Consequently, pollutants and sediments entering these watercourses are not regularly diluted or flushed out of the catchment, leading to a lack of resilience to pollution, erosion, and sedimentation (Aquatic Biodiversity Impact Assessment, January 2023).
- 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. 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).
- According to the DWAF 1996 Target Water Quality Range (TWQR) for potable use, the groundwater from BH13 is suitable for domestic use, having a pH of 6.9. Only the EC of 75.5 mS/m and dissolved Calcium of 89 mg Ca/l exceed the DWAF TWQR (0 – 70 mS/m and 0 – 32 mg Ca/l, respectively).
- Similarly, the groundwater abstracted from Solar Borehole No. 5 is suitable for domestic use with a pH of 6.7. Four water quality parameters exceeded the DWAF TWQR, specifically EC (82.7 mS/m > 70 mS/m DWAF TWQR), TDS (466 mg/l > 450 mg/l DWAF TWQR), Dissolved Ca (94 mg Ca/l > 32 mg Ca/l DWAF TWQR) and Dissolved Mg (37 mg Ca/l > 30 mg Ca/l DWAF TWQR).
- Groundwater boreholes are generally situated within and downstream of the development areas, hence are potential receptors to pollution.

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- The sanitation system will be supplemented by portable chemical toilets or e-loos for use by the work front further away from the construction camp. Wastewater shall be collected by a supplier for disposal at a licensed municipal Wastewater Treatment Works (WWTW). "domestic wastewater" means wastewater arising from domestic and commercial activities and premises, and may contain sewage (GA for Section 21(g), 2013).
- Waste Manifest System 11(1) Every holder of waste that has been classified as hazardous in terms of Regulation 4(2) or a waste that is listed in item (2)(b) of Annexure 1 to these Regulation, must be in possession of a waste manifest document containing the relevant information specified in Annexure 2 to these Regulations (Waste Classification and Management Regulations, 2013).

Impact 12 (Surface Water Hydrology)

- The project area is located within a Strategic Water Source Area (Screening Report).
- The project area falls within quaternary catchment D62D and the Orange Water Management Area.
- Available rainfall data suggest a MAP ranging from 112.4 (30th percentile) to 738.9 (90th percentile) mm/yr, based on a historical record of 69 years (e.g., 1920 to 1989). The average rainfall is in the order of 320 mm/yr.
- The site falls within evaporation zone 17A, of which Mean Annual Evaporation (MAE) ranges from 2 000 to 2 150 mm/yr. The MAE far exceeds the MAP for the site, which implies greater evaporative losses when compared to incident rainfall. Due to evaporation being about 85% more than local rainfall, non-perennial streams and rivers will only have water when there are flooding events (e.g., 1:2, 1:5, 1:50 and 1:100 year flood events). Lowest average rainfall (mm) is from May to September and lowest estimated monthly run-off (mm) is from May to November.
- BH14 is located approximately 60 m north of BH13 and falls within BH13's estimated radius of influence (1 607.54 m). Consequently, there is a risk that simultaneous dewatering, and/or over-production may lead to fracture failures and borehole collapse. (Geohydrological Assessment Report, 31st January 2023).
- Erosion and sedimentation are important ecological processes in the Karoo. Loss and fragmentation of habitat disrupt these processes. Erosion is a particularly high risk on steep slopes, and in drainage lines that lack channel features and are naturally adapted to lower energy runoff with dispersed surface flows, and naturally less turbid freshwater systems (Aquatic Biodiversity Impact Assessment, January 2023). Although the presence of the buffer zone seems futile as the upgrading of the access road is permissible linear infrastructure activities that will take place in in a broad strip (or corridor) through the watercourses and associated buffers, the intention of the buffer is to emphasize the importance and sensitivity of the applicable drainage systems. That is why the area included between the buffer zones should have explicit and very strict biodiversity conservation management measures and the operating teams should be aware of this. A level of best practices will be imposed in the riverine environment when the proposed construction gets under way and the process will be overseen by the project management (Aquatic Biodiversity Impact Assessment, January 2023).

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- The Ecological Importance and Sensitivity Category (EISC) of the smaller ephemeral tributaries, alluvial floodplains, and headwater drainage lines was classified as "Low to Medium" (Aquatic Biodiversity Impact Assessment, January 2023).
- The unnamed FEPA drainage line D62D – 05610 SQ (a tributary of the Brak River) is in a good condition despite some weirs and diversion walls in the catchment. The field assessment revealed that the unnamed drainage line D62D – 05610 SQ is discernible only as a slightly shallow depression with no clear associated vegetation and slightly clayey soils. Dwarf karroid scrub and tufted grass are the only vegetation present in this drainage area. It is in a good condition despite some weirs and diversion walls in the catchment. The ephemeral or intermittent drainage line is surrounded by alluvial floodplains, washes, and fans. These alluvial fans are usually bare soil flats or conduits, with dwarf karroid scrub and tufted grass colonising higher lying portions of ground (Aquatic Assessment prepared by Andrew Deacon, October 2017).
- These non-perennial drainage lines are prone to exhibiting ponded flood occurrence zones, in the absence of clearly defined drainage channels or streams. This is due to the micro-catchment style drainage associated with the project area. Sheet flow from micro-sub catchments towards lower topographical areas or isolated depressions form 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.

Impact 13 (Water quantity/use)

- Available data suggest that water production boreholes in the project area dewater the fractured aquifer zone, rather than the weathered aquifer zone. This is due to the observation that existing boreholes intercept dolerite dyke contact areas. Where a series of boreholes are drilled in the same contact, and close to each other (<500 m), borehole interference may occur as the fractures are simultaneously dewatered. Over-production may lead to fracture failures which will lead to borehole collapse.
- The largest risk of geohydrology is therefore the proposed groundwater abstraction activities. As groundwater is a very important resource for locals in the area, care should be taken not to overproduce from boreholes chosen for this project, and there is a limited impact on existing livestock/domestic watering already implemented (Geohydrological Assessment Report, 20th December 2022).
- Demand:
    - It is estimated that approximately 211 m3/day of groundwater will be required during construction of the 14.1 km-long access road. Water use during construction includes:
    - Road Stabilisation (118 m3/day),
    - Concrete mixing (watercourse crossings and MTS) (25 m3/day),
    - Domestic use for workers (drinking, washing hands, and sanitation) (2,25 m3/day), and
    - Dust suppression (spraying once per day and using a soil binding agent) (65,8 m3/day). The access road from the N10 to the Main Transmission Substation is approximately 14,1 km. However, it is assumed that dust control would only be required on two thirds of the access road at any one time during its construction. In total, dust control will be required on an estimated 9,4 km of 7 m-wide dirt road, covering a surface area of 65 800 m2. Outdoor dust control operations in typically dry areas require "about four litres of water on every square meter, every day." Applying this formula, a road roughly 14,1 km long and 7 m wide would require the use of roughly 263 200 L or 263 m3 of water for every spraying (https://blog.midwestind.com/water-is-a-poor-dust-control-method/).

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  - The estimated demand* (211 m3/day) exceeds the available groundwater yields (197.85 m3/8hr day) from two selected boreholes, creating a potential deficit of 13,15 m3/day. Water saving strategies will need to be implemented on site to ensure sufficient water during the construction of the access road.
  - * The estimated demand was calculated using available data and assumptions where no data was provided, such findings may change at any time should any further information be made available.
- Yield:
  - The pump test data generated from BH13 in sub-catchment/HRU 4 indicates a total abstraction of 191.23 m3/8hr day, and the pump test data from Solar Borehole No. 5 in sub-catchment/HRU 5 indicates a total abstraction of 6.62 m3/day. Consequently, cumulative water demand during construction of the access road should not exceed 197.85 m3/8hr day, unless there is another borehole to supplement water usage for other projects (limited to the surplus groundwater reserve in the respective sub-catchments; HRU4 and HRU5) or SAE staggers other construction projects, e.g., MTS, Dx and solar field, to reduce the total water demand on BH13 and Solar BH5 at any one time.
  - BH13 is in HRU4. So, assuming there is no Base Flow and Basic Human Needs are met by Existing Groundwater Abstraction, then there is a surplus amount of 98 450.63 m^3/yr (269.73 m^3/day) available, after the allocation of the proposed PU (which is the sustainable yield; 191,23 m3/day). Therefore, it is estimated that there is enough groundwater available on a sub-catchment level to sustain the proposed 8-hour abstraction from the designated boreholes and the sub-catchments they fall in (Geohydrological Assessment Report, 20th December 2022).
  - Solar BH No. 5 is in HRU5. So, assuming there is no Existing Use, Basic Human Needs and Base Flow, then there is a surplus amount of 416 010.85 m^3/yr (1 139.76 m^3/day) available, after the allocation of the proposed PU (which is the sustainable yield; 6.62 m3/day). Therefore, it is estimated that there is enough groundwater available on a sub-catchment level to sustain the proposed 8-hour abstraction from the designated boreholes and the sub-catchments they fall in (Geohydrological Assessment Report, 31st January 2023).
- The pump test data generated from BH13 in sub-catchment/HRU 4 indicates a total abstraction of 191.23 m3/8hr day, and the pump test data from Solar Borehole No. 5 in sub-catchment/HRU 5 indicates a total abstraction of 6.62 m3/day. Consequently, cumulative water demand during construction of the access road should not exceed 197.85 m3/8hr day, unless there is another borehole to supplement water usage for other projects (limited to the surplus groundwater reserve in the respective sub-catchments; HRU4 and HRU5) or SAE staggers other construction projects, e.g., MTS, Dx and solar field, to reduce the total water demand on BH13 and Solar BH5 at any one time.

- It is advised that water be pumped to dedicated storage tanks from the boreholes to build up a reserve, whereafter the boreholes are only used to top up the storage tanks. Allowing boreholes to rest and recover between pumping cycles will help to decrease the impact on the aquifer reserve.
- If dust suppression and operational water use volumes taken from groundwater resources in the sub-catchments are within the surplus estimates (of the groundwater reserve), the impact on the groundwater reserve will likely be minimum. (Geohydrological Assessment Report, 31st January 2023)

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

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

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

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

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- None

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

- Geohydrological Assessment Report Version – Final 1 prepared by GCS Water and Environmental Consultants dated 31st January 2023 (GCS Project Number: 22-0401).
- Hydrological Assessment for additional listed activities and water uses relating to the development of the Sun Central Cluster 1 300 MW Solar PV facility (previously known as Phase 1) in the Northern Cape", Version – Final 1, prepared by Hendrik Botha and dated 09 January 2023 (GCS Ref – 22 - 1054).
- General Authorisation for Section 21(g) Disposing of waste in a manner which may detrimentally impact on a water resource published in GN No. 665 of Government Gazette No. 36820 on 06th September 2013.
  The Waste Classification and Management Regulations published in GN No. R. 634 of Government Gazette No. 36784 on 23rd August 2013.
- Aquatic Biodiversity Impact Assessment, Section 21(c) & (i) Risk Assessment and Wetland Delineation Verification, prepared by Dr Andrew Deacon and dated January 2023.
- Proposed Development of a 225 MW Solar PV Plant Farms in the Hanover District, Northern Cape", The Present Ecological State and Risk Assessment for the Drainage System at the Proposed Solar PV Plant: Water Use License (WUL) Applications, prepared by Andrew Deacon (Pr. Sci. Nat. 116951) and dated October 2017.

Mitigations:

Impact Management Outcome(s):

- Avoid contamination of run-off. Avoid soil contamination a water pollution from the handling and disposal of domestic wastewater.
- Responsible disposal of domestic wastewater.
- Compliance with waste handling and storage
- Groundwater for domestic use falls within DWAF's TWQR (1996).
- Minimise ponding, erosion, and sedimentation of watercourses.
- Quick response to and remediation of any disturbance to watercourses in the area.
- Preserve in-stream hydrological pattern
- Maintain the Present Ecological State of the Brak River drainage system and large ephemeral tributaries.
- Preserve topsoil, control soil erosion.
- Minimise disturbance to the vadose zone soils.

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- Improve water use efficiency by reducing water volumes used for dust suppression.
- Avoid over pumping boreholes, decreasing the life of a borehole, pump failure and unsustainable rates of abstraction that deplete the groundwater reserve faster that it can recharge.
- Avoid risk of fracture failures and borehole collapse. Avoid decreasing borehole yields of other water users within the actual radius of influence.
- Maintain the integrity of the groundwater reserve(s).
- Reduce invasive alien plant recruitment

Targets:

- No potential or actual effluent contamination of ground and vadose zone.
- Water for dust suppression is treated
- Environmentally friendly soil binding agents
- Residual RMC stored in a temporary waste storage facility at the workshop area
- A designated and contained, impervious waste storage area
- Chemical toilets have drip tray
- Waste not stored longer than 90 days
- Waste is separated
- Waybill
- Recycle water. Reuse rubble, aggregate and concrete slurry
- Potable water supply. Deionisation plant
- Spill kits
- Dedicated parking areas with drip trays
- One point for access to watercourse crossings
- Temporary stormwater systems in place
- Implement stormwater management plan. Stormwater systems are not blocked
- No rivulets on site.
- Implementation of the Surface Water Monitoring Plan (Appendix D of EMP)
- Natural hydrology is retained.
- Erosion controls are in place and Soil horizons are separated.
- Backfilling by repacking separate soil horizons
- No signs of sand mining
- Fill roads of gravel/crushed rock.

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- Shaped to natural forms during operations and final grading does not alter flow characteristics
- Records of monitoring for signs of erosion.
- Vegetation is not cleared from the road verge.
- Project management supervision
- Construction takes place during dry months
- In-stream diversion.
- No erosion of banks or bars.
- Access routes are in good condition and roads are returned to a usable state.
- No construction creep
- No unprotected exposed soils
- Reduce the quantity of water used for each spray (e.g., 1 000 ml per sqm) and the frequency of spraying (e.g., less frequent than daily).
- Storage tanks with groundwater
- Field assessment results and water sample results
- Flow meters and Logbook
- Abstraction rate records and Water level monitoring results
- Complaints register
- Avoid declining abstraction yields from boreholes belonging to other water users (within the zone of influence).
- Minimise water usage.
- Avoid abstracting more groundwater than is available (e.g., the estimated surplus) on a sub-catchment level.
- Avoid over production and declining abstraction yields from project boreholes if unsustainable rates of abstraction deplete the groundwater reserve faster that it can recharge.
- No signs of alien plants on site
- Buffer zones are maintained
- Stormwater management on site

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
11	Handling Hazardous Substances	Potential pollution due to effluent from infrastructure, including concrete slurry	Maintain the Present Ecological State of the Brak River drainage	No potential or actual effluent contamination of ground and vadose zone.	Batching operations and the storage of concrete slurry from concrete mixing or should take place in intact, impervious, not	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		from mixing operations	system, large and small ephemeral tributaries, alluvial floodplains, and headwater drainage lines.		corroded receptacles outside the outer edge of the 15 m ecological buffer on both sides of the large ephemeral drainage systems.			
11	Handling Hazardous Substances	Potential pollution due to effluent from infrastructure, including concrete slurry from mixing operations	Maintain the Present Ecological State of the Brak River drainage system, large and small ephemeral tributaries, alluvial floodplains, and headwater drainage lines.	No potential or actual effluent contamination of ground and vadose zone.	Ensure correct placing of concrete batching plants and vehicle servicing areas etc. to avoid areas susceptible to soil and water pollution. Water runoff from the sites should be controlled as far as possible to prevent adverse effects. The seasonal drainage line should be protected from an increased inflow of poor-quality water.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
11	Water management (abstraction, storage and use) and General and Hazardous Waste Management	Dust suppression with chemical additives or treated effluent may contaminate a watercourse.	Groundwater for domestic use falls within DWAF's TWQR (1996).	Water for dust suppression is treated	Treated effluent used for dust suppression must be treated to General or Special Wastewater Limit Values as prescribed in the General Authorisation for the discharge of waste or water containing waste into a water resource and/ or IWULA, whichever is applicable.	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.

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11	Water management (abstraction, storage and use) and General and Hazardous Waste Management	Dust suppression with chemical additives or treated effluent may contaminate a watercourse.	Groundwater for domestic use falls within DWAF's TWQR (1996).	Environmentally friendly soil binding agents	Soil binding agents used for dust suppression shall be biodegradable, environmentally friendly, non phototoxic and must not harm flora or fauna (e.g., local wildlife and livestock).	Holder, Contractor, SEO	Continuous	Compliance to be verified by ECO and IEA.
11	General and Hazardous Waste Management	Concrete slurry can contaminate surface water run-off.	Avoid contamination of run-off	No residual RMC dumped on site	Mixer trucks should return any residual RMC to their batching plant after the delivery.	Contractor, SEO	Continuous	Compliance to be verified by ECO and IEA.
11	General and Hazardous Waste Management	Concrete slurry can contaminate surface water run-off.	Avoid contamination of run-off	Residual RMC stored in a temporary waste storage facility at the workshop area	If it is not possible for mixer trucks to return the residual RMC to their batching plant after the delivery, then the residual RMC within the truck mixers shall be disposed in a temporary waste storage receptacle designated for this purpose at the Workshop Area within the construction camp. Temporary storage means a once off storage of waste for a period not exceeding 90 days.	Contractor, SEO	Continuous	Compliance to be verified by ECO and IEA.
11	General and Hazardous Waste Management	Concrete slurry can contaminate	Avoid contamination of run-off	A designated and contained, impervious	Designated RMC waste storage receptacles shall be covered and contained, that is	Contractor, SEO	Continuous	Compliance to be verified by

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		surface water run-off.		waste storage area	impervious, and shall not detrimentally impact on a water resource (surface and groundwater) outside the outer edge of the ecological buffer.			ECO and IEA.
11	General and Hazardous Waste Management	Unsafe disposal, leaking /overflowing chemical toilets can contaminate soil and surface water causing soil and water pollution.	Avoid soil contamination a water pollution from the handling and disposal of domestic wastewater.	Chemical toilets have drip tray	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.	Contractor	Construction	Compliance to be verified by ECO and IEA.
11	General and Hazardous Waste Management	Unsafe disposal, leaking /overflowing chemical toilets can contaminate soil and surface water causing soil and water pollution.	Responsible disposal of domestic wastewater.	Waybill	The sewerage shall be removed regularly (dependant on usage) from the holding tank of portable chemical toilet and conveyed to a licensed private or municipal treatment or disposal facility.	Contractor	Construction	Compliance to be verified by ECO and IEA.
11	General and Hazardous Waste Management	Unsafe disposal, leaking /overflowing chemical toilets can contaminate soil and surface	Responsible disposal of domestic wastewater.	Waybill	The appointed service provider shall dispose of the domestic wastewater at a licensed private or municipal Wastewater Treatment Works (WWTW) that has the	Contractor	Construction	Compliance to be verified by ECO and IEA.

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		water causing soil and water pollution.			capacity to receive it, and provide evidence of safe disposal, e.g., retain a copy of the waste manifest document completed by the manager of waste, confirming that the hazardous waste load was accepted and managed.			
11	General and Hazardous Waste Management	Waste, such as concrete slurry, can contaminate surface water run-off.	Compliance with waste handling and storage	Waste not stored longer than 90 days	Temporarily stored waste shall be re-used, recycled, and/or disposed of within a period not exceeding 90 days.	Holder, Contractor	Continuous, No more than 90 days	Compliance to be verified by ECO and IEA.
11	General and Hazardous Waste Management	Waste, such as concrete slurry, can contaminate surface water run-off.	Compliance with waste handling and storage	Separate waste	Paper and stationary waste (from the offices) should be separated for re-use, recycling, and/or collected for disposal at the De Aar licensed landfill siteunless capacity constraints necessitate the use of an alternative licensed landfill site(s).	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.
11	General and Hazardous Waste Management	Waste, such as concrete slurry, can contaminate surface water run-off.	Compliance with waste handling and storage	Waybills for ink cartridges	Ink cartridges (from the offices) should be transferred to or collected by the supplier for recyclingunless capacity constraints necessitate the use of an alternative licensed landfill site(s).	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.

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11	General and Hazardous Waste Management	Waste, such as concrete slurry, can contaminate surface water run-off.	Compliance with waste handling and storage	Waybill	Organic food waste (from the staff welfare area) should be collected for disposal at the De Aar licensed landfill site unless capacity constraints necessitate the use of an alternative licensed landfill site(s).	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.
11	General and Hazardous Waste Management	Waste, such as concrete slurry, can contaminate surface water run-off.	Compliance with waste handling and storage	Waste is separated	Food/drink packaging (from the staff welfare area) should be separated for re-use, recycling, and/or collected for disposal at the De Aar licensed landfill site unless capacity constraints necessitate the use of an alternative licensed landfill site(s).	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.
11	General and Hazardous Waste Management	Waste, such as concrete slurry, can contaminate surface water run-off.	Compliance with waste handling and storage	Waste is separated	Packaging (Cardboard, plastic, wood, cement bags, etc.) should be collected for re-use and/or recycling. Packaging may not be 'donated' for reuse in the townships as its addition to houses is illegal and creates a fire hazard.	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.
11	General and Hazardous Waste Management	Waste, such as concrete slurry, can contaminate	Compliance with waste handling and storage	Aggregate reused	Excavated road material or aggregate should be reused if possible. If unsuitable, the spoil	Contractor	Construction	Compliance to be verified by

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		surface water run-off.			material is to be used as fill material, for rehabilitation of the site and/or removed from site to a suitable and approved location by the contractor under his contract.			ECO and IEA.
11	General and Hazardous Waste Management	Waste, such as concrete slurry, can contaminate surface water run-off.	Compliance with waste handling and storage	Waybill	Used motor oil should be collected by a registered collector or mechanic for recycling.	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.
11	General and Hazardous Waste Management	Waste, such as concrete slurry, can contaminate surface water run-off.	Compliance with waste handling and storage	Recycle water	As far as is practical, reuse the clean water from the oil-water separator at the wash bay, for washing plant.	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.
11	General and Hazardous Waste Management	Waste, such as concrete slurry, can contaminate surface water run-off.	Compliance with waste handling and storage	Reuse rubble	Solid concrete rubble will be re-used as fill material and/or disposed at the De Aar licensed landfill site.	Contractor	Construction	Compliance to be verified by ECO and IEA.
11	General and Hazardous Waste Management	Waste, such as concrete slurry, can contaminate surface water run-off.	Compliance with waste handling and storage	Reuse concrete slurry	Concrete slurry from concrete mixing operations should as far as is possible be reused for mixing future batches of concrete or once hardened, reused as fill material and/or disposed at the De Aar licensed landfill site.	Contractor	Construction	Compliance to be verified by ECO and IEA.

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11	General and Hazardous Waste Management	Waste, such as concrete slurry, can contaminate surface water run-off.	Compliance with waste handling and storage	Reuse residual RMC wastewater	Reuse residual RMC wastewater by supplementing/replacing borehole water for making new mortar or concrete, and/or allow the wastewater to evaporate.	Contractor	Construction	Compliance to be verified by ECO and IEA.
11	General and Hazardous Waste Management	Waste, such as concrete slurry, can contaminate surface water run-off.	Compliance with waste handling and storage	Residual RMC is stored correctly	The temporary storage of residual RMC for re-use (or disposal) must comply with the limits and conditions of the GA for S21(g) in GN 665 of 06 September 2013, particularly those provisions relating to the location of the wastewater storage facility and incidence reporting.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
11	General and Hazardous Waste Management	Waste, such as concrete slurry, can contaminate surface water run-off.	Compliance with waste handling and storage	Concrete solid waste is reused	Once hardened, solid waste arising from the concrete mixer truck washing can be recycled in concrete production, reused as fill material and/or disposed at the De Aar licensed landfill site.	Contractor	Construction	Compliance to be verified by ECO and IEA.
11	Water management (abstraction, storage and use)	Hard water is aesthetically unpleasant for domestic use and can result in scaling in piping exposed	Groundwater for domestic use falls within DWAF's TWQR (1996).	Potable water supply	Potable water will be supplied by the contractor(s) from a commercial source or permissible boreholes: Borehole No. 13, Borehole No. 14, Solar	Contractor	Continuous	Compliance to be verified by ECO and IEA.

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		to heat, or in utensils used to boil water.			Borehole No.4 and/or Solar Borehole No. 5.			
11	Water management (abstraction, storage and use)	Hard water is aesthetically unpleasant for domestic use and can result in scaling in piping exposed to heat, or in utensils used to boil water.	Groundwater for domestic use falls within DWAF's TWQR (1996).	Deionisation plant	Treat the groundwater abstracted from boreholes with a deionisation (or other suitable) treatment plant if it is to be used for domestic use and/or cleaning solar panels. Groundwater need not be treated if it will only be used for road construction, e.g., road stabilisation or dust suppression.	Holder, Contractor.	Continuous	Compliance to be verified by ECO and IEA.
11	Stormwater Management Control	Two ephemeral drainage line crossings, associated with the proposed road development can be considered critical stormwater management areas, where there will be an activity that could alter the natural conditions of the rivers/streams,	Minimise ponding, erosion, and sedimentation of watercourses.	Spill kits	Have fuel/oil spill kits on-site, for immediate clean-up of any hydrocarbons during the proposed activities.	Contractor.	Continuous	Compliance to be verified by ECO and IEA.

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		which could lead to sedimentation and erosion if storm events occur during the construction phase.						
11	Stormwater Management and Erosion Control	Two ephemeral drainage line crossings, associated with the proposed road development can be considered critical stormwater management areas, where there will be an activity that could alter the natural conditions of the rivers/streams, which could lead to sedimentation and erosion if storm events occur during the	Minimise ponding, erosion, and sedimentation of watercourses.	Dedicated parking areas with drip trays	Park vehicles in dedicated areas, with drip trays to manage potential leakages.	Contractor, SEO	Continuous	Compliance to be verified by ECO and IEA.

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		construction phase.						
11	Linear Infrastructure Crossings	Installation of road culverts may cause temporary sedimentation after storm events.	Minimise ponding, erosion, and sedimentation of watercourses.	No unnecessary vegetation clearance	Limit vegetation clearing to the physical footprint of the road and the minimum width required for the operation of machinery to install the culverts.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
12	Stormwater Management and Erosion Control	Two ephemeral drainage line crossings, associated with the proposed road development can be considered critical stormwater management areas, where there will be an activity that could alter the natural conditions of the rivers/streams, which could lead to sedimentation and erosion if storm events occur during the	Minimise ponding, erosion, and sedimentation of watercourses.	One point for access to watercourse crossings	Ensure access to watercourse crossings is limited to one point to prevent sedimentation.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.

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		construction phase.						
12	Stormwater Management and Erosion Control	Two ephemeral drainage line crossings, associated with the proposed road development can be considered critical stormwater management areas, where there will be an activity that could alter the natural conditions of the rivers/streams, which could lead to sedimentation and erosion if storm events occur during the construction phase.	Minimise ponding, erosion, and sedimentation of watercourses.	Temporary stormwater systems in place	Temporary stormwater systems, such as sandbags, berms or shallow channels should be used to stabilise work areas and manage stormwater runoff at watercourse crossings.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
12	Stormwater Management and Erosion Control	Two ephemeral drainage line crossings, associated with the proposed road	Minimise ponding, erosion, and sedimentation of watercourses.	Implement stormwater management plan	Ensure a stormwater management plan is implemented.	Contractor, SEO, ECO	Continuous	Compliance to be verified by ECO and IEA.

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		development can be considered critical stormwater management areas, where there will be an activity that could alter the natural conditions of the rivers/streams, which could lead to sedimentation and erosion if storm events occur during the construction phase.	Quick response to and remediation of any disturbance to watercourses in the area.					
12	Stormwater Management and Erosion Control	Two ephemeral drainage line crossings, associated with the proposed road development can be considered critical stormwater management areas, where there will be an	Minimise ponding, erosion, and sedimentation of watercourses. Quick response to and remediation of any disturbance to watercourses in the area.	Stormwater systems are not blocked	Ensure that all stormwater systems are kept clean of any debris to reduce flooding risk.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.

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		activity that could alter the natural conditions of the rivers/streams, which could lead to sedimentation and erosion if storm events occur during the construction phase.						
12	Stormwater Management and Erosion Control	Two ephemeral drainage line crossings, associated with the proposed road development can be considered critical stormwater management areas, where there will be an activity that could alter the natural conditions of the rivers/streams, which could lead to	Minimise ponding, erosion, and sedimentation of watercourses. Quick response to and remediation of any disturbance to watercourses in the area.	No rivulets on site.	Conduct regular inspections and maintenance of the site to ensure that vegetation cover is adequate, and no rivulets are generated.	SEO, ECO	Construction	Compliance to be verified by ECO and IEA.

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		sedimentation and erosion if storm events occur during the construction phase.						
12	Stormwater Management and Erosion Control and Linear Infrastructure Crossings	Two ephemeral drainage line crossings, associated with the proposed road development can be considered critical stormwater management areas, where there will be an activity that could alter the natural conditions of the rivers/streams, which could lead to sedimentation and erosion if storm events occur during the construction phase.	Quick response to and remediation of any disturbance to watercourses in the area.	Implementation of the Surface Water Monitoring Plan (Appendix D of EMP)	Implement the Surface Water Monitoring Plan (Appendix D of EMP) during the construction phase only for both the proposed stormwater systems and surface water resources identified in the area.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.

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12	Linear infrastructure crossings	Alter surface water hydrology.	Maintain the Present Ecological State of the Brak River drainage system and large ephemeral tributaries, including inter alia the unnamed FEPA drainage line D62D – 05610 SQ (a tributary of the Brak River) in a good ecological condition.	Natural hydrology is retained.	Disturbance of the natural topography and vegetation cover should be minimised.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
12	Linear infrastructure crossings	Alter surface water hydrology.	Maintain the Present Ecological State of the Brak River drainage system and large ephemeral tributaries, including inter alia the unnamed FEPA drainage line D62D – 05610 SQ (a	Natural hydrology is retained.	The natural contours should be preserved as far as is practical to preserve the existing site drainage patterns.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.

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			tributary of the Brak River) in a good ecological condition.					
12	Linear infrastructure crossings	Alter surface water hydrology.	Maintain the Present Ecological State of the Brak River drainage system and large ephemeral tributaries, including inter alia the unnamed FEPA drainage line D62D – 05610 SQ (a tributary of the Brak River) in a good ecological condition.	Natural hydrology is retained.	Natural, dispersed, drainage should be encouraged, by maintaining the natural drainage characteristics of the land as far as possible.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.
12	Linear infrastructure crossings	Alter surface water hydrology.	Maintain the Present Ecological State of the Brak River drainage system and large ephemeral	Erosion controls are in place.	Manage surface water runoff during construction of pipeline crossings within the large ephemeral tributaries and wetlands.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.

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			tributaries, including inter alia the unnamed FEPA drainage line D62D – 05610 SQ (a tributary of the Brak River) in a good ecological condition.					
12	Linear infrastructure crossings	Alter surface water hydrology.	Maintain the Present Ecological State of the Brak River drainage system and large ephemeral tributaries, including inter alia the unnamed FEPA drainage line D62D – 05610 SQ (a tributary of the Brak River) in a good ecological condition.	Records of monitoring for signs of erosion.	Monitor for signs of erosion during construction of pipeline crossings within the large ephemeral tributaries and wetlands.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.

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12	Linear infrastructure crossings and Earthworks	Mixed soil horizons	Preserve topsoil	Soil horizons are separated.	Do not mix the different soil horizons. Keep topsoil separate from the subsoil horizons, e.g., first remove the topsoil and stockpile/windrow it along the one side of the trench, then excavate the subsoil and stockpile/windrow it along the opposite side of the trench.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
12	Linear infrastructure crossings and Earthworks	Mixed soil horizons	Preserve topsoil	Backfilling by repacking separate soil horizons	Backfill trenches by repacking the separately stockpiled/windrowed soil horizons in the same sequence that they naturally occur within the ground.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
12	Linear infrastructure crossings	Construction of linear infrastructure across the dolerite ridge, ephemeral drainage system or wetlands will reshape the ridge, bed and banks of the drainage line or wetland.	Preserve in-stream hydrological pattern	No signs of sand mining	Sand mining in the ephemeral drainage system is prohibited.	Contractor.	Continuous	Compliance to be verified by ECO and IEA.

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12	Linear infrastructure crossings	Construction of linear infrastructure across the dolerite ridge, ephemeral drainage system or wetlands will reshape the ridge, bed and banks of the drainage line or wetland.	Preserve in-stream hydrological pattern	Fill roads of gravel/crushed rock.	Limit or restrict the construction of fill roads. All fill roads must use a permeable fill material (such as gravel or crushed rock) for at least the first layer of fill in order to maintain the natural flow regimes of subsurface water.	Contractor.	Construction	Compliance to be verified by ECO and IEA.
12	Linear infrastructure crossings	Construction of linear infrastructure across the dolerite ridge, ephemeral drainage system or wetlands will reshape the ridge, bed and banks of the drainage line or wetland.	Preserve in-stream hydrological pattern	Shaped to natural forms during operations.	Re-instatement of the original landscape levels must be done concurrent with construction activities.	Contractor, SEO	Concurrent with construction	Compliance to be verified by ECO and IEA.
12	Linear infrastructure crossings	Construction of linear infrastructure across the dolerite ridge, ephemeral drainage system or wetlands will	Preserve in-stream hydrological pattern	Final grading does not alter flow characteristics	The final grading of the crossing area should not significantly alter the flow characteristics of the ridge, ephemeral drainage system or wetland during periods of high flows, e.g., shaped to natural forms	Contractor, SEO	Concurrent with construction	Compliance to be verified by ECO and IEA.

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		reshape the ridge, bed and banks of the drainage line or wetland.			that blend in with pre-construction topography.			
12	Linear Infrastructure Crossings	Erosion and sedimentation	Maintain the Present Ecological State of the Brak River drainage system and large ephemeral tributaries.	Erosion controls are in place.	Manage surface water runoff during construction of crossings within the Brak River drainage system (Section 2.2: 30°51'6.74"S 24°16'32.57"E and 30°51'9.48"S 24°16'48.11"E) and large ephemeral tributaries (Section 1.3: 30 51 42.6 S; 24 14 00.5 E, Section 1.5: 30 51 25.7 S; 24 14 12.3 E and 30 51 25.8 S; 24 14 47.1 E.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.
12	Linear Infrastructure Crossings	Erosion and sedimentation	Maintain the Present Ecological State of the Brak River drainage system and large ephemeral tributaries.	Erosion controls are in place.	Manage surface water runoff during construction of crossings within or within proximity to smaller ephemeral tributaries (Section 1.2: 30 51 59.1 S; 24 13 49.7, Section 2.3: 30°51'15.66"S 24°17'4.51"E, Section 2.5: 30°51'38.05"S; 24°17'49.25"E), alluvial floodplains (Section 1.6: 30 51 24.3 S; 24 14	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.

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					59.3 E, Section 1.7: 30°51'23.25"S; 24°15'7.15"E, Section 1.8: 30°51'20.34"S; 24°15'34.11"E, Section 2.1: 30°51'13.13"S 24°16' 8.41"E and 30°51'7.53"S 24°16'30.31"E, Section 2.4: 30°51'16.23"S 24°17'6.43"E to 30°51'24.52"S 24°17'31.11"E), and headwater drainage lines (Section 1.1: 30 52 32.0 S; 24 13 26.9, Section 1.4: 30 51 29.3 S; 24 14 23.7 E).			
12	Linear Infrastructure Crossings	Erosion and sedimentation	Maintain the Present Ecological State of the Brak River drainage system and large ephemeral tributaries.	Records of monitoring for signs of erosion.	Monitor for signs of erosion during construction of crossings within the Brak River drainage system and large ephemeral tributaries, as well as within or within proximity to the smaller ephemeral tributaries, alluvial floodplains, and headwater drainage lines.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
12	Linear Infrastructure Crossings	Erosion and sedimentation	Maintain the Present Ecological State of the Brak River	Vegetation is not cleared from the road verge.	Vegetation clearance must be restricted to the physical footprints of the construction camp, staging area, permanent	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.

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			drainage system and large ephemeral tributaries.		and temporary roads within the road servitude, and the pipeline corridors only.			
12	Linear Infrastructure Crossings	Erosion and sedimentation	Maintain the Present Ecological State of the Brak River drainage system and large ephemeral tributaries.	Project management supervision	Construction within the watercourse crossings and buffers must be overseen by the project management.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
12	Linear Infrastructure Crossings	Construction of linear infrastructure across the ephemeral drainage system and wetlands may involve temporary diversion works, changing the surface water hydrology or flow patterns.	Preserve in-stream hydrological pattern	Construction takes place during dry months	The construction of linear infrastructure across parts of the large ephemeral drainage system and wetlands should to the extent possible be restricted to the dry winter months (e.g., May to September), that is commence with such activities as clearing or grading, excavating and importing material at the end of the wet season/beginning of the dry season whilst the soil is still moist and as far as is practical, be completed in, the dry winter months.	Holder, Contractor	Construction during dry months	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
12	Linear Infrastructure Crossings	Construction of linear infrastructure across the ephemeral drainage system and wetlands may involve temporary diversion works, changing the surface water hydrology or flow patterns.	Preserve in-stream hydrological pattern	In-stream diversion.	Any diversion works must remain inside the active channel or permanent zone, e.g., the works may not extend into the active channel bank or temporary or seasonal zones. The location of the active channel bank or permanent zone must be verified by the ECO.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
12	Linear Infrastructure Crossings	Construction of linear infrastructure across the ephemeral drainage system and wetlands may involve temporary diversion works, changing the surface water hydrology or flow patterns.	Preserve in-stream hydrological pattern	No erosion of banks or bars.	Any diversion works, and their outlets must be designed in such a way so as not to cause scouring of any bank, mid-channel bar or wetland. The works must be monitored regularly by the SEO for signs of scouring.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
12	Linear Infrastructure Crossings	Construction of linear infrastructure across the ephemeral	Preserve in-stream hydrological pattern	No erosion of banks or bars.	Any signs of scouring caused by the diversion works must be immediately rectified and remediated.	Contractor, SEO	Construction and immediately	Compliance to be verified by ECO and IEA.

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		drainage system and wetlands may involve temporary diversion works, changing the surface water hydrology or flow patterns.						
12	Linear Infrastructure Crossings and Stockpiling and Storing (Laydown)	Construction activities may alter the physical characteristics of the terrain, and surface water hydrology	Preserve topsoil	Erosion is repaired	Monitor for signs of channelled surface water run-off, e.g., rills and gullies, caused by construction activities, and if observed, take actions necessary to immediately re-instate the original ground level and sheet flow across the affected site.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
12	Earthworks	Construction activities may alter the physical characteristics of the terrain	Preserve topsoil, control soil erosion.	Access routes are in good condition	Maintain all access routes and roads adequately in order to minimise erosion and undue surface damage by repairing rutts and potholes and maintaining stormwater control mechanisms.	Contractor	Construction	Compliance to be verified by ECO and IEA.
12	Earthworks	Construction activities may alter the physical characteristics of the terrain	Preserve topsoil, control soil erosion.	Erosion is repaired	Any erosion problems observed to be associated with the project infrastructure should be rectified as soon as possible and	Contractor	Construction	Compliance to be verified by ECO and IEA.

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					monitored thereafter to ensure that it does not re-occur.			
12	Earthworks	Construction activities may alter the physical characteristics of the terrain	Preserve topsoil, control soil erosion.	Roads are returned to a usable state.	Ensure that all access roads utilised during construction (which are not earmarked for closure and rehabilitation) are returned to a usable state and / or a state no worse than prior to construction.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
12	Earthworks	Disturbing vadose zone during excavations activities, contractor laydown areas. Excavations may subject the surroundings to temporary sedimentation during storm events. There is a potential for some erosion if there are storm events.	Minimise disturbance to the vadose zone soils.	No construction creep	All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is essential.	Contractor, SEO.	Construction	Compliance to be verified by ECO and IEA.
12	Earthworks	Disturbing vadose zone during excavations activities,	Minimise disturbance to the vadose zone soils.	No construction creep	Only excavate / clear areas applicable to the project area.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		contractor laydown areas. Excavations may subject the surroundings to temporary sedimentation during storm events. There is a potential for some erosion if there are storm events.						
12	Earthworks	Disturbing vadose zone during excavations activities, contractor laydown areas. Excavations may subject the surroundings to temporary sedimentation during storm events. There is a potential for some erosion if there are storm events.	Minimise disturbance to the vadose zone soils.	No unnecessary vegetation clearing	Retain as much indigenous vegetation as possible / re-vegetate.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
12	Earthworks	Disturbing vadose zone during excavations	Minimise disturbance to the vadose zone soils.	No unprotected exposed soils	Exposed soils are to be protected using a suitable covering or sandbags or berms to	Contractor, SEO, E	Construction	Compliance to be verified by

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		activities, contractor laydown areas. Excavations may subject the surroundings to temporary sedimentation during storm events. There is a potential for some erosion if there are storm events.			control erosion.			ECO and IEA.
13	Water management (abstraction, storage and use)	Natural Resource depletion - Construction will require the abstraction of water from boreholes for dust suppression, mixing concrete and potable usage. Dust suppression using only water is a wasteful use (decrease) of a limited resource.	Improve water use efficiency by reducing water volumes used for dust suppression.	Reduce the quantity of water used for each spray (e.g., 1 000 ml per sqm) and the frequency of spraying (e.g., less frequent than daily).	Reduce the quantity of groundwater and frequency of applications required for dust suppression on gravel access roads by adding environmentally safe/friendly soil binding agents.	Holder, Contractor.	Continuous	Compliance to be verified by ECO and IEA.
13	Water management	Natural Resource	Improve water use efficiency	Reduce the quantity of	Monitor the amount of water used for	Holder, Contractor,	Continuous	Compliance to be

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	(abstraction, storage and use)	depletion - Construction will require the abstraction of water from boreholes for dust suppression, mixing concrete and potable usage. Dust suppression using only water is a wasteful use (decrease) of a limited resource.	by reducing water volumes used for dust suppression.	water used for each spray (e.g., 1 000 ml per sqm) and the frequency of spraying (e.g., less frequent than daily).	suppressing dust on gravel roads.	SEO, ECO		verified by ECO and IEA.
13	Water management (abstraction, storage and use)	Natural Resource depletion - Construction will require the abstraction of water from boreholes for dust suppression, mixing concrete and potable usage. Dust suppression using only water is a wasteful use (decrease) of a	Improve water use efficiency by reducing water volumes used for dust suppression.	Reduce the quantity of water used for each spray (e.g., 1 000 ml per sqm) and the frequency of spraying (e.g., less frequent than daily).	Regular, light watering of gravel roads is better than infrequent, heavy watering.	Holder, Contractor.	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		limited resource.						
13	Water management (abstraction, storage and use)	Uncontrolled abstraction can lead to over pumping boreholes, reduced borehole life, pump failure and depletion of the underground aquifer.	Avoid over pumping boreholes, decreasing the life of a borehole, pump failure and unsustainable rates of abstraction that deplete the groundwater reserve faster that it can recharge.	Storage tanks with groundwater	Water should be pumped from the boreholes to dedicated storage tanks to build up a reserve, whereafter the boreholes are only used to top up the storage tanks.	Contractor, Landowner	Continuous	Compliance to be verified by ECO and IEA.
13	Water management (abstraction, storage and use)	Over-production from a series of boreholes that are drilled in the same contact, and close to each other (<500 m), may lead to fracture failures as the fractures are simultaneously dewatered.	Avoid risk of fracture failures and borehole collapse.	Avoid over production and declining abstraction yields from project boreholes if unsustainable rates of abstraction deplete the groundwater reserve faster that it can recharge.	If both BH13 and BH14 are made operational, they should not be dewatered simultaneously. The Groundwater abstraction from either borehole shall not exceed the sustainable yield. The sustainable yield for BH13 is 6.64 l/sec (for 8hrs per 24hr day of pumping only), which is equivalent to 191.23 m3/day or 5 736.96 m3/month. The Expected yield for BH14 (not pump tested) is 6	Holder, Contractor, Landowner	Continuous	Compliance to be verified by ECO and IEA.

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					l/sec for 8 hours/day (172.8 m³/day). recommended.			
13	Water management (abstraction, storage and use)	Over-production from a series of boreholes that are drilled in the same contact, and close to each other (<500 m), may lead to fracture failures as the fractures are simultaneously dewatered.	Avoid decreasing borehole yields of other water users within the actual radius of influence.	Field assessment results	Undertake monthly field assessments of borehole groundwater for pH, Electrical Conductivity (EC)/Total Dissolved Solids (TDS), temperature and groundwater level. project.	Holder, Contractor	Monthly	Compliance to be verified by ECO and IEA.
13	Water management (abstraction, storage and use)	Over-production from a series of boreholes that are drilled in the same contact, and close to each other (<500 m), may lead to fracture failures as the fractures are simultaneously dewatered.	Avoid decreasing borehole yields of other water users within the actual radius of influence.	Sample results	Undertake annual laboratory samples of borehole groundwater for pH, EC/TDS, COD, Turbidity, Major cations, and anions (Ca, Mg, Na, K, Cl, NO3, SO4, PO4, F) and Microbes (E. coli, total coliforms, and standard plate count).	Holder, Contractor	Annually	Compliance to be verified by ECO and IEA.
13	Water management (abstraction,	Over-production from a series of boreholes that	Avoid decreasing borehole yields of other water	Flow meters	Install flow meters on any pipeline between a borehole and the point of abstraction to ensure	Contractor, SEO, ECO	Continuous	Compliance to be verified by

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
	storage and use)	are drilled in the same contact, and close to each other (<500 m), may lead to fracture failures as the fractures are simultaneously dewatered.	users within the actual radius of influence.		usage remains within the sustainable yield determined in the Geohydrological Assessment Report. The sustainable yield of BH13 is 6.64 l/sec for 8hrs per 24hr day of pumping only, which is equivalent to 191.23 m3/day or 5 736.96 m3/month. The sustainable yield for Solar BH No. 5 is 0.23 l/sec (for 8hrs per 24hr day of pumping only), which is equivalent to 6.62 m3/day or 198.72 m3/month.			ECO and IEA.
13	Water management (abstraction, storage and use)	Over-production from a series of boreholes that are drilled in the same contact, and close to each other (<500 m), may lead to fracture failures as the fractures are simultaneously dewatered.	Avoid decreasing borehole yields of other water users within the actual radius of influence.	Abstraction rate records	Monitor abstraction rates (in litres and/or m3) and pumping periods (duration in minutes and/or hours) from BH13 & Solar BH5 daily.	Contractor, SEO, ECO	Continuous	Compliance to be verified by ECO and IEA.
13	Water management (abstraction,	Over-production from a series of	Avoid decreasing borehole yields	Logbook	Conduct multi borehole water level logging, to ensure that no	Contractor	Continuous	Compliance to be verified by

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	storage and use)	boreholes that are drilled in the same contact, and close to each other (<500 m), may lead to fracture failures as the fractures are simultaneously dewatered.	of other water users within the actual radius of influence.		cumulative dewatering impacts are taking place for boreholes which may be in the same contact zones, e.g., downstream and within HRU4.			ECO and IEA.
13	Water management (abstraction, storage and use)	Over-production from a series of boreholes that are drilled in the same contact, and close to each other (<500 m), may lead to fracture failures as the fractures are simultaneously dewatered.	Avoid decreasing borehole yields of other water users within the actual radius of influence.	Water level monitoring results	Undertake water level monitoring of boreholes within a 1.5 km radius of the pumping borehole. If a decline in water levels is noted in all boreholes, because of pumping, the abstraction rate should be lowered to prevent aquifer depletion.	Contractor	Continuous	Compliance to be verified by ECO and IEA.
13	Water management (abstraction, storage and use)	Over-production from a series of boreholes that are drilled in the same contact, and close to each other (<500 m), may lead to	Avoid decreasing borehole yields of other water users within the actual radius of influence.	Complaints register	Evaluate any complaints by landowners about declining yields which may relate to the project.	Holder, Contractor, SEO	Continuous	Compliance to be verified by ECO and IEA.

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		fracture failures as the fractures are simultaneously dewatered.						
13	Water management (abstraction, storage and use)	Natural Resource depletion (groundwater reserve) - Construction will require the abstraction of water from boreholes for road stabilisation, dust suppression, mixing concrete and potable usage. Uncontrolled abstraction can lead to over pumping boreholes, reduced borehole life, pump failure and depletion of the underground aquifer.	Maintain the integrity of the groundwater reserve(s).	Avoid over production and declining abstraction yields from project boreholes if unsustainable rates of abstraction deplete the groundwater reserve faster that it can recharge.	Do not overproduce from boreholes used as part of the project: 8 hours of pumping per day is recommended.	Holder, Contractor, Landowner	Continuous	Compliance to be verified by ECO and IEA.
13	Water management (abstraction,	Natural Resource depletion	Maintain the integrity of the groundwater	Avoid over production and declining	Groundwater abstraction from BH13 shall not exceed its	Holder, Contractor, Landowner	Continuous	Compliance to be verified by

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	storage and use)	(groundwater reserve) - Construction will require the abstraction of water from boreholes for road stabilisation, dust suppression, mixing concrete and potable usage. Uncontrolled abstraction can lead to over pumping boreholes, reduced borehole life, pump failure and depletion of the underground aquifer.	reserve(s).	abstraction yields from project boreholes if unsustainable rates of abstraction deplete the groundwater reserve faster that it can recharge.	sustainable yield, that is 6.64 l/sec (for 8hrs per 24hr day of pumping only), which is equivalent to 6.62 m3/day or 198.72 m3/month.			ECO and IEA.
13	Water management (abstraction, storage and use)	Natural Resource depletion (groundwater reserve) - Construction will require the abstraction of water from boreholes for road	Maintain the integrity of the groundwater reserve(s).	Avoid declining abstraction yields from boreholes belonging to other water users (within the zone of influence).	Cumulative water demand during construction of the access road should not exceed 197.85 m3/8hr day, unless there is another borehole to supplement water usage for other projects (limited to the surplus groundwater reserve in	Holder, Contractor, Landowner	Continuous	Compliance to be verified by ECO and IEA.

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		stabilisation, dust suppression, mixing concrete and potable usage. Uncontrolled abstraction can lead to over pumping boreholes, reduced borehole life, pump failure and depletion of the underground aquifer.			the respective sub-catchments; HRU4 and HRU5) or SAE staggers other construction projects, e.g., MTS, Dx and solar field, to reduce the total water demand on BH13 and Solar BH5 at any one time.			
13	Water management (abstraction, storage and use)	Natural Resource depletion (groundwater reserve) - Construction will require the abstraction of water from boreholes for road stabilisation, dust suppression, mixing concrete and potable usage. Uncontrolled abstraction can	Maintain the integrity of the groundwater reserve(s).	Minimise water usage.	Continually investigate and implement water-saving strategies and technologies or alternatives, including design to ensure sufficient groundwater during the construction of the access road.	Holder	Continuous	Compliance to be verified by ECO and IEA.

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		lead to over pumping boreholes, reduced borehole life, pump failure and depletion of the underground aquifer.						
13	Water management (abstraction, storage and use)	Natural Resource depletion (groundwater reserve) - Construction will require the abstraction of water from boreholes for road stabilisation, dust suppression, mixing concrete and potable usage. Uncontrolled abstraction can lead to over pumping boreholes, reduced borehole life, pump failure and depletion	Maintain the integrity of the groundwater reserve(s).	Avoid abstracting more groundwater than is available (e.g., the estimated surplus) on a sub-catchment level.	If the adopted water saving strategies and technologies are insufficient to curb demand, then SAE should use another borehole to supplement water usage for this and/or other projects (limited to the surplus groundwater reserve in the respective sub-catchments; HRU4 and HRU5 and subject to additional	Holder,	Continuous	Compliance to be verified by ECO and IEA.

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		of the underground aquifer.						
13	Water management (abstraction, storage and use)	Natural Resource depletion (groundwater reserve) - Construction will require the abstraction of water from boreholes for road stabilisation, dust suppression, mixing concrete and potable usage. Uncontrolled abstraction can lead to over pumping boreholes, reduced borehole life, pump failure and depletion	Maintain the integrity of the groundwater reserve(s).	Avoid over production and declining abstraction yields from project boreholes if unsustainable rates of abstraction deplete the groundwater reserve faster that it can recharge.	Groundwater abstraction from Solar BH No. 5 shall not exceed its sustainable yield, that is 0.23 l/sec (for 8hrs per 24hr day of pumping only), which is equivalent to 6.62 m3/day or 198.72 m3/month.	Holder, Contractor, Landowner	Continuous	Compliance to be verified by ECO and IEA.

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		of the underground aquifer.						
13	Alien plant management	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.	Reduce invasive alien plant recruitment	No signs of alien plants on site	Immediately control any alien invasive plant in its entirety (including roots and propagating material) upon being identified on site, using preferably mechanical control methods as opposed to chemical spraying.	Holder, Contractor, SEO	Continuous	Compliance to be verified by ECO and IEA
13	Linear Infrastructure Crossing	Removal of vegetation and disturbing topsoil by laying underground pipelines at watercourse crossings.	Preserve topsoil	Erosion control on site	Implement source-directed erosion controls.	Contractor, SEO	Continuous	Compliance to be verified by ECO and IEA
13	Linear Infrastructure Crossing	Removal of vegetation and disturbing topsoil by laying underground pipelines at watercourse crossings.	Preserve topsoil	Buffer zones are maintained	Maintain buffer zones to trap sediments.	Contractor, SEO	Continuous	Compliance to be verified by ECO and IEA

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13	Linear Infrastructure Crossing	Removal of vegetation and disturbing topsoil by laying underground pipelines at watercourse crossings.	Preserve topsoil	Stormwater management on site	Implement appropriate stormwater management around the excavation areas to prevent the ingress of run-off into the excavation trenches.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA

Assessment with mitigation:

Alternative Site No. 1 (preferred)

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

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

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

Residual Risk (feeds back into "Mitigations"):

- The estimated water demand (211 m3/day) exceeds the available groundwater yields (197.85 m3/8hr day), creating a potential deficit of 13,15 m3/day. Water saving strategies will need to be implemented on site to ensure sufficient water during the construction of the access road. The residual risk of abstracting groundwater on the underground aquifer (13) is Low if water saving strategies are in place.

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Receiving Environment: Atmosphere

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Plant Management	Driving & Transport	Generating emissions incl. noise and dust	**Impact:** Dust and noise pollution caused by increased traffic. Air pollution or reduced air quality due to increased ambient PM10 concentrations and dust fallout. **Consequence:** Decrease in sense of place due to dust and noise generated by traffic. Nuisance effects of PM, e.g., settling on houses, deposition on and discolouration of buildings, and reduction in visibility. Respiratory problems - airborne dust from gravel roads (a type of PM10) can cause eye, nose and throat irritations (direct). Dust settling on and smothering plants will reduce photosynthetic capacity and plant vigour, making them less resistant to diseases and pest infestations.	quality	14
General and Hazardous Waste Management	Disposal	Contamination	**Impact:** Burning of waste as a disposal method increases the risk of veld fires caused by workers during the construction of the facility. **Consequence:** - increase emissions to air reducing air quality (direct)	quality	14
Handling Hazardous Substances	Importing Ready Mix/ Concrete Batching Plant	Contamination, emitting	**Impact:** Increase in ambient PM10 concentrations, Total Suspended Particulate (TSP) and dust fallout emitted from the concrete batching plant. **Consequence:** Respiratory problems. Nuisance effects of PM, e.g., settling on houses, deposition on and discolouration of buildings, and reduction in visibility.	quality	14

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Clearing/Grubbing and Grading	Access Road, pipeline, construction camp & staging area	Removal of vegetation	**Impact:** Increase in ambient PM10 concentrations and dust fallout from construction activities, including excessive dust from clearing and grubbing. **Consequence:** Respiratory problems. Nuisance effects of PM, e.g., settling on houses, deposition on and discolouration of buildings, and reduction in visibility. Dust settling on and smothering plants will reduce photosynthetic capacity and plant vigour, making them less resistant to diseases and pest infestations. Dust settling on and smothering any already installed solar panels will reduce their efficiency, causing a decline in electrical power output, lost income for the operator and increase the payback period.	quality	14
Earthworks	Excavations/Trenching	NA	**Impact:** Increase in ambient PM10 concentrations and dust fallout from construction activities, including excessive dust from clearing and grubbing. **Consequence:** Respiratory problems. Nuisance effects of PM, e.g., settling on houses, deposition on and discolouration of buildings, and reduction in visibility. Dust settling on and smothering plants will reduce photosynthetic capacity and plant vigour, making them less resistant to diseases and pest infestations. Dust settling on and smothering any already installed solar panels will reduce their efficiency, causing a decline in electrical power output, lost income for the operator and increase the payback period.	quality	14
Blasting	NA	Dust, Noise & Flyrock generation	**Impact:** Vibrations, dust, noise and flyrock from blasting. **Consequence:** Disturbance.	quality	14

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Stockpiling and Storing (Laydown)	Mulch, topsoil, aggregate, spoil and infrastructure	Burying, smothering, impeding, sedimentation, emitting	**Impact:** Increase in ambient PM10 concentrations, Total Suspended Particulate (TSP) and dust fall out emitted from storage and stockpiles. **Consequence:** Respiratory problems. Nuisance effects of PM, e.g., settling on houses, deposition on and discolouration of buildings, and reduction in visibility.	quality	14

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

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

Impact 14 (Dust generation)

- The study area is not within an Air Quality Priority Area. According to the Emathanjeni Local Municipality Final Integrated Development Plan 2021 – 2022, the air quality within this municipality is in good condition compared to the other urban areas, but dust pollution does occur in the Karoo to some extent due to low variable rainfall and sparse vegetation.
  The predicted dust fallout is low and well below the limit value for acceptable dust fallout in non-residential areas. Consequently, the significance of the impact of dust fallout resulting during construction of the Access Road is also low. This assessment considers the current dust control measures, e.g., spraying the Access Road once a day with water. It is however recommended that these are expanded to reduce the emission and ensure that the significance of the impact remains low (Air Quality Impact Assessment, January 2023). For the uncontrolled scenario the predicted ambient PM10 concentrations exceed the annual average and 24-hour NAAQS for PM10 up to 1 500 m from the Access Road. For the controlled scenario the predicted ambient PM10 concentrations are below the annual average NAAQS for PM10 but exceed the 24-hour NAAQS for PM10 up to 300 m from the Access Road. Sensitive receptors have been noted within these zones. The significance of the impact of operations on air quality is therefore medium. This assessment considers the dust control measures of watering once per day. These however need to be expanded to reduce the emission and lower the impact significance to low with mitigation (Air Quality Impact Assessment, January 2023).
- The main source of particulate emissions will be entrainment of dust by vehicles on the unpaved Access Road. Some particulates will be generated by other construction equipment and activities, such as the stockpiles, concrete batching plant, but particulate emission from these activities is expected to be relatively low and was not estimated (Air Quality Impact Assessment, January 2023).

Assessment without mitigation:

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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 Route No. 1 (preferred)

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

- Air Quality Impact Assessment for the Proposed Development of the Sun Central Cluster 300 MW Solar PV Facility between De Aar & Hanover, Emthanjeni Local Municipality, Pixley Ka Seme District Municipality, Northern Cape Province", Version – Final, prepared by Mark Zunckel of uMoya-NILU and dated January 2023 (Report number: uMN192-22).
- Traffic Impact Assessment for the upgrading & development of an access road from the N10/'Burgerville' district road (2448) turn-off to the Main Transmission Substation (MTS) as well as the construction of a loop-in loop-out from the MTS to the 400 kV Hydraposeidon Tx overhead line (line 1), and other projects on the Sun Central Cluster 1 (300 MW) solar PV footprint between De Aar and Hanover, Northern Cape province (project No.: STUR0375) prepared by Sturgeon Consulting (Pty) Ltd dated February 2023.

Mitigations:

Impact Management Outcome(s):

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- Minimal noise generated by blasting and traffic.
- Minimise dust generation.
- Minimise smoke generation from Veld fires.

Targets:

- Avoid exceeding NAAQS annual ambient PM10 concentrations (40 µg/m3) and 24-hour ambient PM10 concentrations (75 µg/m3).
- Avoid exceeding the National Dust Standard for non-residential (1 200 mg/m2/da) and residential (600 mg/m2/day) areas.
- No blasting in windy conditions
- Use of minimum magnitude and amount of 'explosive' material.
- Blast mat in use.
- No blasting after hours or on weekends
- Dust suppressants
- Comply with bylaws and regulations.
- Responsible storage of fine aggregate
- Cement silos are in good condition.
- No waste is burned.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
14	Blasting	Vibrations, dust, noise and flyrock from blasting.	Minimal noise generated by blasting	No blasting in windy conditions	Blasting shall not occur during windy conditions.	Contractor	Construction	Compliance to be verified by ECO and IEA.
14	Blasting	Vibrations, dust, noise and flyrock from blasting.	Minimal noise generated by blasting	Use of minimum magnitude and amount of 'explosive' material.	The contractor carrying out the blasting work shall apply the absolute minimum magnitude and amount of 'explosive' material.	Contractor	Construction	Compliance to be verified by ECO and IEA.
14	Blasting	Vibrations, dust, noise and flyrock from blasting.	Minimal noise generated by blasting	Blast mat in use	The contractor carrying out the blasting work shall use a blast mat (not	Contractor	Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
					soil) to reduce noise/fly rock.			
14	Blasting	Vibrations, dust, noise and flyrock from blasting.	Minimal noise generated by blasting	No blasting after hours or on weekends	Blasting should be done during work hours and during weekdays only.	Contractor	Construction	Compliance to be verified by ECO and IEA.
14	Blasting	Vibrations, dust, noise and flyrock from blasting.	Minimal noise generated by blasting	Dust suppressants	Dust suppressant must be prioritised for the blasting periods.	Contractor	Construction	Compliance to be verified by ECO and IEA.
14	Blasting	Vibrations, dust, noise and flyrock from blasting.	Minimal noise generated by blasting	Comply with bylaws and regulations	Adhere to any local bylaws and regulations regarding the generation of noise.	Contractor	Construction	Compliance to be verified by ECO and IEA.
14	Earthworks	Increase in ambient PM10 concentrations and dust fallout from construction activities.	Minimise dust generation.	Avoid exceeding NAAQS annual ambient PM10 concentrations (40 µg/m3) and 24-hour ambient PM10 concentrations (75 µg/m3). Avoid exceeding the National Dust Standard for non-residential (1 200 mg/m2/da) and residential (600	Implement a dust monitoring programme for the construction sites, including the installation of dust monitoring units.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
				mg/m2/day) areas.				
14	Earthworks	Increase in ambient PM10 concentrations and dust fallout from construction activities	Minimise dust generation.	Avoid exceeding NAAQS annual ambient PM10 concentrations (40 µg/m3) and 24-hour ambient PM10 concentrations (75 µg/m3). Avoid exceeding the National Dust Standard for non-residential (1 200 mg/m2/da) and residential (600 mg/m2/day) areas.	Wetting of open areas and erection of wind shields, where necessary.	Contractor	Construction	Compliance to be verified by ECO and IEA.
14	Handling of hazardous substances	Increase in ambient PM10 concentrations, Total Suspended Particulate (TSP) and dust fallout emitted from the concrete batching plant.	Minimise dust generation.	Responsible storage of fine aggregate	Store fine aggregate materials such as cement and sand in a manner so as to avoid or minimize dust generation, with water also being used as a dust suppressant.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
14	Handling of hazardous substances	Increase in ambient PM10 concentrations, Total Suspended Particulate (TSP) and dust fallout emitted from the concrete batching plant.	Minimise dust generation.	Cement silos are in good condition	Fit cement silos with alarms to prevent over filling, airtight inspection hatches and automatic cut-off switches on the filler lines where appropriate.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
14	Handling of hazardous substances	Increase in ambient PM10 concentrations, Total Suspended Particulate (TSP) and dust fallout emitted from the concrete batching plant.	Minimise dust generation.	Avoid exceeding NAAQS annual ambient PM10 concentrations (40 µg/m3) and 24-hour ambient PM10 concentrations (75 µg/m3). Avoid exceeding the National Dust Standard for non-residential (1 200 mg/m2/da) and residential (600 mg/m2/day) areas.	To minimize dust generation the following measures are recommended: • Drop heights from haulage trucks into bins and onto conveyors should be minimised as far as possible. • Work surfaces should be kept clean. • Duct work must be airtight as far as possible. • Vehicle movement and loading areas should be enclosed as much as is practicable. • Aggregate spills should be cleaned up. • Conveyor belts and hoppers must be	Holder, Contractor	Construction and Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
					covered or enclosed where practical and appropriate.			
14	Plant Management	Dust and noise pollution caused by increased traffic. Air pollution or reduced air quality due to increased ambient PM10 concentrations and dust fallout.	Minimise dust and noise generated by traffic.	Avoid exceeding NAAQS annual ambient PM10 concentrations (40 µg/m3) and 24-hour ambient PM10 concentrations (75 µg/m3). Avoid exceeding the National Dust Standard for non-residential (1 200 mg/m2/day) and residential (600 mg/m2/day) areas.	Stagger delivery trips.	Contractor	Construction	Compliance to be verified by ECO and IEA.
14	Plant Management	Dust and noise pollution caused by increased traffic. Air pollution or reduced air quality due to increased ambient PM10	Minimise dust and noise generated by traffic.	Avoid exceeding NAAQS annual ambient PM10 concentrations (40 µg/m3) and 24-hour ambient PM10 concentrations (75 µg/m3).	As far as possible, reduce the number of vehicle trips by transporting staff in busses instead of 15-seater taxis.	Contractor	Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		concentrations and dust fallout.		Avoid exceeding the National Dust Standard for non-residential (1 200 mg/m2/day) and residential (600 mg/m2/day) areas.				
14	Plant Management	Dust and noise pollution caused by increased traffic. Air pollution or reduced air quality due to increased ambient PM10 concentrations and dust fallout.	Minimise dust and noise generated by traffic.	Avoid exceeding NAAQS annual ambient PM10 concentrations (40 µg/m3) and 24-hour ambient PM10 concentrations (75 µg/m3). Avoid exceeding the National Dust Standard for non-residential (1 200 mg/m2/day) and residential (600 mg/m2/day) areas.	Implement and enforce speed limits on project-controlled roads. Reduce speed to 30 km/hr. Enforce speed control through speed limit road signage and fines.	Holder, Contractor	Construction and Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
14	Plant Management	Dust and noise pollution caused by increased traffic. Air pollution or reduced air quality due to increased ambient PM10 concentrations and dust fallout.	Minimise dust and noise generated by traffic.	Avoid exceeding NAAQS annual ambient PM10 concentrations (40 µg/m3) and 24-hour ambient PM10 concentrations (75 µg/m3). Avoid exceeding the National Dust Standard for non-residential (1 200 mg/m2/day) and residential (600 mg/m2/day) areas.	Effective implementation of the National Dust Control Regulations to ensure that the dust fallout does not exceed the acceptable limits.	Holder, Contractor	Construction and Continuous	Compliance to be verified by ECO and IEA.
14	Plant Management	Dust and noise pollution caused by increased traffic. Air pollution or reduced air quality due to increased ambient PM10 concentrations and dust fallout.	Minimise dust and noise generated by traffic.	Avoid exceeding NAAQS annual ambient PM10 concentrations (40 µg/m3) and 24-hour ambient PM10 concentrations (75 µg/m3). Avoid exceeding the National Dust	The contractor should take into consideration predicted wind speeds from the local weather station when planning construction-related activities with a high risk of generating dust, such as adding cement to the road.	Contractor	Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
				Standard for non-residential (1 200 mg/m2/day) and residential (600 mg/m2/day) areas.				
14	Plant Management	Dust and noise pollution caused by increased traffic. Air pollution or reduced air quality due to increased ambient PM10 concentrations and dust fallout.	Minimise dust and noise generated by traffic.	Avoid exceeding NAAQS annual ambient PM10 concentrations (40 µg/m3) and 24-hour ambient PM10 concentrations (75 µg/m3). Avoid exceeding the National Dust Standard for non-residential (1 200 mg/m2/day) and residential (600 mg/m2/day) areas.	Implement dust control measures on gravel access roads, including watering, but only in combination with an environmentally friendly (organic) soil binding agent/dust suppressant (to reduce wasteful water consumption).	Holder, Contractor	Construction and Continuous	Compliance to be verified by ECO and IEA.
14	Plant Management	Dust and noise pollution caused by increased traffic.	Minimise dust and noise generated by traffic.	Avoid exceeding NAAQS annual ambient PM10	Implement a scheduled watering program by tanker.	Holder, Contractor	Construction and Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		Air pollution or reduced air quality due to increased ambient PM10 concentrations and dust fallout.		concentrations (40 µg/m3) and 24-hour ambient PM10 concentrations (75 µg/m3). Avoid exceeding the National Dust Standard for non-residential (1 200 mg/m2/day) and residential (600 mg/m2/day) areas.				
14	Plant Management	Dust and noise pollution caused by increased traffic. Air pollution or reduced air quality due to increased ambient PM10 concentrations and dust fallout.	Minimise dust and noise generated by traffic.	Avoid exceeding NAAQS annual ambient PM10 concentrations (40 µg/m3) and 24-hour ambient PM10 concentrations (75 µg/m3). Avoid exceeding the National Dust Standard for non-residential (1 200 mg/m2/day)	Increase frequency of road wetting during times of high expected traffic loads.	Holder, Contractor	Construction and Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
				and residential (600 mg/m2/day) areas.				
14	Plant Management	Dust and noise pollution caused by increased traffic. Air pollution or reduced air quality due to increased ambient PM10 concentrations and dust fallout.	Minimise dust and noise generated by traffic.	Avoid exceeding NAAQS annual ambient PM10 concentrations (40 µg/m3) and 24-hour ambient PM10 concentrations (75 µg/m3). Avoid exceeding the National Dust Standard for non-residential (1 200 mg/m2/day) and residential (600 mg/m2/day) areas.	Keep a record of spraying roads with water including frequency, duration, volumes, as well as length and width of road sprayed.	Holder, Contractor	Construction and Continuous	Compliance to be verified by ECO and IEA.
14	Plant Management	Dust and noise pollution caused by increased traffic. Air pollution or reduced air quality due to increased ambient PM10	Minimise dust and noise generated by traffic.	Avoid exceeding NAAQS annual ambient PM10 concentrations (40 µg/m3) and 24-hour ambient PM10	Implement and maintain good drainage on all (permanent or temporary) gravel roads within the road servitude, including a schedule of maintenance activities to reduce	Contractor	Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		concentrations and dust fallout.		concentrations (75 µg/m3). Avoid exceeding the National Dust Standard for non-residential (1 200 mg/m2/day) and residential (600 mg/m2/day) areas.	potholes and rough areas that could increase dust generation.			
14	Plant Management	Dust and noise pollution caused by increased traffic. Air pollution or reduced air quality due to increased ambient PM10 concentrations and dust fallout.	Minimise dust and noise generated by traffic.	Avoid exceeding NAAQS annual ambient PM10 concentrations (40 µg/m3) and 24-hour ambient PM10 concentrations (75 µg/m3). Avoid exceeding the National Dust Standard for non-residential (1 200 mg/m2/day) and residential (600 mg/m2/day) areas.	Ensure that vehicles always use the approved route and do not take shortcuts that may result in excess dust generation.	Holder, Contractor	Construction and Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
14	General and Hazardous Waste Management	Burning of waste as a disposal method increases the risk of veld fires caused by workers during the construction of the facility.	Minimise smoke generation from Veld fires	No waste is burned	Burning of waste is prohibited.	Contractor, SEO	Continuous	Compliance to be verified by ECO and IEA.
14	Clearing/grubbing and grading	Increase in ambient PM10 concentrations and dust fallout from construction activities, including excessive dust from clearing and grubbing.	Minimise dust generation.	Avoid exceeding NAAQS annual ambient PM10 concentrations (40 µg/m3) and 24-hour ambient PM10 concentrations (75 µg/m3). Avoid exceeding the National Dust Standard for non-residential (1 200 mg/m2/da) and residential (600 mg/m2/day) areas.	Avoid the unnecessary clearance of indigenous vegetation by restricting construction activities within the road servitude to the existing footprints and/or road design specifications (8 m wide plus 3 m for side/cut-off drain), as well as designated (30 m-long & 3 m-wide) passing lanes.	Contractor, SEO, ECO	Continuous	Compliance to be verified by ECO and IEA.
14	Clearing/grubbing and grading	Increase in ambient PM10 concentrations and dust fallout	Minimise dust generation.	Avoid exceeding NAAQS annual	Encourage natural vegetation growth in areas where a large area of soils are	Contractor, SEO	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		from construction activities, including excessive dust from clearing and grubbing.		ambient PM10 concentrations (40 µg/m3) and 24-hour ambient PM10 concentrations (75 µg/m3). Avoid exceeding the National Dust Standard for non-residential (1 200 mg/m2/da) and residential (600 mg/m2/day) areas.	exposed to the elements to reduce the amount of potential loose soil especially close to sensitive receptors.			
14	Clearing/grubbing and grading	Increase in ambient PM10 concentrations and dust fallout from construction activities, including excessive dust from clearing and grubbing.	Minimise dust generation.	Avoid exceeding NAAQS annual ambient PM10 concentrations (40 µg/m3) and 24-hour ambient PM10 concentrations (75 µg/m3). Avoid exceeding the National Dust Standard for non-residential (1 200	Adopt dust suppression such as watering in areas of the worksites in close proximity to dust sensitive receptors where earthworks have been completed.	Contractor, SEO	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
				mg/m2/da) and residential (600 mg/m2/day) areas.				
14	Clearing/grubbing and grading	Increase in ambient PM10 concentrations and dust fallout from construction activities, including excessive dust from clearing and grubbing.	Minimise dust generation.	Avoid exceeding NAAQS annual ambient PM10 concentrations (40 µg/m3) and 24-hour ambient PM10 concentrations (75 µg/m3). Avoid exceeding the National Dust Standard for non-residential (1 200 mg/m2/da) and residential (600 mg/m2/day) areas.	Re-vegetate open areas with indigenous plants as soon as practicably possible to minimize the risk of wind erosion and dust generation.	Contractor, SEO, ECO	Continuous	Compliance to be verified by ECO and IEA.
14	Clearing/grubbing and grading and Earthworks	Increase in ambient PM10 concentrations and dust fallout from construction activities, including excessive dust	Minimise dust generation.	Avoid exceeding NAAQS annual ambient PM10 concentrations (40 µg/m3) and 24-hour ambient PM10	The contractor should take into consideration predicted wind speeds from the local weather station when planning construction-related activities with a high	Contractor	Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		from clearing and grubbing.		concentrations (75 µg/m3). Avoid exceeding the National Dust Standard for non-residential (1 200 mg/m2/da) and residential (600 mg/m2/day) areas.	risk of generating dust, such as clearing and grubbing.			
14	Stockpiling and Storing (Laydown)	Increase in ambient PM10 concentrations, Total Suspended Particulate (TSP) and dust fall out emitted from storage and stockpiles.	Minimise dust generation.	Avoid exceeding NAAQS annual ambient PM10 concentrations (40 µg/m3) and 24-hour ambient PM10 concentrations (75 µg/m3). Avoid exceeding the National Dust Standard for non-residential (1 200 mg/m2/da) and residential (600 mg/m2/day) areas.	Additional control measures may include enclosures and covering or increasing the moisture content of the material.	Contractor	Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
14	Stockpiling and Storing (Laydown)	Increase in ambient PM10 concentrations, Total Suspended Particulate (TSP) and dust fall out emitted from storage and stockpiles.	Minimise dust generation.	Avoid exceeding NAAQS annual ambient PM10 concentrations (40 µg/m3) and 24-hour ambient PM10 concentrations (75 µg/m3). Avoid exceeding the National Dust Standard for non-residential (1 200 mg/m2/da) and residential (600 mg/m2/day) areas.	Dampen the stockpiles during dry or windy conditions where aggregate materials are exposed and located close to sensitive receptors.	Contractor, SEO	Construction during dry or windy conditions	Compliance to be verified by ECO and IEA.
14	Stockpiling and Storing (Laydown)	Increase in ambient PM10 concentrations, Total Suspended Particulate (TSP) and dust fall out emitted from storage and stockpiles.	Minimise dust generation.	Avoid exceeding NAAQS annual ambient PM10 concentrations (40 µg/m3) and 24-hour ambient PM10 concentrations (75 µg/m3). Avoid exceeding the National Dust	Restrict the height of stockpiles of topsoil and dry materials and gently shape these as far as practicable to minimize wind erosion and dust generation.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
				Standard for non-residential (1 200 mg/m2/da) and residential (600 mg/m2/day) areas.				
14	Stockpiling and Storing (Laydown)	Increase in ambient PM10 concentrations, Total Suspended Particulate (TSP) and dust fall out emitted from storage and stockpiles.	Minimise dust generation.	Avoid exceeding NAAQS annual ambient PM10 concentrations (40 µg/m3) and 24-hour ambient PM10 concentrations (75 µg/m3). Avoid exceeding the National Dust Standard for non-residential (1 200 mg/m2/da) and residential (600 mg/m2/day) areas.	Remove materials first from the bottom of the piles to minimize the generation of dust.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.
14	Stockpiling and Storing (Laydown)	Increase in ambient PM10 concentrations, Total Suspended	Minimise dust generation.	Avoid exceeding NAAQS annual ambient PM10	Keep the hatches on material storage containers closed when not in use.	Contractor	Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		Particulate (TSP) and dust fall out emitted from storage and stockpiles.		concentrations (40 µg/m3) and 24-hour ambient PM10 concentrations (75 µg/m3). Avoid exceeding the National Dust Standard for non-residential (1 200 mg/m2/da) and residential (600 mg/m2/day) areas.				

Assessment with mitigation:

Alternative Route No. 1 (preferred)

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

Residual Risk (feeds back into "Mitigations"):

- None.

Receiving Environment: Terrestrial and Avian Ecosystem

Description of potential impacts:

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Management Category No.	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
General and Hazardous Waste Management	Storage	Contamination	**Impact:** Unsanitary conditions surrounding infrastructure promoting the establishment of alien plants and/or invasive rodents. **Consequence:** disturbance to ecosystems	Transformation	15
General and Hazardous Waste Management	Transport	Contamination	**Impact:** Windblown litter from transporting waste **Consequence:** Contaminate the environment.	Transformation	15
General and Hazardous Waste Management	Disposal	Contamination	**Impact:** Illegal dumping **Consequence:** Smothering plant communities.	quantity	15
General and Hazardous Waste Management	Disposal	Contamination	**Impact:** Pollution of waste material **Consequence:** Degrade the environment	Transformation	15
Handling Hazardous Substances	Fuel Storage	Contamination	**Impact:** Hydrocarbon spills can contaminate fauna and flora **Consequence:** Less efficient ecological processes.	Transformation	15
Handling Hazardous Substances	Refuelling	Causing spills	**Impact:** Hydrocarbon spills can contaminate the environment. **Consequence:** Sterile dysfunctional patches of habitat.	Transformation	15
Handling Hazardous Substances	Cement Storage	Contamination	**Impact:** Cement can contaminate fauna and flora **Consequence:** Less efficient ecological processes.	Transformation	15
Handling Hazardous Substances	Mixing concrete on site	Effluent (cement slurry) discharges and contamination	**Impact:** Concrete spills can contaminate the environment. **Consequence:** Sterile dysfunctional patches of habitat.	Transformation	15
Handling Hazardous Substances	Lubricant, oil	Land contamination	**Impact:** Hydrocarbon spills can contaminate the environment. **Consequence:** Sterile dysfunctional patches of habitat.	Transformation	15
Handling Hazardous Substances	Oil-contaminated water Storage and Disposal	Contamination	**Impact:** Hydrocarbon spills can contaminate fauna and flora **Consequence:** Less efficient ecological processes.	Transformation	15
Alien Plant Management	Disturbance to natural areas	Favourable conditions for alien plant/animal recruitment.	**Impact:** Herbicides can introduce toxic chemicals into the food chain. **Consequence:** Disruption of trophic levels and disturbance to terrestrial ecosystems	Transformation	15

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Alien Plant Management	Disturbance to natural areas	Favourable conditions for alien plant/animal recruitment.	**Impact:** Recruitment of alien invasive plants. Disturbance can favour the recruitment of pioneer species and alien invasive plants, threatening habitats and alter the composition, structure and functioning of ecosystems. **Consequence:** - altered or dysfunctional ecosystem - loss of biodiversity and climate change resilience.	Transformation	15
Clearing/Grubbing and Grading	Access Road, pipeline, construction camp & staging area	Removal of vegetation	**Impact:** The physical footprint of the access road 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	16
Stockpiling and Storing (Laydown)	Mulch, topsoil, aggregate, spoil and infrastructure	Burying, smothering, impeding, sedimentation, emitting	**Impacts:** Stockpiled topsoil left for extended period. **Consequences:** seed bank becoming depleted and increased growth/dispersal of alien plants.	Transformation	16
Clearing/Grubbing and Grading	Access Road, pipeline, construction camp & staging area	Removal of vegetation	**Impact:** Removal of vegetation causing soil erosion. Loss of indigenous seed source due to vegetation clearing. **Consequence:** Soil erosion leads to ecosystem degradation.	Transformation	17

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

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

Impact 15 (Pollution – chemical and hydrocarbon)

- The Eastern Upper Karoo is classified as "Least Threatened" with moderate to high soil erosion and the presence of the common and widespread alien plant Medicago laciniata (Mucina and Rutherford, 2011).
- The soil profile is generally thin, less than 1m within the area and the nature of the bedrock is consistent across the footprint.
- Electricity for the construction camp will be sourced from two (2) 50 kVA (minimum) mobile generators with an integrated diesel tank (fuel capacity ± 200 litres), e.g., one will be used as backup during service periods and allow the other to rest. The integrated diesel tanks will be supplied fuel from a bunded 5 to 10 m3 aboveground diesel tank. A filling station alongside the aboveground diesel tank and/or a mobile fuel

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bowser will supply plant on site for general use. The generators, aboveground fuel tank and filling station will be located at the construction camp.

Impact 16 (Terrestrial Biodiversity)

- The access road occurs within Ecological Support Areas while the eastern section of the road lies within CBA 1 and CBA 2 areas associated with the Brak Rivier. In terms of other broad-scale planning studies, the site does not fall within a National Protected Areas Expansion Strategy Focus Area (NPAES), indicating that the area has not been identified as an area of exceptional biodiversity or of significance for the long-term maintenance of broad-scale ecological processes and climate change buffering within the region.
- The combination of rocky hills and plains creates a diversity of habitats that is important for fauna and the diversity of these areas is higher than areas without open plains. There is a low ridge with runs through the area in the vicinity of the Main Transmission Station (MTS) of the site and which is not considered suitable for development as the hills are significant for biodiversity and ecological functioning.

Impact 16 (Ecosystem/Vegetation Type)

- The vegetation consists of shrubland dominated by dwarf Karoo shrubs, grasses and Acacia mellifera subsp. detinens, and other low trees particularly on the sandy soils. The vegetation is flat to gently sloping with isolated hills of Upper Karoo Hardeveld in the south and Vaalbos Rocky Shrubland in the northeast and with many interspersed pans (Mucina & Rutherford 2006).
- The access road will be rebuilt and built to a width of 8 m, allowing for the roadbed preparation including the surface of the road and its shoulders, and excluding up to 3 m for the side/cut-off drain, with 1 m on either side of the road for the verge to a fence line. However, temporary 30 m passing lanes will increase the servitude width from 19 m to 22 m to allow for passing should this be required during construction. The contractor will need an adjacent and parallel working servitude width of 3 m for the movement of construction vehicles and/or providing a diversion lane for farm traffic.
- Ideally, SAE will be working with one fully wrapped EPC tender, in which case the construction camp will be used for all construction fronts, including the MTS, Dx, solar field and access road.

Impact 17 (Surface Water Hydrology)

- The project area falls within quaternary catchment D62D and the Orange Water Management Area.
- The average rainfall is in the order of 320 mm/yr. Due to evaporation being about 85% more than local rainfall, non-perennial streams and rivers will only have water when there are flooding events (i.e., 1:2, 1:5, 1:50 and 1:100-year flood events). Average monthly rainfall peaks from October (23 mm) to April (39.4 mm). Alternatively, the least rainfall falls between May (18.9 mm) and September (11.6 mm). Runoff from natural (unmodified) catchments in Catchment D62D is equivalent to 3.1 mm/yr over the surface area. This is equal to approximately

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0.9% of the MAP and amounts to approximately 7.4 Mm³/yr over the surface of the quaternary catchment. Runoff is directly related to rainfall intensity, and longer precipitation events. Peak runoff is from December (0.2 mm) to April (0.4 mm). Alternatively, the least runoff occurs between May (0.1 mm) and November (0.1 mm) (Hydrological Assessment prepared by Hendrik Botha and dated 10 January 2023).

- Although the presence of the buffer zone seems futile as the upgrading of the access road is permissible linear infrastructure activities that will take place in in a broad strip (or corridor) through the watercourses and associated buffers, the intention of the buffer is to emphasize the importance and sensitivity of the applicable drainage systems. That is why the area included between the buffer zones should have explicit and very strict biodiversity conservation management measures and the operating teams should be aware of this. A level of best practices will be imposed in the riverine environment when the proposed construction gets under way and the process will be overseen by the project management (Aquatic Biodiversity Impact Assessment, January 2023).

Assessment without mitigation:

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

Alternative Site No. 1 (preferred)

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

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

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

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

- The construction of linear infrastructure across parts of the ephemeral drainage system, should be restricted to the dry winter months (e.g., May 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:

- Aquatic Biodiversity Impact Assessment, Section 21(c) & (i) Risk Assessment and Wetland Delineation Verification, prepared by Dr Andrew Deacon and dated January 2023.
- Hydrological Assessment, Version – Final 1, prepared by Hendrik Botha and dated 10 January 2023 (GCS Ref – 22 - 1054).
- Environmental Impact Assessment for the proposed Soventix Solar PV Project, De Aar, Northern Cape: Fauna & Flora Specialist EIA Report prepared by Simon Todd Consulting dated May 2017.

Mitigations:

Impact Management Outcome(s):

- Preserve ecosystem function and ecological processes.
- Good waste management
- Sanitary conditions and good waste management.
- Responsible disposal of waste spoil.
- Adopt an integrated pest management (IPM) approach to avoid the use of chemical pesticides and minimize risks to human health and the environment while maintaining economically viable management.
- Prevent and control alien plant recruitment.
- Zero disturbance outside the existing District Road servitude.
- Minimize habitat loss.

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- Prevent and control alien plant recruitment.
- Promote post-disturbance recovery of cleared areas.

Targets:

- Accidental spills are remediated.
- Storage of hazardous materials is contained.
- No signs of dumping and No litter
- Waybills
- No signs of unsanitary conditions or of increased rodent populations
- Covered trucks
- No illegal dumping
- Integrated Weed Management (IWM) plan.
- FSC Pesticides Policy adopted
- Best practise is used when undertaking alien plant control
- No alien invasive infestations in or from construction footprint.
- No construction creep outside fenced servitude.
- No alien plants on stockpiles
- Vegetated patches retain in cleared areas (where possible).

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
15	Handling hazardous substances	Hydrocarbon spills can contaminate the environment.	Preserve ecosystem function.	Accidental spills are remediated.	Drip trays should be placed under any activity requiring active lubrication or oiling.	Contractor	Construction	Compliance to be monitored by the SEO and verified by ECO and IEA.
15	Handling hazardous substances	Hydrocarbon spills can contaminate the	Preserve ecosystem function.	Accidental spills are remediated.	Spill clean-up kits should be available on site for immediate remediation of any spills and removal	Holder, Contractor	Construction and Continuous	Compliance to be monitored by the SEO and verified by

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		environment.			of contaminated soils.			ECO and IEA.
15	Handling hazardous substances	Cement can contaminate fauna and flora	Preserve ecological processes.	Storage of hazardous materials is contained.	All hazardous materials should be stored in the appropriate manner to prevent contamination of the site.	Holder, Contractor	Construction and Continuous	Compliance to be monitored by the SEO and verified by ECO and IEA.
15	Handling hazardous substances	Hydrocarbon spills can contaminate the environment.	Preserve ecosystem function.	Accidental spills are remediated.	Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.	Holder, Contractor	Construction and Continuous	Compliance to be monitored by the SEO and verified by ECO and IEA.
15	Handling hazardous substances	Hydrocarbon spills can contaminate fauna and flora	Preserve ecological processes.	Storage of hazardous materials is contained.	All hazardous materials should be stored in the appropriate manner to prevent contamination of the site.	Holder, Contractor	Construction and Continuous	Compliance to be monitored by the SEO and verified by ECO and IEA.
15	General and hazardous waste management	Pollution of waste material	Good waste management	No signs of dumping	No illegal dumping of waste.	Holder, Contractor	Construction and Continuous	Compliance to be monitored by the SEO and verified by ECO and IEA.
15	General and hazardous waste management	Pollution of waste material	Good waste management	No litter	No littering.	Holder, Contractor	Construction and Continuous	Compliance to be monitored by the SEO and

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
								verified by ECO and IEA.
15	General and hazardous waste management	Pollution of waste material	Good waste management	Waybills	General Waste shall be disposed of at a licensed municipal landfill, whereas hazardous waste will be disposed of at a licensed hazardous waste disposal facility.	Holder, Contractor	Construction and Continuous	Compliance to be monitored by the SEO and verified by ECO and IEA.
15	General and hazardous waste management	Unsanitary conditions surrounding infrastructure promoting the establishment of alien plants and/or invasive rodents.	Sanitary conditions and good waste management.	No signs of unsanitary conditions or of increased rodent populations	Waste management must be a priority and all waste must be collected and stored adequately. It is recommended that all waste be removed from site on a weekly basis to prevent rodents and pests entering the site.	Holder, Contractor	Construction and Continuous	Compliance to be verified by ECO and IEA.
15	General and hazardous waste management	Windblown litter from transporting waste can contaminate the environment.	Sanitary conditions and good waste management.	Covered trucks	Trucks transporting waste must be covered.	Holder, Contractor	Construction and Continuous	Compliance to be monitored by the SEO and verified by ECO and IEA.
15	General and hazardous waste management	Illegal dumping	Responsible disposal of waste spoil.	No illegal dumping	Excavated material or aggregate is to be re-used if suitable.	Contractor	Construction and Continuous	Compliance to be verified by ECO and IEA.
15	General and hazardous waste management	Illegal dumping	Responsible disposal of waste spoil.	No illegal dumping	If the material cannot be re-used, the spoil should be used as fill material, rehabilitation of the site, or removed from site to	Contractor	Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					a suitable and approved location (a licensed waste disposal facility) by the contractor under his contract.			
15	General and hazardous waste management	Illegal dumping	Responsible disposal of waste spoil.	No illegal dumping	All spoil from earthworks or excavations should be re-used or removed from the site as soon as is practically possible.	Contractor	Construction	Compliance to be verified by ECO and IEA.
15	Alien Plant Management	Herbicides can introduce toxic chemicals into the food chain.	Adopt an integrated pest management (IPM) approach to avoid the use of chemical pesticides and minimize risks to human health and the environment while maintaining economically viable management.	No alien plants on site	Immediately control any alien invasive plant in its entirety (including roots and propagating material) upon being identified on site, using preferably mechanical control methods as opposed to chemical spraying.	Contractor, SEO	Construction and Continuous	Compliance to be verified by ECO and IEA.
15	Alien Plant Management	Herbicides can introduce toxic chemicals into the food chain.	Adopt an integrated pest management (IPM) approach to avoid the use of chemical pesticides and minimize risks to human health and the environment while maintaining economically viable management.	Integrated Weed Management (IWM) plan.	Develop an integrated approach to weed management, combining all appropriate weed control options into an integrated weed management (IWM) plan. Methods of control include herbicide application, mechanical removal, mulch or weed mat, shading, manual control, slashing, ring barking, and controlled grazing.	Holder	Construction and Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
15	Alien Plant Management	Herbicides can introduce toxic chemicals into the food chain.	Adopt an integrated pest management (IPM) approach to avoid the use of chemical pesticides and minimize risks to human health and the environment while maintaining economically viable management.	FSC Pesticides Policy adopted	Adopt the FSC Pesticides Policy (FSC-POL-30-001 V3-0 EN) to regulate the use of chemical pesticides, if after having considered all available pest management strategies, the use of chemical pesticides may be identified as the most suitable control.	Holder, Contractor	Construction and Continuous	Compliance to be verified by ECO and IEA.
15	Alien Plant Management	Herbicides can introduce toxic chemicals into the food chain.	Adopt an integrated pest management (IPM) approach to avoid the use of chemical pesticides and minimize risks to human health and the environment while maintaining economically viable management.	Best practise is used when undertaking alien plant control	Give preference, as a matter of principle, to: (a) non-chemical methods over chemical pesticides, (b) chemical pesticides not listed in the FSC lists of Highly Hazardous Pesticides (HHPs) over those listed in the FSC lists of HHPs, and (c) FSC restricted HHPs over FSC highly restricted HHPs.	Contractor	Construction and Continuous	Compliance to be verified by ECO and IEA.
15	Alien Plant Management	Recruitment of alien invasive plants. Disturbance can favour the recruitment of pioneer species and alien invasive plants,	Prevent and control alien plant recruitment.	No alien invasive infestations in or from construction footprint.	Regular monitoring for alien plants within the road footprint as well as adjacent areas which receive runoff from the road as these are also likely to be prone to invasion problems.	Contractor, SEO, ECO	Construction and Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		threatening habitats and alter the composition, structure and functioning of ecosystems.						
15	Alien Plant Management	Recruitment of alien invasive plants. Disturbance can favour the recruitment of pioneer species and alien invasive plants, threatening habitats and alter the composition, structure and functioning of ecosystems.	Prevent and control alien plant recruitment.	No alien invasive infestations in or from construction footprint.	Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.	Contractor, SEO, ECO	Construction and Continuous	Compliance to be verified by ECO and IEA.
16	Clearing/grubbing and grading	The physical footprint of the access road will result in a loss of local terrestrial habitat	Zero disturbance outside the existing District Road servitude.	No construction creep outside fenced servitude.	All construction on the district road section, including access for the public, will remain within the fenced road reserve.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
16	Clearing/grubbing and grading	The physical footprint of the access road will	Zero disturbance outside the existing District Road servitude.	No construction creep outside fenced servitude.	The road servitude shall not be cleared in its entirety. The clearance of indigenous vegetation	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		result in a loss of local terrestrial habitat			shall be restricted to the physical footprint of the road and side/cut-off drain and associated infrastructure, such as passing lanes (with the exception of temporary clearance and/or disturbance associated with 'normal' construction-related activities).			
16	Clearing/grubbing and grading	The physical footprint of the access road will result in a loss of local terrestrial habitat	Minimize habitat loss.	No construction creep outside fenced servitude.	The clearance or disturbance of indigenous vegetation resulting from 'normal' construction-related activities shall be rehabilitated immediately upon the completion of those activities on a site, in accordance with a rehabilitation plan and/or the Bare Patch Restoration Protocol (Appendix C).	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
16	Stockpiling and Storing (Laydown)	Stockpiled topsoil left for extended period.	Prevent and control alien plant recruitment.	No alien plants on stockpiles	Alien plant growth on stockpiled topsoil must be uprooted manually by hand.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.
17	Clearing/grubbing and grading	Removal of vegetation causing soil erosion.	Promote post-disturbance recovery of cleared areas.	Vegetated patches retain in cleared areas (where possible).	A low cover of vegetation should be left intact wherever possible within the construction footprint to bind the soil,	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		Loss of indigenous seed source due to vegetation clearing.			prevent erosion, create a seed source for adjacent cleared areas and promote post-disturbance recovery of an indigenous ground cover.			
17	Clearing/grubbing and grading	Removal of vegetation causing soil erosion. Loss of indigenous seed source due to vegetation clearing.	Promote post-disturbance recovery of cleared areas.	Vegetated patches retain in cleared areas (where possible).	These vegetated patches should be clearly demarcated and physically protected from any disturbance.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

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

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

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

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Residual Risk (feeds back into "Mitigations"):

- None

Receiving Environment: Aquatic Ecosystem

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Plant Management	Driving & Transport	Damage to the roads or environment	**Impact:** Altered surface water flow patterns, e.g., changing sheet flow (natural open system) to concentrated flows leads to erosion. **Consequence:** Increased suspended solids, siltation in watercourses and soil erosion.	Transformation	19
Plant Management	Operating & Parking Plant	Causing spills	**Impact:** Operation of heavy equipment in a channel bed can directly destroy spawning habitat for fish and macro-invertebrate habitat and produce increased turbidity (lower dissolved oxygen) and increased suspended sediment downstream. **Consequence:** Alter aquatic ecosystem structure and function (indirect).	Transformation	18
Plant Management	Operating & Parking Plant	Causing spills	**Impact:** Operating construction equipment within a watercourse and floodplain can cause water pollution/contamination from accidental chemical releases associated leaking machinery or spills. **Consequence:** Poisoning aquatic ecosystems, disrupting food chains and life cycles.	Transformation	18
General and Hazardous Waste Management	Storage	Contamination	**Impacts:** Altered aquatic ecosystem structure and function. **Consequences:** pollution of watercourse	Transformation	18
General and Hazardous Waste Management	Disposal	Contamination	**Impact:** Chemical pollution of the water resources. **Consequence:** Loss of aquatic flora and fauna	Transformation	18
Handling Hazardous Substances	Refuelling	Causing spills	**Impact:** Chemical pollution of the water resources. **Consequence:** Loss of aquatic flora and fauna	Transformation	18

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Handling Hazardous Substances	Mixing concrete on site	Effluent (cement slurry) discharges and contamination	**Impact:** Chemical pollution of the water resources. **Consequence:** Loss of aquatic flora and fauna	Transformation	18
Alien Plant Management	Disturbance to natural areas	Favourable conditions for alien plant/animal recruitment.	**Impact:** Spreading invasive non-native plants into degraded areas. **Consequence:** Competing with indigenous plant species	Transformation	18
Alien Plant Management	Disturbance to natural areas	Favourable conditions for alien plant/animal recruitment.	**Impact:** Water and soil pollution by chemicals Herbicides can enter waterbodies either directly through spray or spray drift, or they can move into waterbodies via surface water run-off or leaching and sub-surface draining. **Consequence:** disturbance to aquatic ecosystems	Transformation	18
Stormwater Management and Erosion Control	NA	NA	**Impact:** Vegetation clearance of the project footprint for the access road and underground pipelines close to watercourses will be subject to erosion. **Consequence:** Erosion will lead to sedimentation or siltation and an increase in turbidity of watercourses.	Transformation	19
Stormwater Management and Erosion Control	NA	NA	**Impact:** Damage to farm infrastructure **Consequence:** Economic costs in replacing damaged infrastructure.	Fragmentation	18
Security	NA	Influx of contractors and workers into the area.	**Impact:** Damage to farm infrastructure **Consequence:** Economic costs in replacing damaged infrastructure.	Fragmentation	18
Linear Infrastructure Crossings	Roads	Grading existing & new roads/Removal of Vegetation /Sedimentation	**Impacts:** The crossing alignments will result in the loss of aquatic or river habitat equivalent to the size of the development footprint or in the case of construction creep, greater. **Consequence:** - reduced habitat for aquatic fauna and Aves (direct) - reduced productivity and carrying capacity (direct)	quantity	18

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Linear Infrastructure Crossings	Roads	Grading existing & new roads/Removal of Vegetation /Sedimentation	**Impact:** Habitat loss and fragmentation of watercourse areas because of infrastructure installation (roads). **Consequences:** Destroy existing habitat but also displace bird species from large areas of natural habitat. This specifically has a greater impact on bird species restricted to a specific habitat and its requirements.	Fragmentation	18
Linear Infrastructure Crossings	Roads	Importing material/ Shaping/Diversion Works/Sedimentation /Erosion	**Impact:** River diversion works may result in sedimentation and increased turbidity of the ephemeral drainage system. **Consequence:** Turbid waters reduce light penetration, decreasing photosynthesis and primary production, reducing food availability for aquatic organisms higher up the food chain. Alter feeding and breeding behaviour (lowering vigour and reproductivity) of certain macroinvertebrates, species abundance and/or composition and aquatic ecosystem functioning (indirect). Sensitive species may be permanently eliminated if the source of the suspended solids is not removed.	Transformation	18
Linear Infrastructure Crossings	Roads	Installing culverts/Watercourse contamination	**Impact:** Operation of heavy equipment in a channel bed can directly destroy spawning habitat for fish and macro-invertebrate habitat and produce increased turbidity (lower dissolved oxygen) and increased suspended sediment downstream. **Consequence:** Alter aquatic ecosystem structure and function.	Transformation	18
Linear Infrastructure Crossings	Roads	Installing culverts/Watercourse contamination	**Impact:** Poorly maintained vehicles can result in hydrocarbon and other pollution. Hydrocarbon spills, during construction in the watercourse may contaminate the watercourse/reduce the quality of the water. **Consequence:** Sterile habitat for fauna and flora (direct). Alter feeding and breeding behaviour (lowering vigour and reproductivity), species composition and aquatic ecosystem functioning (indirect).	Transformation	18

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Linear Infrastructure Crossings	Underground Pipelines	Clearing & Grubbing/Removal of Vegetation/Sedimentation	**Impacts:** The crossing alignments will result in the loss of aquatic or river habitat equivalent to the size of the development footprint or in the case of construction creep, greater. **Consequence:** - reduced habitat for aquatic fauna and Aves (direct) - reduced productivity and carrying capacity (direct)	quantity	18
Linear Infrastructure Crossings	Underground Pipelines	Clearing & Grubbing/Removal of Vegetation/Sedimentation	**Impact:** Habitat loss and fragmentation of watercourse areas due to displacement because of infrastructure installation (underground pipelines). **Consequences:** Destroy existing habitat but also displace bird species from large areas of natural habitat. This specifically has a greater impact on bird species restricted to a specific habitat and its requirements.	Fragmentation	18
Linear Infrastructure Crossings	Underground Pipelines	Importing material/ Trenching/Diversion Works/Sedimentation /Erosion	**Impact:** River diversion works may result in sedimentation and increased turbidity of the ephemeral drainage system. **Consequence:** Turbid waters reduce light penetration, decreasing photosynthesis and primary production, reducing food availability for aquatic organisms higher up the food chain. Alter feeding and breeding behaviour (lowering vigour and reproductivity) of certain macroinvertebrates, species abundance and/or composition and aquatic ecosystem functioning (indirect). Sensitive species may be permanently eliminated if the source of the suspended solids is not removed.	Transformation	18

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Linear Infrastructure Crossings	Underground Pipelines	Installing pipes/Watercourse contamination	**Impact:** Operation of heavy equipment in a channel bed can directly destroy spawning habitat for fish and macro-invertebrate habitat and produce increased turbidity (lower dissolved oxygen) and increased suspended sediment downstream. **Consequence:** Alter aquatic ecosystem structure and function.	Transformation	18
Clearing/Grubbing and Grading	Access Road, pipeline, construction camp & staging area	Removal of vegetation	**Impact:** Habitat loss and fragmentation of watercourse areas because of infrastructure installation (roads, fences and sub surface pipelines). **Consequences:** Destroy existing habitat but also displace bird species from large areas of natural habitat. This specifically has a greater impact on bird species restricted to a specific habitat and its requirements.	Fragmentation	18
Earthworks	Access Road, pipeline, construction camp & staging area	Creating bare surfaces susceptible to erosion, corrugations, potholes and puddles.	**Impact:** Clearing of vegetation for the construction of access roads can cause sediment load in the water courses before the cleared areas can be stabilized. Roads concentrate surface water run-off, increasing its velocity and potential to erode river or stream banks at crossings. **Consequence:** -Erosion of banks, ecosystem degradation and dysfunction. -Sedimentation of a watercourse.	Transformation	19
Stockpiling and Storing (Laydown)	Mulch, topsoil, aggregate, spoil and infrastructure	Burying, smothering, impeding, sedimentation, emitting	**Impact:** Stockpiles and overburden left in the river or floodplain can alter channel hydraulics during high flows, e.g., stockpiles left in the river channel can also deflect water to the other side of the riverbank. **Consequence:** Excessive bank erosion, undercutting of property and loss of riparian vegetation on one side of the river (direct).	Transformation	19

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Stockpiling and Storing (Laydown)	Mulch, topsoil, aggregate, spoil and infrastructure	Burying, smothering, impeding, sedimentation, emitting	**Impact:** Erosion and sedimentation of watercourses due to unforeseen circumstances (i.e., bad weather). **Consequence:** Sedimentation of watercourses.	Transformation	19
Stockpiling and Storing (Laydown)	Mulch, topsoil, aggregate, spoil and infrastructure	Burying, smothering, impeding, sedimentation, emitting	**Impact:** There is a potential for erosion and sedimentation of the surroundings or ephemeral drainage lines **Consequence:** Sedimentation of a watercourse.	Transformation	19
Clearing/Grubbing and Grading	Access Road, pipeline, construction camp & staging area	Removal of vegetation	**Impact:** Disturbed or exposed sites are vulnerable to erosion. **Consequence:** Erosion can cause terrestrial and aquatic ecosystem degradation/dysfunction	Transformation	19
Linear Infrastructure Crossings	Underground Pipelines	Clearing & Grubbing/Removal of Vegetation/Sedimentation	**Impact:** Vegetation clearance of the project footprint for the access road and underground pipelines close to watercourses will be subject to erosion. **Consequence:** Erosion will lead to sedimentation or siltation and an increase in turbidity of watercourses.	Transformation	19
Linear Infrastructure Crossings	Roads	Grading existing & new roads/Removal of Vegetation /Sedimentation	**Impact:** Vegetation clearance of the project footprint for the access road and underground pipelines close to watercourses will be subject to erosion. **Consequence:** Erosion will lead to sedimentation or siltation and an increase in turbidity of watercourses.	Transformation	19

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

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

Impact 18 (Aquatic Ecosystem Loss)

- The drainage systems are predominantly classified as ephemeral drainage lines and not wetlands.
- The project area contains National Freshwater Ecosystem Priority Areas (NFEPA) "Wetlands and Estuaries" and "Rivers", including the floodplain areas of the Brak River and its tributaries (non-perennial drainage streams).

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- The Brak River and a tributary (unnamed FEPA drainage line D62D – 05610 SQ bounding the Sun Central 1 development) are the only recognised water courses impacted by Alternative Route No. 1 (Hydrology Assessment, 2023)
- The study area falls within a CBA1 because the Brak River has been identified as having FEPA River Ecosystem Type status according to the Freshwater Ecosystem Protected Areas (FEPA) map for the area (Phase 1 Aquatic Report October 2017) and all FEPA prioritised rivers and wetlands have a minimum category of CBA1. All FEPA prioritised wetland clusters have minimum category of CBA2, and natural non-FEPA wetlands and larger rivers have minimum category of ESA (Avifauna Final EIA Report prepared by Sam Laurence of Enviro-Insight cc, dated October 2022).
- The unnamed FEPA drainage line D62D – 05610 SQ (a tributary of the Brak River) is in a good condition despite some weirs and diversion walls in the catchment.
- Ephemeral rivers are particularly vulnerable to changes in hydrology, as they are specifically adapted to brief periods of inundation and flow. Consequently, pollutants and sediments entering these watercourses are not regularly diluted or flushed out of the catchment, leading to a lack of resilience to pollution, erosion, and sedimentation (Aquatic Assessment prepared by Andrew Deacon, October 2017).
- Five distinct water resource types were recognised in the project area. Not all water resource types, specifically the alluvial floodplains, are technically a 'watercourse':
    - Brak River drainage system.
    - Large ephemeral tributaries.
    - Smaller ephemeral tributaries.
    - Alluvial floodplains:
        - Alluvial fans.
        - Braided channel: bar and swale topography.
        - Floodplain flats.
    - Headwater drainage lines
- The common reed Phragmites australis dominates the instream habitat along the Brak River, while there is very little discernible riparian vegetation. The ephemeral streams have no visible aquatic vegetation. Phragmites australis reeds grow in the beds of several of the ephemeral rivers.
- The more seasonal and ephemeral ecosystems provide aquatic habitat to a diverse array of faunal species that depend on brief periods of inundation for hatching, mating, feeding and refuge.
- A great number of other organisms are not confined to these temporary systems, but derive crucial benefits from them, like migratory birds and many invertebrates that migrate from permanent to temporary habitats on a regular basis.
- Erosion and sedimentation are important ecological processes in the Karoo. Loss and fragmentation of habitat disrupt these processes. Erosion is a particularly high risk on steep slopes, and in drainage lines that lack channel features and are naturally adapted to lower energy runoff with dispersed surface flows, and naturally less turbid freshwater systems (Aquatic Biodiversity Impact Assessment, January 2023).

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- The access road will be rebuilt and built to a width of 8 m, allowing for the roadbed preparation including the surface of the road and its shoulders, and excluding up to 3 m for the side/cut-off drain, with 1 m on either side of the road for the verge to a fence line. However, temporary 30 m passing lanes will increase the servitude width from 19 m to 22 m to allow for passing should this be required during construction. The contractor will need an adjacent and parallel working servitude width of 3 m for the movement of construction vehicles and/or providing a diversion lane for farm traffic.
- A concern is the waterflow around the wetland and the potential impact on the road.
- The movement of workers and vehicles on the site could cause damage to farm infrastructure (e.g., fencing, water troughs and gates), during construction and operation (Access Road and Part 2 Amendment Addendum to Social Impact Assessment Report prepared by Equispectives Research & Consulting Services dated January 2023).
- Farm owners are concerned about the impact of fences on water flow during heavy rain. If fences are not kept clear of debris, there is a risk that it can affect the waterflow into dams in the area, which is critical in a dry area like the Karoo (Access Road and Part 2 Amendment Addendum to Social Impact Assessment Report prepared by Equispectives Research & Consulting Services dated January 2023).
- The generation of excessive wind-blown dust could 'choke' the ecologically sensitive ephemeral drainage line system (pers. comm. Sam Laurence).The recovery of a stream from sediment deposition is dependent on the elimination of the sediment source and the potential for the deposited material to be flushed out by stream flow.

Impact 19 (Surface Water Hydrology)

- The project area is located within a Strategic Water Source Area (Screening Report).
- The average rainfall is in the order of 320 mm/yr. Due to evaporation being about 85% more than local rainfall, non-perennial streams and rivers will only have water when there are flooding events (i.e., 1:2, 1:5, 1:50 and 1:100-year flood events). Average monthly rainfall peaks from October (23 mm) to April (39.4 mm). Alternatively, the least rainfall falls between May (18.9 mm) and September (11.6 mm).
- Runoff from natural (unmodified) catchments in Catchment D62D is equivalent to 3.1 mm/yr over the surface area. This is equal to approximately 0.9% of the MAP and amounts to approximately 7.4 Mm^3/yr over the surface of the quaternary catchment. Runoff is directly related to rainfall intensity, and longer precipitation events. Peak runoff is from December (0.2 mm) to April (0.4 mm). Alternatively, the least runoff occurs between May (0.1 mm) and November (0.1 mm) (Hydrological Assessment prepared by Hendrik Botha and dated 10 January 2023).
- The Ecological Importance and Sensitivity Category (EISC) of the Brak River drainage system and large ephemeral tributaries was classified as "High" (Aquatic Biodiversity Impact Assessment, January 2023).
- Erosion and sedimentation are important ecological processes in the Karoo. Loss and fragmentation of habitat disrupt these processes. Erosion is a particularly high risk on steep slopes, and in drainage lines that lack channel features and are naturally adapted to lower energy runoff with dispersed surface flows, and naturally less turbid freshwater systems (Aquatic Biodiversity Impact Assessment, January 2023). During the rainy season terrain mobility on high clay soils in low lying areas with drainage lines will be difficult and might increase soil erosion

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when drainage lines are disturbed. However, it is important to note that rainfall is highly unpredictable with frequent droughts for the project areas (Aquatic Biodiversity Impact Assessment, January 2023).

- During the rainy season terrain mobility on high clay soils in low lying areas with drainage lines will be difficult and might increase soil erosion when drainage lines are disturbed. However, it is important to note that rainfall is highly unpredictable with frequent droughts for the project areas (Aquatic Biodiversity Impact Assessment, January 2023).

Assessment without mitigation:

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

Alternative Site No. 1 (preferred)

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

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

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

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- The construction of linear infrastructure across parts of the ephemeral drainage system, should be restricted to the dry winter months (e.g., May to September) 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:

- Avifauna Final EIA Report prepared by Enviro-Insight CC (Sam Laurence and A.E. van Wyk) dated October 2022.
- "Proposed Development of a 225 MW Solar PV Plant Farms in the Hanover District, Northern Cape", The Present Ecological State and Risk Assessment for the Drainage System at the Proposed Solar PV Plant: Water Use License (WUL) Applications, prepared by Andrew Deacon (Pr. Sci. Nat. 116951) and dated October 2017.
- Aquatic Biodiversity Impact Assessment, Section 21(c) & (i) Risk Assessment and Wetland Delineation Verification Report prepared by Dr Andrew Deacon dated August 2022.
- Aquatic Biodiversity Impact Assessment, Section 21(c) & (i) Risk Assessment and Wetland Delineation Verification, prepared by Dr Andrew Deacon and dated January 2023.
- Environmental Impact Assessment for the proposed Soventix Solar Pv Project, De Aar, Northern Cape: Fauna & Flora Specialist EIA Report prepared by Simon Todd Consulting dated May 2017.
- Hydrological Assessment for additional listed activities and water uses relating to the development of the Sun Central Cluster 1 300 MW Solar PV facility (previously known as Phase 1) in the Northern Cape", Version – Final 1, prepared by Hendrik Botha and dated 09 January 2023 (GCS Ref – 22 - 1054).
- Access Road and Part 2 Amendment Addendum to Social Impact Assessment Report prepared by Equispectives Research & Consulting Services dated January 2023.

Mitigations:

Impact Management Outcome(s):

- Avoid spillage onto soil or into water while mixing or using chemicals.
- Prevent contamination of ecologically sensitive environments.
- Prevent loss of biodiversity and non-targeted plant species (damage to indigenous trees).
- Responsible waste storage and management
- No incidents of chemical pollution of watercourses.
- Maintain the unnamed FEPA drainage line D62D – 05610 SQ (a tributary of the Brak River) in a good ecological condition.
- Minimise dust generation.
- Contain construction and avoid the unnecessary loss of aquatic habitat.

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- Sensitive avifauna habitats are protected and maintained.
- Preserve aquatic ecosystem structure and function, as well as riparian habitat.
- Maintain the Present Ecological State of the Brak River drainage system, large and small ephemeral tributaries, alluvial floodplains, and headwater drainage lines.
- Reduce sedimentation of watercourses
- Minimise erosion of disturbed sites from storm water run-off.
- Avoid sedimentation of watercourses and soil movement from designated stockpiles.

Targets:

- Weed and invasive alien species control plan
- No mature (bearing seed) alien invasive plants observed within the road servitude, staging area or construction camp.
- Best practise is used when undertaking alien plant control
- Waste storage area, waste is disposed of correctly and No litter
- Waybills
- Responsible refuelling and Spill kit on the mobile fuel bowser
- Refuelling using the mobile fuel bowers outside of sensitive areas
- Concrete batching is outside of sensitive areas
- No vehicles outside of demarcated construction servitudes
- Washing plants are outside 100 m watercourse buffer
- No repairs on site except under an emergency
- Emergency protocol. Drip trays at emergency repairs
- Avoid emergency repairs within 100m of a watercourse
- No overnight parking within 100m of watercourse
- Refuel area have a bund to 110% volume
- Drips trays are not overflowing
- Fences are clear of debris
- Topsoil is removed during dry season
- No leaking plant, machinery or equipment on site and No parking outside of designated areas
- No exposed contaminated soil on site
- No vehicles or pedestrian access beyond demarcated areas

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- Vegetation removed only prior to earthworks/construction
- Active rehabilitation. Rehabilitated areas are cordoned off.
- Use of existing farm roads and New routes are minimal (only where necessary) and plans are approved by the ECO.
- Roads do not impeded flow
- Limited fill roads. Raised bridges and culverts
- Layout down area more than 35m from wetland
- No unnecessary equipment within the wetland
- Silt fences
- Timber mats
- Pipelines are below subsurface flows with Zero interruption to flow
- Pipeline construction during dry season
- Pipeline corridors are no more than 5m wide
- Method statement
- Topsoil is backfilled in the correct order.
- No surplus spoil stored on site
- No construction creep.
- Aggregate is protected from any flowing water
- No dispersive soils used
- No off-road driving immediately after rainfall
- Stormwater management measures in place and good working order.
- No vegetation clearing during rainfall season
- No bare areas
- Stormwater control measures
- No cleared areas exposed for extended periods.
- Vegetation is not cleared from the road verge.
- Construction Method Statements for crossings.
- Roads are returned to a usable state
- Construction during dry winter months
- Stockpiles are stored correctly, covered and Sediment traps (if applicable)

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
18	Alien Plant Management	Spreading invasive non-native plants into degraded areas.	Maintain the Present Ecological State of the Brak River drainage system, large and small ephemeral tributaries, alluvial floodplains, and headwater drainage lines.	Weed and invasive alien species control plan	A weed and alien invasive species control plan should be implemented during the contract period.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
18	Alien Plant Management	Spreading invasive non-native plants into degraded areas.	Maintain the Present Ecological State of the Brak River drainage system, large and small ephemeral tributaries, alluvial floodplains, and headwater drainage lines.	No mature (bearing seed) alien invasive plants observed within the road servitude, staging area or construction camp.	Control involves killing the plants present, killing the seedlings which emerge, and establishing and managing an alternative plant cover to limit re-growth and re-invasion.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.
18	Alien Plant Management	Spreading invasive non-native plants into degraded areas.	Maintain the Present Ecological State of the Brak River drainage system, large and small ephemeral tributaries, alluvial floodplains, and headwater drainage lines.	No mature (bearing seed) alien invasive plants observed within the road servitude, staging area or construction camp.	Any materials brought into construction sites should be from sources free of invasive alien species.	Contractor	Construction	Compliance to be verified by ECO and IEA.

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18	Alien Plant Management	Spreading invasive non-native plants into degraded areas.	Maintain the Present Ecological State of the Brak River drainage system, large and small ephemeral tributaries, alluvial floodplains, and headwater drainage lines.	No mature (bearing seed) alien invasive plants observed within the road servitude, staging area or construction camp.	Clearing of invasive alien plants must take place coupled with the sowing of seeds of indigenous species to stabilise disturbed habitats.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
18	Alien Plant Management	Water and soil pollution by chemicals Herbicides can enter waterbodies either directly through spray or spray drift, or they can move into waterbodies via surface water run-off or leaching and sub-surface draining.	Avoid spillage onto soil or into water while mixing or using chemicals. Prevent contamination of ecologically sensitive environments. Prevent loss of biodiversity and non-targeted plant species (damage to indigenous trees).	Best practise is used when undertaking alien plant control	Minimise the use of herbicides near waterways by considering other techniques that can be alternatives to, or complementary with, herbicides.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.

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18	Alien Plant Management	Water and soil pollution by chemicals Herbicides can enter waterbodies either directly through spray or spray drift, or they can move into waterbodies via surface water run-off or leaching and sub-surface draining.	Avoid spillage onto soil or into water while mixing or using chemicals. Prevent contamination of ecologically sensitive environments. Prevent loss of biodiversity and non-targeted plant species (damage to indigenous trees).	Best practise is used when undertaking alien plant control	If chemical spraying is adopted: (a) use only approved herbicides prescribed by the Working for Water guidelines. (b) Staff using chemicals are trained and aware of the risks of using chemicals. (c) Chemicals are mixed on impermeable and level surfaces as per the manufacturer's instructions. (d) All waste material and containers are safely and properly removed after use. (e) Chemicals are stored, mixed and used in demarcated areas. (f) Do not apply foliar hand spray chemical applications under conditions where chemical drift may impact non-targeted species (as indicated on the manufacturer's directions for use on the herbicide label).	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
18	General Hazardous Waste Management	Altered aquatic ecosystem structure and function.	Responsible waste storage and management	Waste storage area	The designated temporary waste storage area must be contained (e.g., covered skips and scavenger proof bins) and fenced with a diamond mesh fence to prevent rainfall accumulation or wind-blown litter.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.
18	General Hazardous Waste Management	Chemical pollution of the water resources.	No incidents of chemical pollution of watercourses.	Waste is disposed of correctly	No illegal dumping of waste.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.

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18	General Hazardous Waste Management	Chemical pollution of the water resources.	No incidents of chemical pollution of watercourses.	No litter	No littering. Windblown litter should be cleared regularly.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.
18	General Hazardous Waste Management	Chemical pollution of the water resources.	No incidents of chemical pollution of watercourses.	Waybills	General Waste shall be disposed of at a licensed municipal landfill, whereas hazardous waste will be disposed of at a licensed hazardous waste disposal facility.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
18	Handling hazardous substances	Chemical pollution of the water resources.	No incidents of chemical pollution of watercourses	Responsible refuelling	Refuelling of construction plant may only take place at a designated and permitted (from local Fire Chief) fuel storage tank or using a mobile fuel bowser, under the guidance of a Specific Operating Procedure (SOP) that minimises the risk of spillage and addresses remedial actions in the event of a spillage. The Contractor's Site Environmental Officer (SEO) shall be responsible for compiling the SOP, which must be approved by the Environmental Control Officer (ECO).	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
18	Handling hazardous substances	Chemical pollution of the water resources.	No incidents of chemical pollution of watercourses	Spill kit on the mobile fuel bowser	An emergency response spill kit must accompany the mobile fuel bowser.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.
18	Handling hazardous substances	Chemical pollution of the water resources.	No incidents of chemical pollution of watercourses	Refuelling using the mobile fuel bowers outside of sensitive areas	Refuelling with a mobile fuel bowser shall take place 100 m away from the ecological buffer, as well as any boreholes and soakaways.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.

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18	Handling hazardous substances	Chemical pollution of the water resources.	No incidents of chemical pollution of watercourses	Concrete batching is outside of sensitive areas	No concrete batching shall take place within the delineated riparian zone or within the ecological buffer of a watercourse.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.
18	Plant Management	Operation of heavy equipment in a channel bed can directly destroy spawning habitat for fish and macro-invertebrate habitat and produce increased turbidity (lower dissolved oxygen) and increased suspended sediment downstream.	Maintain the Present Ecological State of the Brak River drainage system, large and small ephemeral tributaries, alluvial floodplains, and headwater drainage lines.	No vehicles outside of demarcated construction servitudes	Vehicles and other machinery are prohibited from accessing the ecologically sensitive wetlands or ephemeral drainage system and its ecological buffer unless confined to the demarcated construction servitudes associated with the construction of linear infrastructure crossings.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
18	Plant Management	Operating construction equipment within a watercourse and floodplain can cause water pollution/contamination from accidental chemical releases associated leaking machinery or spills.	Maintain the unnamed FEPA drainage line D62D – 05610 SQ (a tributary of the Brak River) in a good ecological condition.	Washing plants are outside 100 m watercourse buffer	No washing of plant is permitted on the construction site, within 100 m of the edge of any wetlands or other watercourses, and on land outside of the Sun Central Cluster 1 footprint.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.

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18	Plant Management	Operating construction equipment within a watercourse and floodplain can cause water pollution/contamination from accidental chemical releases associated leaking machinery or spills.	Maintain the unnamed FEPA drainage line D62D – 05610 SQ (a tributary of the Brak River) in a good ecological condition.	No repairs on site except under an emergency	No maintenance/service/repair of construction plant is permitted on the construction site (except emergency repairs) or on land outside of the Sun Central Cluster 1 footprint.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
18	Plant Management	Operating construction equipment within a watercourse and floodplain can cause water pollution/contamination from accidental chemical releases associated leaking machinery or spills.	Maintain the unnamed FEPA drainage line D62D – 05610 SQ (a tributary of the Brak River) in a good ecological condition.	Emergency protocol	An emergency protocol must be developed that deals with accidents and spills. This must include methods for absorbing chemical spills, as well as the transport and on-site bioremediation or disposal of all contaminated material at a licensed hazardous waste site.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
18	Plant Management	Operating construction equipment within a watercourse and floodplain can cause water pollution/contamination from accidental chemical releases associated leaking machinery or spills.	Maintain the unnamed FEPA drainage line D62D – 05610 SQ (a tributary of the Brak River) in a good ecological condition.	Drip trays at emergency repairs	Emergency breakdowns must be addressed with immediate and adequate pollution containment measures including but not limited to drip trays with plastic liners and spill kits.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.

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18	Plant Management	Operating construction equipment within a watercourse and floodplain can cause water pollution/contamination from accidental chemical releases associated leaking machinery or spills.	Maintain the unnamed FEPA drainage line D62D – 05610 SQ (a tributary of the Brak River) in a good ecological condition.	Spill kits	A spill kit should accompany the work front.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.
18	Plant Management	Operating construction equipment within a watercourse and floodplain can cause water pollution/contamination from accidental chemical releases associated leaking machinery or spills.	Maintain the unnamed FEPA drainage line D62D – 05610 SQ (a tributary of the Brak River) in a good ecological condition.	Avoid emergency repairs within 100m of a watercourse	As far as practical no emergency maintenance/service/repair is permitted within 100 m of the edge of any wetlands or watercourses.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.
18	Plant Management	Operating construction equipment within a watercourse and floodplain can cause water pollution/contamination from accidental chemical releases associated leaking machinery or spills.	Maintain the unnamed FEPA drainage line D62D – 05610 SQ (a tributary of the Brak River) in a good ecological condition.	No overnight parking within 100m of watercourse	No overnight parking of plant (e.g., outside business hours) is permitted within 100 m of the edge of any wetlands or watercourses.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.

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18	Plant Management	Operating construction equipment within a watercourse and floodplain can cause water pollution/contamination from accidental chemical releases associated leaking machinery or spills.	Maintain the unnamed FEPA drainage line D62D – 05610 SQ (a tributary of the Brak River) in a good ecological condition.	Refuel area have a bund to 110% volume	Refuelling and fuel storage areas should be located on an impervious bund capable of containing 110% of the volume of the fuel storage tank(s).	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
18	Plant Management	Operating construction equipment within a watercourse and floodplain can cause water pollution/contamination from accidental chemical releases associated leaking machinery or spills.	Maintain the unnamed FEPA drainage line D62D – 05610 SQ (a tributary of the Brak River) in a good ecological condition.	Drip trays	Drip trays must be placed under all stationary construction plant and equipment that can leak, such as, for example, TLBs, compressors and generators. The volume (litres) of drip trays must be sized according to their application and should be sufficient to hold 110% of the capacity of the reservoir holding the contaminant, e.g., a 100 cm (L) x 100 cm (W) x 10 cm (D) will hold 100 litres. A plastic liner that is at least twice the length and width of the drip tray shall be placed underneath it.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.

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18	Plant Management	Operating construction equipment within a watercourse and floodplain can cause water pollution/contamination from accidental chemical releases associated leaking machinery or spills.	Maintain the unnamed FEPA drainage line D62D – 05610 SQ (a tributary of the Brak River) in a good ecological condition.	Drips trays are not overflowing	Drip trays must be inspected regularly and emptied into containers designated for the temporary storage of hazardous waste. Hydrophobic hydrocarbon absorbent material is recommended to avoid contaminated rainwater from overflowing during rainfall events.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
18	Stormwater management and Erosion control and Security	Damage to farm infrastructure	Minimize damage to farm infrastructure.	Fences are clear of debris	Inspections of boundary fences should be done daily in areas where there are activities.	Contractor, SEO, ECO	Daily	Compliance to be verified by ECO and IEA.
18	Stormwater management and Erosion control	Damage to farm infrastructure	Minimize damage to farm infrastructure.	Fences are clear of debris	All fences should be inspected and be kept clear of debris, especially in the rainy season.	Holder, Contractor, SEO, ECO	Construction and Continuous	Compliance to be verified by ECO and IEA.
18	Stormwater management and Erosion control	Damage to farm infrastructure	Minimize damage to farm infrastructure.	Fences are clear of debris	Damaged fences must be repaired immediately.	Holder, Landowner, Contractor,	Construction and Continuous	Compliance to be verified by ECO and IEA.
18	Clearing/grubbing and grading	Habitat loss and fragmentation of watercourse areas because of infrastructure installation (roads, fences and sub surface pipelines).	Sensitive avifauna habitats are restored.	Topsoil is removed during dry season	All topsoil harvesting must take place in the dry season.	Contractor, SEO, ECO	Construction (dry season)	Compliance to be verified by ECO and IEA.

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18	Linear Infrastructure Crossings	Poorly maintained vehicles can result in hydrocarbon and other pollution. Hydrocarbon spills, during construction in the watercourse may contaminate the watercourse/reduce the quality of the water.	Preserve aquatic ecosystem structure and function, as well as riparian habitat.	No leaking plant, machinery or equipment on site	Any construction plant, machinery, and equipment which leaks shall not be permitted on site. Undertake visual inspections for any leakages that may emanate from any vehicle accessing the site - all vehicles must be in good working order when entering the site (Hydrology Assessment).	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
18	Linear Infrastructure Crossings	Poorly maintained vehicles can result in hydrocarbon and other pollution. Hydrocarbon spills, during construction in the watercourse may contaminate the watercourse/reduce the quality of the water.	Preserve aquatic ecosystem structure and function, as well as riparian habitat.	No parking outside of designated areas	All vehicles must be parked with drip trays in designated areas outside ecological buffer areas and if overnight, then preferably in the construction camp (Hydrology Assessment).	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
18	Linear Infrastructure Crossings	Poorly maintained vehicles can result in hydrocarbon and other pollution. Hydrocarbon spills, during construction in the watercourse may contaminate the watercourse/reduce the quality of the water.	Preserve aquatic ecosystem structure and function, as well as riparian habitat.	Drip trays	Enough drip trays must be available for all construction plant.	Contractor	Construction	Compliance to be verified by ECO and IEA.

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18	Linear Infrastructure Crossings	Poorly maintained vehicles can result in hydrocarbon and other pollution. Hydrocarbon spills, during construction in the watercourse may contaminate the watercourse/reduce the quality of the water.	Preserve aquatic ecosystem structure and function, as well as riparian habitat.	Spill response equipment	Provide accidental spill response equipment at the construction camp.	Contractor	Construction	Compliance to be verified by ECO and IEA.
18	Linear Infrastructure Crossings	Poorly maintained vehicles can result in hydrocarbon and other pollution. Hydrocarbon spills, during construction in the watercourse may contaminate the watercourse/reduce the quality of the water.	Preserve aquatic ecosystem structure and function, as well as riparian habitat.	No exposed contaminated soil on site	In event of a spill, immediately remove the contaminated soil to the depth of penetration and temporarily store in a sealed container within the designated waste storage area for on-site bioremediation or disposal at a licensed hazardous waste landfill.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
18	Linear Infrastructure Crossings	The crossing alignments will result in the loss of aquatic or river habitat equivalent to the size of the development footprint or in the case of construction creep, greater.	Contain construction and avoid the unnecessary loss of aquatic habitat.	No vehicles or pedestrian access beyond demarcated areas	Vehicular/machinery or pedestrian access is prohibited in natural areas beyond the demarcated (fenced) boundary of the construction site (road servitude or pipeline corridor), including working servitudes across the ephemeral drainage system or wetlands.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.

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18	Linear Infrastructure Crossings	The crossing alignments will result in the loss of aquatic or river habitat equivalent to the size of the development footprint or in the case of construction creep, greater.	Contain construction and avoid the unnecessary loss of aquatic habitat.	No unnecessary vegetation clearing	Limit vegetation clearing to the physical footprint of the road and the minimum width required for the operation of machinery to install the culverts.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
18	Linear Infrastructure Crossings	The crossing alignments will result in the loss of aquatic or river habitat equivalent to the size of the development footprint or in the case of construction creep, greater.	Contain construction and avoid the unnecessary loss of aquatic habitat.	Vegetation removed only prior to earthworks/construction	Vegetation and soil should be retained in position for as long as possible and should only be removed immediately ahead of construction / earthworks in any specific area so that cleared areas are not unnecessarily exposed to erosion for extended periods prior to working in those areas.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
18	Linear Infrastructure Crossings	The crossing alignments will result in the loss of aquatic or river habitat equivalent to the size of the development footprint or in the case of construction creep, greater.	Contain construction and avoid the unnecessary loss of aquatic habitat.	Active rehabilitation	Conduct active rehabilitation during the construction activities according to a rehabilitation plan or implement the Bare Patch Restoration Protocol (Appendix C) that will restore the natural vegetation to what it was prior to the construction of road/pipeline crossings, so that the long-term impact could be negligible.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.

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18	Linear Infrastructure Crossings	The crossing alignments will result in the loss of aquatic or river habitat equivalent to the size of the development footprint or in the case of construction creep, greater.	Contain construction and avoid the unnecessary loss of aquatic habitat.	Rehabilitated areas are cordoned off.	Cordon off areas under rehabilitation as "no-go areas" to prevent vehicular, pedestrian and livestock access.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
18	Linear Infrastructure Crossings	Habitat loss and fragmentation of watercourse areas because of infrastructure installation (roads).	Sensitive avifauna habitats are protected and maintained.	Use of existing farm roads	As far as possible utilize or upgrade existing farm roads as opposed to constructing new roads in undisturbed areas.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.
18	Linear Infrastructure Crossings	Habitat loss and fragmentation of watercourse areas because of infrastructure installation (roads).	Sensitive avifauna habitats are protected and maintained.	Roads do not impeded flow	All road crossings must be engineered not to impede surface or subsurface flow in any way.	Contractor	Construction	Compliance to be verified by ECO and IEA.
18	Linear Infrastructure Crossings	Habitat loss and fragmentation of watercourse areas because of infrastructure installation (roads).	Sensitive avifauna habitats are protected and maintained.	Construction during dry season	Schedule road construction during the season least damaging to the stream or wetland system (e.g., dry season).	Holder, Contractor	Construction during dry season	Compliance to be verified by ECO and IEA.
18	Linear Infrastructure Crossings	Habitat loss and fragmentation of watercourse areas because of infrastructure installation (roads).	Sensitive avifauna habitats are protected and maintained.	Limited fill roads	Limit or restrict the construction of fill roads. All fill roads must use a permeable fill material (such as gravel or crushed rock) for at least the first layer of fill to maintain the natural flow regimes of subsurface water.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.

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18	Linear Infrastructure Crossings	Habitat loss and fragmentation of watercourse areas because of infrastructure installation (roads).	Sensitive avifauna habitats are protected and maintained.	Raised bridges and culverts	It is preferable to eliminate fill roads and utilise raised bridges and culverts with adequate sizing and spacing of water crossing structures, proper choice of the type of crossing structure, and installation of drainage structures at a depth adequate to pass subsurface flow.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
18	Linear Infrastructure Crossings	Habitat loss and fragmentation of watercourse areas because of infrastructure installation (roads).	Sensitive avifauna habitats are protected and maintained.	Layout down area more than 35m from wetland	During construction, laydown areas must be a minimum of 35 metres from the wetland edge.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
18	Linear Infrastructure Crossings	Habitat loss and fragmentation of watercourse areas because of infrastructure installation (roads).	Sensitive avifauna habitats are protected and maintained.	No unnecessary equipment within the wetland	Construction equipment used while working in wetlands is limited to only those pieces that are essential and non-essential equipment is allowed to travel through wetlands only once during deployment and once during extraction.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
18	Linear Infrastructure Crossings	Habitat loss and fragmentation of watercourse areas because of infrastructure installation (roads).	Sensitive avifauna habitats are protected and maintained.	Silt fences	During vegetation clearing, sediment barriers such as silt fences must be installed and maintained adjacent to wetlands.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.
18	Linear Infrastructure Crossings	Habitat loss and fragmentation of watercourse areas because of infrastructure installation (roads).	Sensitive avifauna habitats are protected and maintained.	Responsible topsoil removal	Overall, topsoil is first removed and stored separately from the subsoil as well as topsoil from adjacent terrestrial habitats. Where wetland soils are saturated, segregating topsoil is not possible.	Contractor, SEO, ECO	Construction and during the dry season	Compliance to be verified by ECO and IEA.

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18	Linear Infrastructure Crossings	Habitat loss and fragmentation of watercourse areas because of infrastructure installation (roads).	Sensitive avifauna habitats are protected and maintained.	Timber mats	Large timber mats placed ahead of the construction equipment can provide a stable working platform and protect wetland soils by spreading the weight of the construction equipment over a broad area.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
18	Linear Infrastructure Crossings	Habitat loss and fragmentation of watercourse areas due to displacement because of infrastructure installation (underground pipelines).	Sensitive avifauna habitats are protected and maintained.	Pipelines are below subsurface flows	All underground pipelines bisecting sensitive habitats must be placed below the subsurface flow of the ephemeral wetlands with the linear construction pits subjected to full rehabilitation to maintain normal subsurface flow.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
18	Linear Infrastructure Crossings	Habitat loss and fragmentation of watercourse areas due to displacement because of infrastructure installation (underground pipelines).	Sensitive avifauna habitats are protected and maintained.	Zero interruption to flow	All pipeline crossings must be engineered not to impede surface or subsurface flow in any way.	Contractor	Construction	Compliance to be verified by ECO and IEA.
18	Linear Infrastructure Crossings	Habitat loss and fragmentation of watercourse areas due to displacement because of infrastructure installation (underground pipelines).	Sensitive avifauna habitats are protected and maintained.	Pipeline construction during dry season	Schedule pipeline construction during the season least damaging to the stream or wetland system (e.g., dry season).	Contractor, SEO	Construction during dry season	Compliance to be verified by ECO and IEA.

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18	Linear Infrastructure Crossings	Habitat loss and fragmentation of watercourse areas due to displacement because of infrastructure installation (underground pipelines).	Sensitive avifauna habitats are protected and maintained.	Pipeline corridors are no more than 5m wide	All pipeline corridors should be implemented to a maximum width of 5 metres through wetlands during construction.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
18	Linear Infrastructure Crossings	Habitat loss and fragmentation of watercourse areas due to displacement because of infrastructure installation (underground pipelines).	Sensitive avifauna habitats are protected and maintained.	Timber mats	Large timber mats placed ahead of the construction equipment can provide a stable working platform and protect wetland soils by spreading the weight of the construction equipment over a broad area.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.
18	Linear Infrastructure Crossings	Habitat loss and fragmentation of watercourse areas due to displacement because of infrastructure installation (underground pipelines).	Sensitive avifauna habitats are protected and maintained.	Method statement	The method of pipeline construction used in wetlands depends on the stability of the soils. Overall, topsoil is first removed and stored separately from the subsoil as well as topsoil from adjacent terrestrial habitats. All topsoil harvesting must take place in the dry season (late dry season). Where wetland soils are saturated, segregating topsoil is not possible.	Contractor	Construction	Compliance to be verified by ECO and IEA.

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18	Linear Infrastructure Crossings	Habitat loss and fragmentation of watercourse areas due to displacement because of infrastructure installation (underground pipelines).	Sensitive avifauna habitats are protected and maintained.	Topsoil is backfilled din the correct order.	If topsoil is segregated from subsoil, then subsoil is backfilled first. The trench is backfilled to the proper grade to maintain wetland hydrology and grades are restored to the original elevation.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
18	Linear Infrastructure Crossings	River diversion works may result in sedimentation and increased turbidity of the ephemeral drainage system.	Preserve aquatic ecosystem structure and function, as well as riparian habitat.	No surplus spoil stored on site	All surplus spoil material from the trenching (e.g., not used as backfill) should be removed from the site as soon as is practically possible.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.
18	Linear Infrastructure Crossings	River diversion works may result in sedimentation and increased turbidity of the ephemeral drainage system.	Preserve aquatic ecosystem structure and function, as well as riparian habitat.	No construction creep.	If it is practical to do so, construct river diversion works on the perimeter of the working servitude before clearing the in-situ material.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.
18	Linear Infrastructure Crossings	River diversion works may result in sedimentation and increased turbidity of the ephemeral drainage system.	Preserve aquatic ecosystem structure and function, as well as riparian habitat.	Aggregate is protected from any flowing water	Aggregate used in the construction of river diversion works shall not be in direct contact with flowing water, by using for example, plastic sheets, sandbags, culverts, or pipes.	Contractor	Construction	Compliance to be verified by ECO and IEA.
18	Linear Infrastructure Crossings	River diversion works may result in sedimentation and increased turbidity of the ephemeral drainage system.	Preserve aquatic ecosystem structure and function, as well as riparian habitat.	No dispersive soils used	Aggregate used in the construction of river diversion works shall not include dispersive soils.	Contractor	Construction	Compliance to be verified by ECO and IEA.

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19	Plant Management	Altered surface water flow patterns, e.g., changing sheet flow (natural open system) to concentrated flows leads to erosion.	Maintain the Present Ecological State of the Brak River drainage system, large and small ephemeral tributaries, alluvial floodplains, and headwater drainage lines.	No off-road driving immediately after rainfall	There should be reduced activity at the site after rainfall events when the soils are wet. No driving off from hardened roads should occur immediately following large rainfall events until soils have dried out and the risk of bogging down has decreased.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
19	Plant Management	Altered surface water flow patterns, e.g., changing sheet flow (natural open system) to concentrated flows leads to erosion.	Maintain the Present Ecological State of the Brak River drainage system, large and small ephemeral tributaries, alluvial floodplains, and headwater drainage lines.	No off-road driving immediately after rainfall	No off-road driving in wet conditions, and for two weeks afterwards. No driving in veld should take place on clay or fine-textured soils following rain	Contractor, SEO, ECO	Wet conditions and two weeks after	Compliance to be verified by ECO and IEA.
19	Stormwater management and Erosion control	Vegetation clearance of the project footprint for the access road and underground pipelines close to watercourses will be subject to erosion.	Maintain the Present Ecological State of the Brak River drainage system, large and small ephemeral tributaries, alluvial floodplains, and headwater drainage lines.	Stormwater management measures in place and good working order.	Where diversion berms create concentrated flows, particularly in steep and/or sensitive areas, the use of swales, silt fences or other effective erosion control measures is recommended to attenuate runoff.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
19	Stormwater management and Erosion control	Vegetation clearance of the project footprint for the access road and underground pipelines close to watercourses will be subject to erosion.	Maintain the Present Ecological State of the Brak River drainage system, large and small ephemeral tributaries, alluvial floodplains, and headwater drainage lines.	Stormwater management measures in place and good working order.	All storm water management measures should be regularly maintained.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.

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19	Stormwater management and Erosion control	Vegetation clearance of the project footprint for the access road and underground pipelines close to watercourses will be subject to erosion.	Maintain the Present Ecological State of the Brak River drainage system, large and small ephemeral tributaries, alluvial floodplains, and headwater drainage lines.	Stormwater management measures in place and good working order.	Implement appropriate stormwater management around the excavated trenches to prevent the ingress of surface water run-off.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.
19	Earthworks	Clearing of vegetation for the construction of access roads can cause sediment load in the water courses before the cleared areas can be stabilized. Roads concentrate surface water run-off, increasing its velocity and potential to erode river or stream banks at crossings.	Reduce sedimentation of watercourses	No vegetation clearing during rainfall season	Clearing of vegetation should preferably be done outside the main rainfall periods.	Contractor, SEO, ECO	Construction (outside of rainfall season)	Compliance to be verified by ECO and IEA.

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19	Earthworks	Clearing of vegetation for the construction of access roads can cause sediment load in the water courses before the cleared areas can be stabilized. Roads concentrate surface water run-off, increasing its velocity and potential to erode river or stream banks at crossings.	Reduce sedimentation of watercourses	No unnecessary vegetation clearing	Keep as much of the original vegetation intact as possible.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
19	Earthworks	Clearing of vegetation for the construction of access roads can cause sediment load in the water courses before the cleared areas can be stabilized. Roads concentrate surface water run-off, increasing its velocity and potential to erode river or stream banks at crossings.	Reduce sedimentation of watercourses	No bare areas	Rehabilitate areas where the original vegetation was cleared or severely disturbed (e.g., bare patches).	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.

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19	Earthworks	Clearing of vegetation for the construction of access roads can cause sediment load in the water courses before the cleared areas can be stabilized. Roads concentrate surface water run-off, increasing its velocity and potential to erode river or stream banks at crossings.	Reduce sedimentation of watercourses	Stormwater control measures	The applicant shall in response to bank erosion at road crossings either maintain existing or implement new storm water control measures as soon as is reasonably practical (e.g., within 5 working days of being noticed).	Holder	Construction (within 5 working days of being noticed)	Compliance to be verified by ECO and IEA.
19	Earthworks	Clearing of vegetation for the construction of access roads can cause sediment load in the water courses before the cleared areas can be stabilized. Roads concentrate surface water run-off, increasing its velocity and potential to erode river or stream banks at crossings.	Reduce sedimentation of watercourses	Rehabilitation	The applicant shall rehabilitate any erosion of river or stream banks at road crossings as soon as is reasonably practical (e.g., within 5 working days of being noticed)	Holder	Construction (within 5 working days of being noticed)	Compliance to be verified by ECO and IEA.

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19	Linear Infrastructure Crossings	Vegetation clearance of the project footprint for the access road and underground pipelines close to watercourses will be subject to erosion.	Maintain the Present Ecological State of the Brak River drainage system, large and small ephemeral tributaries, alluvial floodplains, and headwater drainage lines.	Construction Method Statements for crossings.	A construction method statement should be compiled and approved prior to the commencement of construction activities within all water resource types and where applicable their buffers.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
19	Linear Infrastructure Crossings	Vegetation clearance of the project footprint for the access road and underground pipelines close to watercourses will be subject to erosion.	Maintain the Present Ecological State of the Brak River drainage system, large and small ephemeral tributaries, alluvial floodplains, and headwater drainage lines.	No cleared areas exposed for extended periods.	Vegetation and soil should be retained in position for as long as possible and should only be removed immediately ahead of construction / earthworks in any specific area.	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.
19	Linear Infrastructure Crossings	Vegetation clearance of the project footprint for the access road and underground pipelines close to watercourses will be subject to erosion.	Maintain the Present Ecological State of the Brak River drainage system, large and small ephemeral tributaries, alluvial floodplains, and headwater drainage lines.	Vegetation is not cleared from the road verge.	Vegetation clearing (and the area of disturbance) is to be kept to a minimum. No unnecessary vegetation to be cleared.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.

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19	Linear Infrastructure Crossings	Vegetation clearance of the project footprint for the access road and underground pipelines close to watercourses will be subject to erosion.	Maintain the Present Ecological State of the Brak River drainage system, large and small ephemeral tributaries, alluvial floodplains, and headwater drainage lines.	Active rehabilitation	In areas where construction activities have been completed and no further disturbance is anticipated, rehabilitation and re-vegetation should commence as soon as possible.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
19	Linear Infrastructure Crossings	Vegetation clearance of the project footprint for the access road and underground pipelines close to watercourses will be subject to erosion.	Maintain the Present Ecological State of the Brak River drainage system, large and small ephemeral tributaries, alluvial floodplains, and headwater drainage lines.	New routes are minimal (only where necessary) and plans are approved by the ECO.	Existing roads and tracks should be used for access as far as possible, rather than creating new routes.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
19	Linear Infrastructure Crossings	Vegetation clearance of the project footprint for the access road and underground pipelines close to watercourses will be subject to erosion.	Maintain the Present Ecological State of the Brak River drainage system, large and small ephemeral tributaries, alluvial floodplains, and headwater drainage lines.	New routes are minimal (only where necessary) and plans are approved by the ECO.	Any additional routes and turning areas required by the contractor must be approved by the ECO, in the form of an amended ESM&R Plan indicating the position and extent of the proposed route / area.	Contractor, ECO	Construction	Compliance to be verified by ECO and IEA.

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19	Linear Infrastructure Crossings	Vegetation clearance of the project footprint for the access road and underground pipelines close to watercourses will be subject to erosion.	Maintain the Present Ecological State of the Brak River drainage system, large and small ephemeral tributaries, alluvial floodplains, and headwater drainage lines.	Construction Method Statements for crossings.	Roads that cross the large flood plains and severe gulley erosion should be planned well to reduce soil erosion.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
19	Linear Infrastructure Crossings	Vegetation clearance of the project footprint for the access road and underground pipelines close to watercourses will be subject to erosion.	Maintain the Present Ecological State of the Brak River drainage system, large and small ephemeral tributaries, alluvial floodplains, and headwater drainage lines.	Roads are returned to a usable state	Ensure that all access roads utilised during construction (which are not earmarked for closure and rehabilitation) are returned to a usable state and / or a state no worse than prior to construction.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
19	Linear Infrastructure Crossings	Disturbed or exposed sites are vulnerable to erosion.	Minimise erosion of disturbed sites from storm water run-off.	Construction during dry winter months	Construction, particularly of linear infrastructure across parts of the ephemeral drainage system, should to the extent possible be restricted to the dry winter months (e.g., May to September), that is commence with such activities as clearing or grading, excavating and importing material at the end of the wet season/beginning of the dry season whilst the soil is still moist to reduce dust and as far as is practical, be completed in, the dry winter months with a decreased probability of storm events.	Contractor	Construction	Compliance to be verified by ECO and IEA.

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19	Stockpiling and storing (Laydown)	Stockpiles and overburden left in the river or floodplain can alter channel hydraulics during high flows, e.g., stockpiles left in the river channel can also deflect water to the other side of the riverbank.	Avoid sedimentation of watercourses.	Stockpiles are stored correctly	Aggregate (sand) stockpiles (except for trenches) must be stored in the construction camp or staging area and outside the ecological buffer of the Brak River and large ephemeral drainage systems, including the 1:100-year flood line and delineated riparian habitat.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
19	Stockpiling and storing (Laydown)	Erosion and sedimentation of watercourses due to unforeseen circumstances (i.e., bad weather).	Avoid sedimentation of watercourses.	Stockpiles are covered	Cover soil stockpiles with a temporary liner to prevent sedimentation (where required and visually determined).	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.
19	Stockpiling and storing (Laydown)	There is a potential for erosion and sedimentation of the surroundings or ephemeral drainage lines	Avoid soil movement from designated stockpiles.	Sediment traps (if applicable)	Sediment traps may be necessary to prevent erosion and soil movement if there are topsoil or other stockpiles present during the wet season.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

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

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

Residual Risk (feeds back into "Mitigations"):

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- 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.

Receiving Environment: Economical

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Plant Management	Driving & Transport	Damage to the roads or environment	**Impact:** Damage to farm infrastructure **Consequence:** Economic costs in replacing damaged infrastructure.	NA	20
Fire Management	Wildfires	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.	NA	20
Stormwater Management and Erosion Control	NA	NA	**Impact:** Flooding in the predicted "ponded flood occurrence zones" (Hydrology Assessment Report) could cause damage to property **Consequences:** - Damage to property and increased maintenance costs (direct) - Reduced electrical power output and income resulting in diminished return on investment (indirect)	NA	20
Stormwater Management and Erosion Control	NA	NA	**Impact:** Poor stormwater management during construction of the road. **Consequence:** Damage to roads and vehicles, as well as delayed transport time.	NA	20
Earthworks	Access Road, pipeline, construction camp & staging area	Creating bare surfaces susceptible to erosion, corrugations, potholes and puddles.	**Impacts:** Damage to vehicles. **Consequences:** Increased maintenance costs	NA	21

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Quarry (Sourcing materials (aggregate) for roads and concrete)	Importing aggregate	NA	**Impact:** The usage of mudstone from the Karoo Supergroup for use as concrete aggregate or road layers may reduce the quality of concrete and/or roads due to its instability. **Consequence:** The usage of poor-quality aggregate is unsafe and will increase the costs of maintenance.	NA	22
Quarry (Sourcing materials (aggregate) for roads and concrete)	Importing aggregate	NA	**Impact:** Haulage of imported materials incur a cost relating to distance travelled and time. The usage of mudstone from the Karoo Supergroup for use as concrete aggregate or road layers may reduce the quality of concrete and/or roads due to its instability. **Consequence:** Financial feasibility of project. The usage of poor-quality aggregate is unsafe and will increase the costs of maintenance.	NA	22

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

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

Impact 20 (Damage to Property/Vehicles and Fires)

- A concern is the waterflow around the wetland and the potential impact on the road.
- The movement of workers and vehicles on the site could cause damage to farm infrastructure (e.g., fencing, water troughs and gates), during construction and operation.
- Farm owners are concerned about the impact of fences on water flow during heavy rain. If fences are not kept clear of debris, there is a risk that it can affect the waterflow into dams in the area, which is critical in a dry area like the Karoo.
- The flood lines suggest a low flooding risk associated with the project area, as no clearly defined drainage lines occur. Micro-sub catchment sheet flow towards lower laying areas within the non-perennial river flood plains is likely to dominate flood propagation, and isolated flooded areas are predicted to occur. As such, no clearly defined exclusion zones/protection buffer areas could be mapped.
- In the absence of clearly defined drainage channels or streams the area is prone to exhibit ponded flood occurrence zones. Micro sub-catchment sheet flow towards lower-lying areas within the non-perennial river flood plains is likely to dominate flood propagation, and isolated flooded areas are predicted to occur. The flood line determination suggests a low flooding risk as no clearly defined drainage lines occur. As such, no clearly defined exclusion zones or protection buffer areas could be mapped. Care should be taken in areas where development does take place within the likely flooding zones (Hydrological Assessment prepared by Hendrik Botha and dated 10 January 2023).
- The area is known for flash floods every few years. Without adequate drainage the roads will be damaged and delivery of supplies to the project will be negatively impacted while the roads dry off (Geotechnical Investigation Report prepared by Bare Rock Consulting (Pty) Ltd

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dated December 2022).

Impact 21 (Transport and Roads)

- There are low-lying areas where water ponding occurs and has softened the layer works to the point where deep rutting occurs due to wheel tracks from traffic on the roads (Traffic Impact Assessment prepared by Sturgeon Consulting (Pty) Ltd dated February 2023).
- The existing road network has sufficient capacity to accommodate the additional trips during the construction and operational stages. A two-lane road such as the N10 in the vicinity of the site can accommodate approximately 2000 vehicles per hour. Once construction is completed, the day-to-day operation of the proposed substation will generate no to very little traffic which can easily be accommodated by the current road surface. It is anticipated that the proposed Main Transmission Substation and associated Eskom grid (network) integration infrastructure will add an additional 28 vehicles a day (±3 vehicles per hour) during the construction stage and 0 vehicles during the operational stage which is far less than the current capacity of the two-lane road (2 000 vehicles per hour).

Impact 22 (Quarry – Sourcing material)

- **Road material or aggregate will be purchased from a licensed commercial source.**
- The potential construction materials available on the farm and in the area consists of sandy transported soils, weathered siltstone, sandstone and dolerite. The gravelly siltstone occurs generally in thin beds overlying or underlying a sandstone member and are relative thin, generally less than 1.0m in thickness. It is however quite expansive with the gravel beds that can cover an area of a 200 to 300 square meters. Considering the construction materials required for the project it will consist of different classes of coarse aggregate for pioneer layer, yard stone as well as course and fine aggregate for concrete production. In the Karoo the best available hard aggregate that can be used for yard stone and concrete aggregate is fresh dolerite (G1 material) of which there are no significant deposits on the farm or in the immediate surrounding areas concrete. The closest commercial supplier is De Aar Stone Crushers which is located approximately 32km from the N10 turnoff. There is a second dolerite quarry along the N1 towards Richmond (44km) from the N10 turn-off. This quarry is currently dormant, but it may be re-opened soon depending on SANRAL upgrades along the N1 in the area (Geotechnical Investigation Report prepared by Bare Rock Consulting (Pty) Ltd dated December 2022).
- The borrow areas close to the property consist of two types of material: weathered siltstone and weathered dolerite. The dolerite borrow pit is located on the eastern slope of the hill close to the N10 turn-off (Borrow Area E in Figure 16 of the Geotechnical Investigation Report for Sun Central PV Project Near De Aar, Northern Cape Province – BRC/RP/31/2022 prepared by Bare Rock Consulting (Pty) Ltd dated December 2022.). Borrow Area F on the other side of the hill facing the N10 is a weathered siltstone borrow area. The other siltstone borrow areas (Borrow areas B to D) are all constrained by a upper and lower competent layer resulting in a large area that have to be disturbed to gain sufficient material for aggregate. None of these areas are currently licensed as borrow areas.

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- Brink (1983) cautions against the use of mudstone from the Karoo Supergroup for use as construction materials – particularly for use as concrete aggregate and to a limited extent also for road layer materials (Geotechnical Investigation Report prepared by Bare Rock Consulting (Pty) Ltd dated December 2022).

Assessment without mitigation:

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

Alternative Site No. 1 (preferred)

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

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

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

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

- Road material or aggregate will be purchased from a licensed commercial source.

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

- Access Road and Part 2 Amendment Addendum to Social Impact Assessment Report prepared by Equispectives Research & Consulting Services dated January 2023.
- Hydrological Assessment, Version – Final 1, prepared by Hendrik Botha and dated 10 January 2023 (GCS Ref – 22 - 1054).
- Traffic Impact Assessment for the upgrading & development of an access road from the N10/'Burgerville' district road (2448) turn-off to the Main Transmission Substation (MTS) as well as the construction of a loop-in loop-out from the MTS to the 400 kV Hydraposeidon Tx overhead line (line 1), and other projects on the Sun Central Cluster 1 (300 MW) solar PV footprint between De Aar and Hanover, Northern Cape province (project No.: STUR0375) prepared by Sturgeon Consulting (Pty) Ltd dated February 2023.
- Geotechnical Investigation Report for Sun Central PV Project Near De Aar, Northern Cape Province – BRC/RP/31/2022 prepared by Bare Rock Consulting (Pty) Ltd dated December 2022.
- SolarAfrica Sun Central – Access Road Study Rev 0.1 (Document Reference: SAE-PD-DA-Access Road Study 0.1 FS
- National Veld and Forest Fire Act, 1998 (Act No. 101 of 1998)
- Generic EMPrs published in GN No. 435 of 22 March 2019 in terms of Section 24(5) of NEMA, 1998

Mitigations:

Impact Management Outcome(s):

- Fire management
- Minimize damage to farm infrastructure.
- Good stormwater management.
- Good road condition
- Maintain financial feasibility of the project.
- Good quality aggregate material

Targets:

- Fences are clear of debris

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- Risk analysis
- Membership of the local Fire Protection Association. PPE and Firefighting equipment. Maintained firefighting equipment
- Person appointed to control fires and trained firefighting personnel
- Flooding protocols are in place
- Roads are free draining, e.g., no ponding or pooling of surface water.
- District gravel road is maintained. Corrugations, potholes and puddles repaired
- Photographs of private road condition
- Environmentally friendly soil binders are used
- G5 is sourced from external suppliers.
- Dolerite rock and/or sandstones and mudstone/shale which have been baked by dolerite intrusions are used as construction material.
- Supplement commercial sources with local borrow pits if possible
- Compliance with regulations
- No offloading during windy conditions and dust suppression in place

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
20	Plant Management	Damage to farm infrastructure	Minimize damage to farm infrastructure.	Fences are clear of debris	Affected landowners must be compensated for losses resulting from any damage to farm infrastructure.	Holder	Construction and Continuous	Compliance to be verified by ECO and IEA.
20	Fire management	Risk of veld fires caused by workers during the construction of the facility.	Fire management	Risk analysis	Undertake a risk analysis to determine inter alia the probability and frequency of a wildfire during construction and operation and prepare a fire management plan accordingly.	Holder	Construction	Compliance to be verified by ECO and IEA.
20	Fire management	Risk of veld fires caused by workers during the construction of the facility.	Fire management	Membership of the local Fire Protection Association	Join the local Fire Protection Association if there is one and abide by their minimum requirements, as well	Holder	Construction	Compliance to be verified by ECO and IEA.

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					as any agreements entered into with the Minister or other FPAs to provide mutual assistance in fighting and extinguishing fires.			
20	Fire management	Risk of veld fires caused by workers during the construction of the facility.	Fire management	PPE	Obtain the necessary PPE for firefighting personnel.	Holder	Construction	Compliance to be verified by ECO and IEA.
20	Fire management	Risk of veld fires caused by workers during the construction of the facility.	Fire management	Firefighting equipment	Obtain such firefighting equipment as would be reasonably required in the circumstances, that is proportional to the risk.	Holder, Contractor	Construction	Compliance to be verified by ECO and IEA.
20	Fire management	Risk of veld fires caused by workers during the construction of the facility.	Fire management	Maintained firefighting equipment	Firefighting equipment shall be maintained and readily available during construction (and operation) - regularly test and service equipment	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.
20	Fire management	Risk of veld fires caused by workers during the construction of the facility.	Fire management	Person appointed to control fires	Appoint a responsible person (or agent) who will extinguish a fire, or assist in doing so, and take all reasonable steps to alert the owners of adjoining land and the relevant Fire Protection Association, if any.	Holder, Contractor	Construction	Compliance to be verified by ECO and IEA.
20	Fire management	Risk of veld fires caused by workers during the	Fire management	Trained firefighting personnel	If no agent is appointed, a team of designated firefighting	Holder, Contractor	Construction	Compliance to be verified by

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		construction of the facility.			personal shall be trained and readily available to immediately deal with any runaway veld fires.			ECO and IEA.
20	Stormwater management and erosion control	Flooding in the predicted "ponded flood occurrence zones" (Hydrology Assessment Report) could cause damage to property	Minimize damage to farm infrastructure.	Flooding protocols are in place	Implement where applicable, prescribed flooding protocols (e.g., drainage and stormwater systems to minimize flooding potential) and erosion prevention measures in the predicted "ponded flood occurrence zones" (Hydrology Assessment Report).	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.
20	Stormwater management and erosion control	Poor stormwater management during construction of the road.	Good stormwater management.	Roads are free draining, e.g., no ponding or pooling of surface water.	During construction of the roads the roads must always be free draining.	Contractor	Construction	Compliance to be verified by ECO and IEA.
21	Earthworks	Damage to vehicles.	Good road condition	District gravel road is maintained	The applicant shall maintain any deterioration to the district gravel road resulting from increased traffic during construction.	Holder	Continuous	Compliance to be verified by ECO and IEA.
21	Earthworks	Damage to vehicles.	Good road condition	Corrugations are repaired	Corrugations shall be removed as soon as is reasonably practical (e.g., within 5 working days of being noticed).	Holder, Contractor	Continuous (within 5 working days of being noticed)	Compliance to be verified by ECO and IEA.
21	Earthworks	Damage to vehicles.	Good road condition	Potholes and puddles repaired	Potholes and puddles will be filled in and	Holder, Contractor	Continuous	Compliance to be

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					compacted as soon as is reasonably practical (e.g., within 5 working days of being noticed).			verified by ECO and IEA.
21	Earthworks	Damage to vehicles.	Good road condition	Photographs of private road condition	In circumstances where private roads must be used, the condition of those roads must be recorded in accordance with section 4.9: photographic record; prior to use and the condition thereof agreed by the landowner, the DPM, and the contractor (DEA Generic EMPr)	Holder, Landowner, Contractor	Prior to private road use	Compliance to be verified by ECO and IEA.
21	Earthworks	Damage to vehicles.	Good road condition	Environmentally friendly soil binders are used	Apply environmentally friendly soil binding agents to the road surface to reduce ripple and pothole occurrences as well as help production machines last longer.	Holder, Contractor, SEO, ECO	Continuous	Compliance to be verified by ECO and IEA.
22	Quarry (Sourcing materials (aggregate) for roads and concrete)	The usage of mudstone from the Karoo Supergroup for use as concrete aggregate or road layers may reduce the quality of concrete and/or roads due to its instability.	Good quality aggregate material.	G5 is sourced from external suppliers.	It is recommended that the material (G5) for the wearing course be sourced from commercial suppliers.	Contractor	Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
22	Quarry (Sourcing materials (aggregate) for roads and concrete)	The usage of mudstone from the Karoo Supergroup for use as concrete aggregate or road layers may reduce the quality of concrete and/or roads due to its instability.	Good quality aggregate material.	Dolerite rock and/or sandstones and mudstone/shale which have been baked by dolerite intrusions are used as construction material.	Preference should be given to the use of dolerite rock as construction material; however, sedimentary rock may be used with caution for the lower road layers – especially the sandstones and mudstone/shale which have been baked by dolerite intrusions.	Contractor	Construction	Compliance to be verified by ECO and IEA.
22	Quarry (Sourcing materials (aggregate) for roads and concrete)	Haulage of imported materials incur a cost relating to distance travelled and time. The usage of mudstone from the Karoo Supergroup for use as concrete aggregate or road layers may reduce the quality of concrete and/or roads due to its instability.	Maintain financial feasibility of the project. Good quality aggregate material	Supplement commercial sources with local borrow pits if possible	On the farm De Bad (See Figure 15 of the Geotechnical Investigation Report for Sun Central PV Project Near De Aar, Northern Cape Province – BRC/RP/31/2022 prepared by Bare Rock Consulting (Pty) Ltd dated December 2022.) there is a quarry where material for the construction of the N10 were sourced. The rock is a competent sandstone, but the flakiness index makes it less suitable for use as concrete aggregate than the dolerite. It can however be suitable for pioneering layers and as well as G2 and G3 material. This quarry	Engineer, Contractor, Landowner	Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					can be used to upgrade and repair roads that intersects the same property. Sections of road that does not intersect properties where existing quarries with suitable material, will need to be repaired/upgraded with material sourced from commercial suppliers.			
22	Quarry (Sourcing materials (aggregate) for roads and concrete)	Haulage of imported materials incur a cost relating to distance travelled and time. The usage of mudstone from the Karoo Supergroup for use as concrete aggregate or road layers may reduce the quality of concrete and/or roads due to its instability.	Maintain financial feasibility of the project. Good quality aggregate material	Supplement commercial sources with local borrow pits if possible	The aggregates available in the area is suitable for construction. The fresh dolerite (borrow pit is located on the eastern slope of the hill close to the N10 turn-off – see Borrow Area E in Figure 16 of the Geotechnical Investigation Report for Sun Central PV Project Near De Aar, Northern Cape Province – BRC/RP/31/2022 prepared by Bare Rock Consulting (Pty) Ltd dated December 2022.) can be used for coarse and fine aggregate for concrete production as well as yard stone. The	Contractor	Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					weathered dolerite as exposed in borrow area E is suitable for wearing course material. The volumes of material remaining at this borrow pit will not be sufficient and the borrow area is currently not licensed. These borrow pits can be used to upgrade and repair roads that intersects the same property. Sections of road that does not intersect properties where existing borrow pits with suitable material, will need to be repaired/upgraded with material sourced from commercial suppliers.			

Assessment with mitigation:

Alternative Site No. 1 (preferred)

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

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

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

Residual Risk (feeds back into "Mitigations"):

- Despite the mitigations to avoid damage to property during floods, strong flows or a flash flood during summer could still result in some damage to property.

Receiving Environment: Social

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Plant Management	Driving & Transport	Generating emissions incl. noise and dust	**Impact:** Noise increase at the boundary of the project footprint and at the abutting houses from construction equipment. Construction traffic to and from the site would create a temporary linear noise source. **Consequence:** Decrease in sense of place. Disturbance to local farmsteads.	NA	23
Plant Management	Driving & Transport	Congestion for other road users/Disruption to landowners	**Impact:** Potential congestion and delays on the road network. **Consequence:** Disruptions and delays to residents and local farmers in the area due to increase traffic volumes, resulting in longer time periods for transportation of goods. A nuisance to local residents and a decrease in sense of place due to dust and noise generated by construction activities and congestion.	NA	23

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Plant Management	Driving & Transport	Damage to the roads or environment	**Impact:** Traffic noise is created by vehicle movement where mechanical noise, rattles, and road surface (development of corrugations, potholes and puddles) play an important role on the noise levels along roads or some distance from roads. **Consequence:** Decrease in sense of place. Disturbance to local farmsteads.	NA	23
Plant Management	Driving & Transport	Damage to the roads or environment	**Impact:** Stakeholders are concerned about the quality of the roads, increases in traffic and traffic safety. **Consequence:** Increase in accidents, longer time periods in transportation of goods.	NA	23
Plant Management	Operating & Parking Plant	Generating emissions incl. noise and dust	**Impact:** Noise increase at the boundary of the project footprint and at the abutting houses from construction equipment. **Consequence:** Decrease in sense of place. Disturbance to local farmsteads.	NA	23
General and Hazardous Waste Management	Storage	Unpleasant odours	**Impacts:** Large amounts of stored waste can cause unpleasant odours **Consequences:** neighbours could be impacted on regarding unpleasant smells	NA	23
Clearing/Grubbing and Grading	Access Road, pipeline, construction camp & staging area	Removal of vegetation	**Impact:** Noise increase at the boundary of the project footprint and at the abutting houses during construction activities. **Consequence:** Decrease in sense of place. Disturbance to local farmsteads.	NA	23

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

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

Impact 23 (Social aspect)

- The social impacts do not occur on the sites, but in the communities around the sites and in the towns closest to the sites. Although municipal services are not currently under pressure, the development of a few renewable facilities within a short period of each other may cause pressure on these services in future. The municipalities depend on borehole water, which may run out and is only available when there is electricity available to run the water pumps. There is a current shortage of housing which will get worse should the area are exposed to a boom cycle of development. It must be acknowledged that it is almost impossible for the proponent to control the cumulative social impacts in

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the neighbouring towns. Therefore, it is important that the proponent have a good working relationship with the local authorities, and that they mitigate the impacts that they can control, as suggested in the Social Impact Management Plan (SIMP).

- The movement of workers and vehicles on the site could cause damage to farm infrastructure (e.g., fencing, water troughs and gates), during construction and operation (Access Road and Part 2 Amendment Addendum to Social Impact Assessment Report prepared by Equispectives Research & Consulting Services dated January 2023).
- Existing traffic information for 2022 indicates that the N10 carries an ADT of 1018 vehicles per day (two-way). The N10 operates well below the capacity of 2000 vehicles per hour for a Class 1 principal arterial with two lanes. Traffic generated during the Operational phase will have an insignificant traffic impact on the surrounding road network. Only the workforce during the construction of the Main Transmission Substation and associated Eskom grid (network) integration infrastructure will be considered as this will be the worst-case scenario. It is not anticipated that the two projects will run simultaneously, since the access and road upgrades need to be in place before the construction of the Main Transmission Substation and associated Eskom grid (network) integration infrastructure can commence.
- A total of 56 vehicles will move to/from the construction site on a daily basis. Should all the trips fall within the peak hours of the road, this will relate to approximately an additional 28 trips on the road network during the peak hours for the construction phase.
  The substation is expected to generate a maximum of 10 heavy vehicle trips per day two-way, assuming that the transport operations occur every day of the week and for 10 hours a day (i.e. 30 days per month) (Traffic Impact Assessment, prepared by Sturgeon Consulting (Pty) Ltd dated February 2023).
- The large variations in the meteorological conditions and the geographical relations between the traffic noise and the noise sensitive receptors allow for the decrease in the noise as it propagates from the gravel road.
- The potential noise impact from the proposed gravel road will be low.
- The main access is off the N10 between De Aar and Hanover, which enters the site from the west. The provincial unsurfaced road (Burgersville District Road) and the existing farm access road will also be used. Once on the farm, an Eskom servitude road will be used to access the main gate to the operational area and on-site substation. During the dry season the area is very dry and dusty. During the wet season, the roads can become muddy, and vehicles can get stuck easily. The district road is used by a number of farmers in the area to access their properties. It also traverses or is adjacent to some of the neighbouring properties. The construction of an access road of a high quality will be a positive impact. Currently, stakeholders are concerned about the quality of the roads, especially if heavy construction vehicles are used. They are also concerned about the increase in traffic on their fence lines and how more traffic and strangers in the area will impact on their properties. The construction phase will generate significant additional traffic on the roads – just the transport of the workers will mean two trips per day, and then the delivery of construction material and management activities must also be considered. Neighbours are concerned about the generation of dust. Although the proposed site is far from any communities, it is relatively close to some of the farmers, but the biggest concern is the impact that the dust will have on the quality of the grazing. Farmers acknowledge that the dust will be washed of by rain, but it is an arid area with relatively low

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rainfall in general (Access Road and Part 2 Amendment Addendum to Social Impact Assessment Report prepared by Equispectives Research & Consulting Services dated January 2023).

Assessment without mitigation:

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

Alternative Site No. 1 (preferred)

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

- Environmental Basic Assessment for the proposed Gravel Road Construction to the approved Phase 1 Project prepared by dBAcoustics dated 21 January 2023.
- Access Road and Part 2 Amendment Addendum to Social Impact Assessment Report prepared by Equispectives Research & Consulting Services dated January 2023.
- Traffic Impact Assessment for the upgrading & development of an access road from the N10/'Burgerville' district road (2448) turn-off to the Main Transmission Substation (MTS) as well as the construction of a loop-in loop-out from the MTS to the 400 kV Hydraposeidon Tx overhead

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line (line 1), and other projects on the Sun Central Cluster 1 (300 MW) solar PV footprint between De Aar and Hanover, Northern Cape province (project No.: STUR0375) prepared by Sturgeon Consulting (Pty) Ltd dated February 2023.

Mitigations:

Impact Management Outcome(s):

- Reduce odours with good waste management.
- Good traffic and road management.
- Minimize noise disturbance to noise receptors/farmhouses.
- Minimise risk of congestion and delays to local residents and farmers.

Targets:

- No odours
- Waybill
- Access to individual properties is maintained.
- Good road condition.
- No unacceptable noise
- No speeding
- Delivery trips outside peak traffic periods
- Passing lane and Stop and Go's
- Construction during daytime only.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
23	General and hazardous waste management	Large amounts of stored waste can cause unpleasant odours	Reduce odours with good waste management	No odours	Waste receptacles must not be overfilled. General waste shall be disposed of at the nearest licensed landfill.	Holder, Contractor, SEO	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
23	General and hazardous waste management	Large amounts of stored waste can cause unpleasant odours	Reduce odours with good waste management	Waybill	It is recommended that all waste be removed from the temporary waste storage area within the construction camp and be disposed of at the nearest licensed landfill on a weekly basis to prevent it from accumulating and 'rotting'.	Contractor, SEO	Construction (weekly removal of waste)	Compliance to be verified by ECO and IEA.
23	Plant Management	Stakeholders are concerned about the quality of the roads, increases in traffic and traffic safety.	Good traffic and road management.	Access to individual properties is maintained.	Road maintenance and access to individual properties is especially important in the construction phase.	Holder, Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.
23	Plant Management	Traffic noise is created by vehicle movement where mechanical noise, rattles, and road surface (development of corrugations, potholes and	Minimize noise disturbance to noise receptors/farmhouses.	Good road condition.	Road maintenance must be done on a regular basis to avoid the creation of potholes.	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		puddles) play an important role on the noise levels along roads or some distance from roads.						
23	Plant Management	Noise increase at the boundary of the project footprint and at the abutting houses from construction equipment. Construction traffic to and from the site would create a temporary linear noise source.	Minimize noise disturbance to noise receptors/farmhouses	No unacceptable noise	Equipment and/or machinery which will be used must comply with the manufacturer's specifications on acceptable noise levels and during daytime only.	Contractor	Construction	Compliance to be verified by ECO and IEA.
23	Plant Management	Noise increase at the boundary of the project footprint and at the abutting houses from construction equipment. Construction traffic to and from the site would create a	Minimize noise disturbance to noise receptors/farmhouses	No speeding	The speed limit to be always adhered to.	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		temporary linear noise source.						
23	Plant Management	Potential congestion and delays on the road network.	Minimise risk of congestion and delays to local residents and farmers.	Delivery trips outside peak traffic periods	Where possible, stagger and schedule peak construction periods, delivery and staff trips, as well as any other trips with an expected increase in vehicle movement outside of the peak traffic periods.	Contractor	Construction	Compliance to be verified by ECO and IEA.
23	Plant Management	Potential congestion and delays on the road network.	Minimise risk of congestion and delays to local residents and farmers.	Passing lanes	Ensure adequate passing lanes for local farmers and residents	Contractor	Construction	Compliance to be verified by ECO and IEA.
23	Plant Management	Potential congestion and delays on the road network.	Minimise risk of congestion and delays to local residents and farmers.	Stop and Go's	Implement "Stop and Go's".	Contractor	Construction	Compliance to be verified by ECO and IEA.
23	Clearing/grubbing and Grading	Noise increase at the boundary of the project footprint and at the abutting houses during	Minimize noise disturbance to noise receptors/farmhouses.	Construction during daytime only.	Topsoil stripping and construction activities should be limited to daytime only.	Contractor	Construction	Compliance to be verified by ECO and IEA.

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

Assessment with mitigation:

Alternative Site No. 1 (preferred)

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

Residual Risk (feeds back into "Mitigations"):

- None.

Receiving Environment: Property

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Fire Management	Wildfires	NA	**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.	NA	24
Blasting	NA	Dust, Noise & Flyrock generation	**Impact:** Fly rock and vibrations from blasting **Consequence:** Damage to property.	NA	25

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

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

Impact 24 (Fire)

- The De Aar area falls within the Nama Karoo biome. Runaway fires could result in damage to property.

Impact 25 (Blasting)

- Based on the COLTO Standard, excavatability is classified as hard, intermediate or soft. Hard excavatability is defined for conditions where boulders or jointed rock masses larger than 0.1m^3 requires blasting or pneumatic and mechanical rock breaking to excavate the material for more than 80% of the excavation.

Assessment without mitigation:

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

Alternative Site No. 1 (preferred)

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

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

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

- None.

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

- National Veld and Forest Fire Act, 1998 (Act No. 101 of 1998)
- Geotechnical Investigation Report for Sun Central PV project near De Aar, Northern Cape Province – BRC/RP/31/2022 prepared by Bare Rock Consulting (Pty) Ltd dated December 2022.

Mitigations:

Impact Management Outcome(s):

- Fire management
- Prevent damage caused by blasting

Targets:

- Risk analysis
- Membership of the local Fire Protection Association. PPE. Firefighting equipment and maintained firefighting equipment
- Person appointed to control fires and rained firefighting personnel
- Use of minimum magnitude and amount of 'explosive' material. Blast mat in use
- Neighbours are advised regarding blasting
- Survey results and photographs
- Method statement
- Logbook

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
24	Fire management	Risk of veld fires caused by workers during	Fire management	Risk analysis	Undertake a risk analysis to determine inter alia the	Holder	Construction	Compliance to be verified

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		the construction of the facility.			probability and frequency of a wildfire during construction and operation and prepare a fire management plan accordingly.			by ECO and IEA.
24	Fire management	Risk of veld fires caused by workers during the construction of the facility.	Fire management	Membership of the local Fire Protection Association	Join the local Fire Protection Association if there is one and abide by their minimum requirements, as well as any agreements entered into with the Minister or other FPAs to provide mutual assistance in fighting and extinguishing fires.	Holder	Construction	Compliance to be verified by ECO and IEA.
24	Fire management	Risk of veld fires caused by workers during the construction of the facility.	Fire management	PPE	Obtain the necessary PPE for firefighting personnel.	Holder	Construction	Compliance to be verified by ECO and IEA.
24	Fire management	Risk of veld fires caused by workers during the construction of the facility.	Fire management	Firefighting equipment	Obtain such firefighting equipment as would be reasonably required in the circumstances, that is proportional to the risk.	Holder, Contractor	Construction	Compliance to be verified by ECO and IEA.
24	Fire management	Risk of veld fires caused by workers during the	Fire management	Maintained firefighting equipment	Firefighting equipment shall be maintained and readily available during construction	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		construction of the facility.			(and operation) - regularly test and service equipment			
24	Fire management	Risk of veld fires caused by workers during the construction of the facility.	Fire management	Person appointed to control fires	Appoint a responsible person (or agent) who will extinguish a fire, or assist in doing so, and take all reasonable steps to alert the owners of adjoining land and the relevant Fire Protection Association, if any.	Holder, Contractor	Construction	Compliance to be verified by ECO and IEA.
24	Fire management	Risk of veld fires caused by workers during the construction of the facility.	Fire management	Trained firefighting personnel	If no agent is appointed, a team of designated firefighting personal shall be trained and readily available to immediately deal with any runaway veld fires.	Holder, Contractor	Construction	Compliance to be verified by ECO and IEA.
25	Blasting	Fly rock and vibrations from blasting	Prevent damage caused by blasting	Use of minimum magnitude and amount of 'explosive' material.	The contractor carrying out the blasting work shall apply the absolute minimum magnitude and amount of 'explosive' material.	Contractor	Construction	Compliance to be verified by ECO and IEA.
25	Blasting	Fly rock and vibrations from blasting	Prevent damage caused by blasting	Blast mat in use	The contractor carrying out the blasting work shall use a blast mat (not soil) to reduce fly rock.	Contractor	Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
25	Blasting	Fly rock and vibrations from blasting	Prevent damage caused by blasting	Neighbours are advised regarding blasting	The applicant shall at least 7 days prior to the commencement of blasting advise owners and occupiers of neighbouring properties.	Holder, Contractor	At least 7 days prior to the commencement of blasting	Compliance to be verified by ECO and IEA.
25	Blasting	Fly rock and vibrations from blasting	Prevent damage caused by blasting	Survey results and photographs	Buildings within the potential damaging zone of the blast will be surveyed with the presence of the owner, or a representative nominated by the owner, and any cracks or latent defects will be pointed out and recorded using photographs.	Holder, Landowner, Contractor	Prior to blasting	Compliance to be verified by ECO and IEA.
25	Blasting	Fly rock and vibrations from blasting	Prevent damage caused by blasting	Method statement	The contractor carrying out the blasting work will prepare a method statement prior to blasting. The aforesaid method statement will include: A locality plan of the blast site; The zones of influence of the ground and air shockwaves; Expected limits of fly rock; and Each dwelling,	Contractor	Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					structure, service and water source within the zones of influence.			
25	Blasting	Fly rock and vibrations from blasting	Prevent damage caused by blasting	Logbook	The contractor carrying out the blasting work shall log the blasting activities.	Contractor	Construction	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

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

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

Residual Risk (feeds back into "Mitigations"):

- None.

Receiving Environment: Health and Safety

Description of potential impacts:

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

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Plant Management	Driving & Transport	Congestion for other road users/Disruption to landowners	**Impact:** Stakeholders are concerned about the quality of the roads, increases in traffic and traffic safety. **Consequence:** Increase in accidents, longer time periods in transportation of goods.	NA	26
Plant Management	Driving & Transport	Damage to the roads or environment	**Impact:** Traffic accidents at primary access location off the N10. **Consequence:** Injury or loss of life.	NA	26
Health and Safety	NA	NA	**Impact:** Traffic accidents at primary access location off the N10. **Consequence:** Injury or loss of life.	NA	26
General and Hazardous Waste Management	Handling and Collection (incl. chemical toilets & concrete slurry)	Contamination	**Impact:** Overuse of chemical toilets can be unhygienic. **Consequence:** Health Risk	NA	27
General and Hazardous Waste Management	Reuse, Recycle	Health and safety	**Impact:** Reuse of certain containers may be harmful to people. **Consequence:** Health risk	NA	27
Health and Safety	NA	NA	**Impact:** Improper safety procedures followed when refuelling. **Consequence:** Injury/loss of life of staff (indirect)	NA	27
Earthworks	Excavations/Trenching	NA	Im**pact:** Collapsing sidewalls of excavated trenches. **Consequence:** Injury/death to construction staff.	NA	27
Fire Management	Wildfires	NA	**Impact:** Risk of veld fires caused by workers during the construction of the facility. **Consequence:** - loss of life (direct)	NA	28
Blasting	NA	Dust, Noise & Flyrock generation	**Impact:** Fly rock from blasting **Consequence:** injury/death to persons	NA	29

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

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

Impact 26 (Traffic Safety)

- The main access is off the N10 between De Aar and Hanover, which enters the site from the west. The provincial unsurfaced road (Burgersville District Road) and the existing farm access road will also be used. Once on the farm, an Eskom servitude road will be used to access the main

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gate to the operational area and on-site substation. During the dry season the area is very dry and dusty. During the wet season, the roads can become muddy, and vehicles can get stuck easily. The district road is used by a number of farmers in the area to access their properties. It also traverses or is adjacent to some of the neighbouring properties. The construction of an access road of a high quality will be a positive impact. Currently, stakeholders are concerned about the quality of the roads, especially if heavy construction vehicles are used. They are also concerned about the increase in traffic on their fence lines and how more traffic and strangers in the area will impact on their properties. The construction phase will generate significant additional traffic on the roads – just the transport of the workers will mean two trips per day, and then the delivery of construction material and management activities must also be considered. Neighbours are concerned about the generation of dust. Although the proposed site is far from any communities, it is relatively close to some of the farmers, but the biggest concern is the impact that the dust will have on the quality of the grazing. Farmers acknowledge that the dust will be washed of by rain, but it is an arid area with relatively low rainfall in general.

- The site visit and photos taken at the existing access location indicated that shoulder sight distance to the left will be sufficient. Sight distance to the right was measured as approximately 320m which is sufficient for Passenger vehicles (P).

Impact 27 (Unhygienic conditions, safety of staff)

- For the access and road upgrades required, it is anticipated that an additional ± 45 temporary staff can be expected on site during the construction stage.

Impact 28 (Fire)

- *The De Aar area falls within the Nama Karoo biome. Runaway fires could result in damage to property.*

Impact 29 (Blasting)

- Intermediate excitability indicates conditions where occasional boulders or bedrock conditions require mechanical breaking or slower excavation for 80% - 20% of the excavation. Soft conditions only require a TLB to excavate the material. In general, the soft material can also be excavated with hand tools. The soft to intermediate excitability across the project area ranges between 0.3m and 0,5m with refusal on medium strong siltstone.

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

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

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

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

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

- None.

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

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

- Geotechnical Investigation Report prepared by Bare Rock Consulting (Pty) Ltd dated December 2022).
  Reference: Geotechnical Investigation Report for Sun Central PV Project Near De Aar, Northern Cape Province – BRC/RP/31/2022 prepared by Bare Rock Consulting (Pty) Ltd dated December 2022.
- Traffic Impact Assessment for the upgrading & development of an access road from the N10/'Burgerville' district road (2448) turn-off to the Main Transmission Substation (MTS) as well as the construction of a loop-in loop-out from the MTS to the 400 kV Hydraposeidon Tx overhead line (line 1), and other projects on the Sun Central Cluster 1 (300 MW) solar PV footprint between De Aar and Hanover, Northern Cape province (project No.: STUR0375) prepared by Sturgeon Consulting (Pty) Ltd dated February 2023.
- Access Road and Part 2 Amendment Addendum to Social Impact Assessment Report prepared by Equispectives Research & Consulting Services dated January 2023.
- National Veld and Forest Fire Act, 1998 (Act No. 101 of 1998).

Mitigations:

Impact Management Outcome(s):

- Good traffic and road management.
- To ensure the safe exit of Single-Unit Trucks (SU) and especially Single-Unit Truck plus Trailers (SU+T) at the junction of the N10 with the existing Burgerville (District) Road.
- Avoid injury or fatality amongst staff.
- Responsible sanitary conditions and waste management
- Minimize collapsing trenches.
- Fire management

Targets:

- Vehicles are marked and road signage is erected.
- Traffic accommodation on eastern approach of N10 and flagman
- Safety posters
- Smoking areas
- First Aid certificate, kit and PPE
- Adequate number of chemical toilets
- No containers which held a Hazardous Chemical Substance (HCS) are being reused
- Side walls of trenches battered back to a 1:1.5 grade slope
- Risk analysis

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- Membership of the local Fire Protection Association. Maintained firefighting equipment
- Person appointed to control fires and trained firefighting personnel
- Copy of license to blast and Notification of neighbour's
- No rock more than 150mm outside the working area

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
26	Plant Management	Stakeholders are concerned about the quality of the roads, increases in traffic and traffic safety.	Good traffic and road management.	Vehicles are marked and road signage is erected.	Vehicles must be clearly marked, and the necessary road signage must be erected on the affected roads to warn road users about the construction activities and traffic.	Holder, Contractor	Construction	Compliance to be verified by ECO and IEA.
26	Plant Management and Health and Safety	Traffic accidents at primary access location off the N10.	To ensure the safe exit of Single-Unit Trucks (SU) and especially Single-Unit Truck plus Trailers (SU+T) at the junction of the N10 with the existing Burgerville (District) Road.	Traffic accommodation on eastern approach of N10 and flagman	Place appropriate traffic accommodation on the eastern approach of the N10, indicating a construction access ahead with a possible flagman to alert drivers and slow them down.	Contractor	Construction	Compliance to be verified by ECO and IEA.
27	Health and Safety	Improper safety procedures followed when refuelling.	Avoid injury or fatality amongst staff.	Safety posters	The Contractor must erect and maintain information posters at key locations on site, and the posters must include the following information as a minimum: a) Safety notifications	Contractor, SEO	Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
27	Health and Safety	Improper safety procedures followed when refuelling.	Avoid injury or fatality amongst staff.	All staff have PPE	Implement the following restrictions on all staff operating on the site: (a)No work may be done without the use of PPE (b)No alcohol or illegal substance use on site (c) No firearms permitted on site.	Contractor	Construction	Compliance to be verified by ECO and IEA.
27	Health and Safety	Improper safety procedures followed when refuelling.	Avoid injury or fatality amongst staff.	First Aid kit	A first aid kit must always be accessible on site and must include the number of the local emergency service.	Contractor	Construction	Compliance to be verified by ECO and IEA.
27	Health and Safety	Improper safety procedures followed when refuelling.	Avoid injury or fatality amongst staff.	Smoking areas	Set up and enforce use of designated smoking area(s)	Contractor	Construction	Compliance to be verified by ECO and IEA.
27	Health and Safety	Improper safety procedures followed when refuelling.	Avoid injury or fatality amongst staff.	First Aid certificate	At least one person within each working team must have a valid First Aid Certificate and a First Aid Kit that is adequate to deal with the range of possible life-threatening injuries.	Contractor	Construction	Compliance to be verified by ECO and IEA.
27	General and hazardous waste management	Overuse of chemical toilets can be unhygienic.	Responsible sanitary conditions	Adequate number of chemical toilets	Sufficient chemical toilets (1 toilet for 15 or less staff) shall be provided for staff at the different work fronts.	Contractor	Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
27	General and hazardous waste management	Reuse of certain containers may be harmful to people.	Responsible waste management	No containers which held a Hazardous Chemical Substance (HCS) are being reused	Reusable containers which held a Hazardous Chemical Substance (HCS) may not be donated to any person for reuse, and preferably returned to the supplier to be cleaned and decontaminated, otherwise if that is not possible then punctured and disposed of at a licensed hazardous waste disposal facility.	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.
27	Earthworks	Collapsing sidewalls of excavated trenches.	Minimize collapsing trenches.	Side walls of trenches battered back to a 1:1.5 grade slope	Sidewalls of excavated trenches will be stable in the overburden material, but it is recommended that the sidewalls excavated be battered back to a 1:1.5 grade slope or shored in excavations deeper than 1.5 m to comply with minimum safety regulations.	Contractor	Construction	Compliance to be verified by ECO and IEA.
28	Fire management	Risk of veld fires caused by workers during the construction of the facility.	Fire management	Risk analysis	Undertake a risk analysis to determine inter alia the probability and frequency of a wildfire during construction and operation and prepare a fire	Holder	Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					management plan accordingly.			
28	Fire management	Risk of veld fires caused by workers during the construction of the facility.	Fire management	Membership of the local Fire Protection Association	Join the local Fire Protection Association if there is one and abide by their minimum requirements, as well as any agreements entered into with the Minister or other FPAs to provide mutual assistance in fighting and extinguishing fires.	Holder	Construction	Compliance to be verified by ECO and IEA.
28	Fire management	Risk of veld fires caused by workers during the construction of the facility.	Fire management	PPE	Obtain the necessary PPE for firefighting personnel.	Holder	Construction	Compliance to be verified by ECO and IEA.
28	Fire management	Risk of veld fires caused by workers during the construction of the facility.	Fire management	Firefighting equipment	Obtain such firefighting equipment as would be reasonably required in the circumstances, that is proportional to the risk.	Holder, Contractor	Construction	Compliance to be verified by ECO and IEA.
28	Fire management	Risk of veld fires caused by workers during the construction of the facility.	Fire management	Maintained firefighting equipment	Firefighting equipment shall be maintained and readily available during construction (and operation) - regularly test and service equipment	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
28	Fire management	Risk of veld fires caused by workers during the construction of the facility.	Fire management	Person appointed to control fires	Appoint a responsible person (or agent) who will extinguish a fire, or assist in doing so, and take all reasonable steps to alert the owners of adjoining land and the relevant Fire Protection Association, if any.	Holder, Contractor	Construction	Compliance to be verified by ECO and IEA.
28	Fire management	Risk of veld fires caused by workers during the construction of the facility.	Fire management	Trained firefighting personnel	If no agent is appointed, a team of designated firefighting personal shall be trained and readily available to immediately deal with any runaway veld fires.	Holder, Contractor	Construction	Compliance to be verified by ECO and IEA.
29	Blasting	Fly rock from blasting	Avoid injury or fatality amongst staff.	Copy of license to blast	Any blasting activity must be conducted by a suitably licensed blasting contractor.	Contractor	Construction	Compliance to be verified by ECO and IEA.
29	Blasting	Fly rock from blasting	Avoid injury or fatality amongst staff.	Notification of neighbour's	Notification of surrounding landowners, emergency services site personnel of blasting activity 24 hours prior to such activity taking place on Site.	Contractor, SEO	24 hours prior to blasting	Compliance to be verified by ECO and IEA.
29	Blasting	Fly rock from blasting	Avoid injury or fatality amongst staff.	No rock more than 150mm outside the working area	Fly rock from blasting activity must be minimised and any pieces greater than	Contractor	Construction	Compliance to be verified by ECO and IEA.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
					150 mm falling beyond the Working Area, must be collected and removed.			

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

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

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

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

Residual Risk (feeds back into "Mitigations"):

- None.

Receiving Environment: Security
Description of potential impacts:

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

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Employee Management	Harvesting muthi plants, collecting firewood and/or poaching	Removal of medicinal plants, dead wood and/or wildlife	**Impact:** Increases in stock theft and other crimes. **Consequence:** Economic losses due to loss of livestock/game/property	NA	30
Plant Management	Driving & Transport	Congestion for other road users/Disruption to landowners	**Impact:** Increases in stock theft and other crimes. **Consequence:** Economic losses due to loss of livestock/game/property	NA	30
Security	NA	Influx of contractors and workers into the area.	Impact: Increases in stock theft and other crimes. Consequence: Economic losses due to loss of livestock/game/property.	NA	30

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

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

Impact 30 (Crime and Security)

- Farm safety is a concern in the rural areas of South Africa. Although there is a low incidence of farm attacks in the Karoo, farmers and farm workers are soft targets due to the isolation on farms and distance from emergency services. More people moving around in the area will make it easier for opportunistic criminals to enter the area without being noticed. Stock theft is a problem in the area, and one farmer reported that during the times that Transnet contractors work in the area they lose up to ten sheep a week.
- Farmers are concerned that the presence of the construction workers in the area will cause an increase in stock theft, due to people becoming aware of where the stock are kept. There is also a possibility that petty theft or opportunistic crimes can take place. The municipality indicated that general crime levels increased during the construction phases of the renewable developments around the town. The municipality reported that once the construction teams left, they perceive that there is an increase in local petty crimes such as housebreaking which they attribute to loss of income amongst some community members. There will be less people in the area during the operational phase and fewer permanent workers. onsite.

Assessment without mitigation:

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

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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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
30	M	M	L	-I	M	M	1	H	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

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

- None.

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

- Social Impact Assessment Report prepared by Ilse Aucamp of Equispectives Research & Consulting Services dated August 2022.
- Access Road and Part 2 Amendment Addendum to Social Impact Assessment Report prepared by Equispectives Research & Consulting Services dated January 2023.

Mitigations:

Impact Management Outcome(s):

- A secure construction site
- Movement of vehicles in the area is controlled.

Targets:

- Staff wear photo ID cards. Vehicles are marked
- Controlled entry and exit to site

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
30	Employee Management	Increases in stock theft and other crimes.	A secure construction site	Staff wear photo ID cards	All contractors and employees need to wear photo identification cards.	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.
30	Plant Management	Increases in stock theft and other crimes.	Movement of vehicles in the area is controlled.	Vehicles are marked	Vehicles should be clearly marked as construction vehicles and should have SAE, or the contractor's logo clearly exhibited.	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.
30	Security	Increases in stock theft and other crimes.	A secure construction site	Controlled entry and exit to site	Entry and exit points of the site should be controlled.	Contractor, Landowner	Continuous	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

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

Residual Risk (feeds back into "Mitigations"):

- None.

Receiving Environment: Public Services

Description of potential impacts:

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

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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Plant Management	Driving & Transport	Damage to the roads or environment	**Impact:** Increased traffic can result in corrugations and potholes on roads. **Consequence:** Decrease in condition of gravel roads, increase in travel times.	NA	31

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

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

Impact 31 (Traffic)

- The main gravel road, Burgerville Road, is in a fair to poor condition. The main surfaced road, the N10, in the vicinity of the proposed development is in a good condition except for the N10 between the Middelburg turn off and Hanover which was noted to be in a poor condition and dangerously potholed as a result of the frequent trips by manganese haulers (Traffic Impact Assessment prepared by Sturgeon Consulting (Pty) Ltd dated February 2023).

Assessment without mitigation:

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

Alternative Site No. 1 (preferred)

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

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

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

- None.

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

- Access Road and Part 2 Amendment Addendum to Social Impact Assessment Report prepared by Equispectives Research & Consulting Services dated January 2023.
- Social Impact Assessment Report prepared by Ilse Aucamp of Equispectives Research & Consulting Services dated August 2022.
- Traffic Impact Assessment for the upgrading & development of an access road from the N10/'Burgerville' district road (2448) turn-off to the Main Transmission Substation (MTS) as well as the construction of a loop-in loop-out from the MTS to the 400 kV Hydraposeidon Tx overhead line (line 1), and other projects on the Sun Central Cluster 1 (300 MW) solar PV footprint between De Aar and Hanover, Northern Cape province (project No.: STUR0375) prepared by Sturgeon Consulting (Pty) Ltd dated February 2023.

Mitigations:

Impact Management Outcome(s):

- Good road conditions.

Targets:

- No corrugations or potholes in access road.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
31	Plant Management	Increased traffic can result in corrugations and potholes on roads.	Good road conditions.	No corrugations or potholes in access road.	Undertake regular maintenance of access road by the contractor.	Contractor	Continuous	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
31	L	L	L	-I	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- None.

Receiving Environment: Visual Aesthetics

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Alien Plant management	Disturbance to natural areas	Favourable conditions for alien plant/animal recruitment.	**Impact:** Disturbance of aquatic or terrestrial habitat can favour the recruitment of alien invasive plants, threatening individuals, habitats and alter the composition, structure and functioning of ecosystems. **Consequence: A** decrease in aesthetic, cultural and recreational values (indirect).	NA	32
Clearing/Grubbing and Grading	Access Road, pipeline, construction camp & staging area	Creating bare surfaces susceptible to erosion, currugations, potholes and puddles.	**Impact:** Short-term landscape change from the current rural agricultural sense of place to the semi-industrial RE landscape - Possible soil erosion from temporary roads.	NA	32

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

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

Impact 32 (Visual)

- The spirit of place associated with an area is an important factor in tourism and hunting and the marketing of these activities. Spirit of place refers to the unique, distinctive, and cherished aspects of a place. Aspects that will impact on the sense and spirit of place include an increase in noise and activity levels from construction activities, but this will be a temporary impact during the construction phase. The construction phase will see a total transformation from the current setting and landscape of the proposed site. It is inevitable that the visual impact during the

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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construction phase will be affected by dust, increase in vehicle traffic and other construction activities (Access Road and Part 2 Amendment Addendum to Social Impact Assessment Report prepared by Equispectives Research & Consulting Services dated January 2023).

- It is inevitable that the visual impact during the construction phase will be affected by dust, increase in vehicle traffic and other construction activities. Potential visual impacts caused by construction activities will include the visual changes brought about by clearance of vegetation for the solar arrays, ancillary buildings, and laydown areas; visual disturbance caused by construction of roads, buildings, energy collectors, power lines, increased traffic (and number of large vehicles), worker presence and activity, and dust emissions. Other visual disturbances may include soil stockpiles (from excavation for building foundations and other structures), soil scars, as well as potential for invasive plant species to develop on disturbed soils and soil stockpiles, which may contrast with existing vegetation (Access Road and Part 2 Amendment Addendum to Social Impact Assessment Report prepared by Equispectives Research & Consulting Services dated January 2023).
- Moderate Zone of Visual Influence with no tourism activities or tourist view-corridors.
- The area is remote, and few receptors were identified.

Assessment without mitigation:

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

Alternative Site No. 1 (preferred)

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

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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- None.

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

- Access Road and Part 2 Amendment Addendum to Social Impact Assessment Report prepared by Equispectives Research & Consulting Services dated January 2023.
- The Proposed Sun Central Solar Photovoltaic Facility - Associated Infrastructure, Northern Cape Province, South Africa Visual Impact Assessment (Final V_2) dated 7 February 2023 prepared by Visual Resource Management Africa cc.

Mitigations:

Impact Management Outcome(s):

- Retain aesthetic values and sense of place.

Targets:

- No alien invasive plant infestations.
- No uncontrolled erosion.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
32	Alien plant management	Disturbance of aquatic or terrestrial habitat can favour the recruitment of alien invasive plants, threatening individuals, habitats and alter the composition, structure and	Retain aesthetic values and sense of place.	No alien invasive plant infestations.	Immediately control any alien invasive plant in its entirety (including roots and propagating material) upon being identified on site, using preferably mechanical control methods as opposed to chemical spraying.	Holder, Contractor, SEO	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
		functioning of ecosystems.						
32	Clearing/grubbing and grading	Short-term landscape change from the current rural agricultural sense of place to the semi-industrial RE landscape - Possible soil erosion from temporary roads.	Retain aesthetic values and sense of place.	No uncontrolled erosion.	Soil erosion measures along the construction roads need to be adequately implemented, maintained and routinely monitored by the ECO (monthly).	Contractor, SEO, ECO	Construction	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

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

Residual Risk (feeds back into "Mitigations"):

- None.

Receiving Environment: Heritage and Culture

Description of potential impacts:

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

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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Chance Find Protocol	NA	NA	**Impact:** Earthmoving activities could damage or destroy artefacts or fossils. **Consequence:** The loss of a heritage resources undermines the understanding of previous generations that is vital to creating a sense of unity, belonging, and even pride among South Africans (risk).	NA	33
Linear Infrastructure Crossings	Roads	Grading existing & new roads/Removal of Vegetation /Sedimentation	**Impact:** Disturbance to or destruction of a scatter of low-density stone tools at heritage site 18. Disturbance to or destruction of sites 19, 20 and 21 during construction. Damage to heritage site 36, as well as stone-walled enclosures (kraals) and homesteads at GPS Coordinates S30 51 25.58 E24 14 33.51 (stone-walled enclosure/kraal; S30 51 25.58 E24 14 33.51 (homestead remains) along the public access road route. **Consequence:** Loss/damage of heritage resource.	NA	33
Linear Infrastructure Crossings	Underground Pipelines	Clearing & Grubbing/Removal of Vegetation/Sedimentation	**Impact:** Damage to rocky outcrop with engravings at heritage site 1 during construction. **Consequence:** Loss/damage of heritage resource.	NA	33
Clearing/Grubbing and Grading	Access Road, pipeline, construction camp & staging area	Removal of vegetation	**Impact:** Damage to previously unknown or invisible sites, features or material heritage artifacts/gravesites during construction. **Consequence:** Loss/damage of heritage resource.	NA	33

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

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

Impact 33 (Heritage)

- Although all efforts are made to locate, identify and record all possible cultural heritage sites and features (including archaeological remains) there is always a possibility that some might have been missed as a result of grass cover and other factors. The subterranean nature of these resources (including low stone-packed or unmarked graves) should also be taken into consideration. Should any previously unknown or invisible sites, features or material be uncovered during any development actions then an expert should be contacted to investigate and provide recommendations on the way forward (A Heritage Scoping Report Impact Assessment prepared by APelser Archaeological Consulting cc (APAC) dated February 2023).

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- Previous archaeological and heritage assessments for Cluster 1 (preferred Alternative Route No. 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 of APELSER Archaeological Consulting dated 18 March 2022).
- The palaeosensitivity of the 'broader' project area has been provisionally rated as Very High by the DFFE Screening Tool. However, previous palaeontological site visits to the same area indicate that this region is generally of LOW palaeosensitivity, despite being underlain at depth by potentially fossiliferous continental sediments of the Adelaide Subgroup (Beaufort Group, Karoo Supergroup) of Middle Permian age, as well as small, reworked blocks of petrified wood and low diversity trace fossil assemblages of low scientific interest being recorded from older alluvial deposits and bedrocks in the area. No High Sensitivity fossil sites have been recorded within any of the Soventix Phase 1 to Phase 3 solar project areas (including all associated infrastructure such as grid connections, substations, access roads, etc.). The low overall palaeosensitivity is probably largely due to rarity of well-preserved fossil remains within the bedrocks concerned, the generally very poor levels of bedrock exposure (especially in flat-lying regions), extensive baking of the sedimentary bedrocks by dolerite intrusions in the region as well as the generally low sensitivity of the superficial deposits in the region. The sedimentary bedrocks by dolerite intrusions in the region as well as the generally low sensitivity of the superficial deposits in the region. The construction phase of the proposed additional infrastructure is very unlikely to cause significant negative impacts on local palaeontological heritage resources (Palaeontological Heritage Comment prepared by John E. Almond (PhD) of Natura Viva cc and dated January 2023).
- Site 18 (S30.89070 E24.31404) is a scatter of low-density stone tools, as well as some ostrich eggshell fragments. The site was given a Medium Heritage Significance rating, and it was recommended that the site be mitigated before destruction. This site is included under SAHRA Permit for Phase 2 Mitigation (A Heritage Scoping Report Impact Assessment prepared by APelser Archaeological Consulting cc (APAC) dated February 2023). Site 18 (GPS Coordinates of site 18: S30.89070 E24.31404) is located approximately 70 m south of the proposed access road.
- Sites 19 (S30.89076 E24.31306); 20 (S30.89010 E24.31322) & 21 (S30.88885 E24.31347) were given a Medium Significance Rating as these stone-packed enclosures were identified as redoubts associated with the Anglo-Boer War. Cultural material in the form of cartridges, porcelains, glass and metal objects were recorded in association with these sites. It was recommended that they should be recorded in detail before destruction. The sites are on the banks of watercourse and development exclusion zone and a 30 m no-go buffer zone was therefore recommended. These sites are also included under a SAHRA Permit for archaeological mitigation (A Heritage Scoping Report Impact Assessment prepared by APelser Archaeological Consulting cc (APAC) dated February 2023).
- Site 36 (S30.85412 E24.27465) was given a Medium Heritage Significance Rating for 3 shallow "excavations", circular in shape, into the bedrock. These features were identified as possible dried-up dams or water reservoirs at the time. The site. No further mitigation measures

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were recommended in the 2017 report (A Heritage Scoping Report Impact Assessment prepared by APelser Archaeological Consulting cc (APAC) dated February 2023).

- Stone Age material, similar to those found on other sites during previous assessments, also occur within the area around the new section of the proposed access road route. It is envisaged that more of these scatters of material (individual and denser concentrations of tools) will be present in the area as well. These finds and sites will be given a Low to Medium Heritage Significance rating. As many similar sites in the area are already forming the focus of detailed archaeological mitigation work, no further mitigation is required (A Heritage Scoping Report Impact Assessment prepared by APelser Archaeological Consulting cc (APAC) dated February 2023).
- Site 1 (S30 51 32.10 E24 18 43.00) was given a Medium to High Heritage Significance Rating as there are several rocks containing possible engravings in the form of various striations and lines, which could be related to proto-historic pastoralists that moved through the area. Stone Age material (tools/flakes) was also identified in the general proximity of the site. Should the site be negatively impacted by the proposed development activities it was recommended that Phase 2 Archaeological mitigation work be undertaken. This will entail the detailed mapping, photographic recording and drawing of the site and the individual engravings (through detailed rubbings) to ensure the capturing of the information contained on the site before destruction.
- Site 1 (GPS Coordinates of site 1: S30 51 32.10 E24 18 43.00) is located approximately 230 m north of the proposed pipeline route.
- The remains of recent historical farming-related settlement are close to and around the district access road, including stone-walled enclosure/kraal (S30 51 25.58 E24 14 33.51) and homestead remains (S30 51 25.58 E24 14 33.51). Cultural material associated with these remains were found that included fragments of decorated ceramics dating the sites to between the late 19th and early 20th centuries. These sites are given a Medium to High Heritage Significance Rating and should they be impacted directly be the development activities should be mitigated through archaeological measures that will include detailed mapping and drawing, as well as limited excavations. If they can be avoided, then these sites should be included in the Cultural Heritage Management Plan for the Solar PV development.

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				

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+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
33	L	L	L	neutral	L	L	0	M	H	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):

- None.

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

- A Heritage Scoping Report Impact Assessment related to the Development of the Sun Central Cluster 1, 300 MW, Solar PV Facility additional activities on various Farm Portions between De Aar & Hanover, Emthanjeni Local Municipality, Pixley Ka Seme District Municipality, Northern Cape Province, South Africa (Report: APAC023/12) prepared by APelser Archaeological Consulting cc (APAC) dated February 2023.
- Palaeontological Heritage Comment, Access Road Basic Assessment and Transmission Line Part 2 Amendment for the Sun Central Cluster 1 between De Aar & Hanover, Pixley Ka Seme District Municipality, Northern Cape Province, prepared by John E. Almond (PhD) of Natura Viva cc, and dated January 2023.

Mitigations:

Impact Management Outcome(s):

- Preservation of cultural heritage resources

Targets:

- No unnecessary damage or destruction of heritage resources.
- Adequate supervision when clearing and grubbing, stripping topsoil, and excavating.
- A written response from the South African Heritage Resources Agency (SAHRA) and where applicable, the local police (SAPS).
- Permits issued by SAHRA.
- Site of discovery has been cordoned off.

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- 5 m-wide working corridors for pipelines
- No go area
- 19 m – wide road servitude

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
33	Chance Find Protocol and Clearing/Grubbing and Grading	Earthmoving activities could damage or destroy artefacts or fossils.	Protection and preservation of heritage resources.	No unnecessary damage or destruction of heritage resources.	The bulk of archaeological and palaeontological remains are normally located beneath or near the soil surface, so please be especially vigilant when clearing and grubbing, and excavating.	Contractor, SEO.	Construction	Compliance to be monitored by the SEO and verified by ECO and IEA.
33	Chance Find Protocol and Clearing/Grubbing and Grading	Earthmoving activities could damage or destroy artefacts or fossils.	Protection and preservation of heritage resources.	No unnecessary damage or destruction of heritage resources.	The SEO must give a cursory inspection of the soil surface for Stone Age open-air surface scatters (cores, waste-flakes, more formal tools such as blades, scrapers and broken points) before clearing, and of the bedrock after clearing and before excavating undisturbed areas,	SEO.	Construction	Compliance to be monitored by the SEO and verified by ECO and IEA.

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					in this case for small marine invertebrates and/or trace fossils (e.g., footprints, trails, burrows, etc.).			
33	Chance Find Protocol and Clearing/Grubbing and Grading	Earthmoving activities could damage or destroy artefacts or fossils.	Protection and preservation of heritage resources.	Adequate supervision when clearing and grubbing, stripping topsoil, and excavating.	The SEO shall supervise all clearing and grubbing, as well as excavation activities: (3.1) Examples of cultural or archaeological objects include inter alia (a) Stone Age open-air surface scatters (e.g., cores, waste-flakes, more formal tools such as blades, scrapers and broken points), and (b) stone cairns. (3.2) Examples of palaeontological objects (fossils) include inter alia (a) Rare vertebrate bones and teeth, (b) petrified wood and other plant material, (c) Trace fossils	SEO.	Construction	Compliance to be monitored by the SEO and verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
					within Beaufort Group sediments, (d) Fossil mammal bones, teeth, horn cores, freshwater molluscs, plant material in Late Caenozoic alluvium and pan deposits, and (d) Blocks of reworked silicified wood within surface gravels and older alluvium.			
33	Chance Find Protocol and Clearing/Grubbing and Grading	Earthmoving activities could damage or destroy artefacts or fossils.	Protection and preservation of heritage resources.	No unnecessary damage or destruction of heritage resources.	If any evidence of archaeological sites or artefacts (e.g., remnants of stone-made structures or artefacts, indigenous ceramics, bones, stone cairns, ostrich eggshell fragments, charcoal, and ash concentrations), fossils or other categories of heritage resources are found or uncovered by	Contractor, SEO, ECO	Construction	Compliance to be monitored by the SEO and verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
					construction staff during construction: 1. IMMEDIATELY cease the construction activity, 2. notify the ECO, and 3. don't tamper with the finds.			
33	Chance Find Protocol and Clearing/Grubbing and Grading	Earthmoving activities could damage or destroy artefacts or fossils.	Protection and preservation of heritage resources.	Site of discovery has been cordoned off.	The site of discovery must be cordoned off and demarcated a no-go area with security tape / fence / sandbags if necessary. Access to construction staff shall be prohibited until further notice by the ECO.	Contractor, SEO, ECO	Construction	Compliance to be monitored by the SEO and verified by ECO and IEA.
33	Chance Find Protocol and Clearing/Grubbing and Grading	Earthmoving activities could damage or destroy artefacts or fossils.	Protection and preservation of heritage resources.	No unnecessary damage or destruction of heritage resources.	A professional archaeologist or palaeontologist, depending on the nature of the finds, must be contracted as soon as possible to inspect the heritage resource and assess the	Contractor, SEO, ECO	Construction	Compliance to be monitored by the SEO and verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
					significance of the findings and advise on further actions.			
33	Chance Find Protocol and Clearing/Grubbing and Grading	Earthmoving activities could damage or destroy artefacts or fossils.	Protection and preservation of heritage resources.	A written response from the South African Heritage Resources Agency (SAHRA) and where applicable, the local police (SAPS).	In the case of unmarked human burials, the ECO shall also alert the local police.	Contractor, SEO, ECO	Construction	Compliance to be monitored by the SEO and verified by ECO and IEA.
33	Chance Find Protocol and Clearing/Grubbing and Grading	Earthmoving activities could damage or destroy artefacts or fossils.	Protection and preservation of heritage resources.	No unnecessary damage or destruction of heritage resources.	If any substantial fossil remains (e.g., vertebrate bones, teeth) are exposed by surface clearance or excavations during the construction phase of the development, the Chance Fossils Finds Protocol must be fully implemented.	Contractor, SEO, ECO	Construction	Compliance to be monitored by the SEO and verified by ECO and IEA.
33	Chance Find Protocol and Clearing/Grubbing and Grading	Earthmoving activities could damage or destroy	Protection and preservation of heritage resources.	A written response from the South African Heritage Resources	If the newly discovered heritage resources prove to be of archaeological	Contractor, SEO, ECO	Construction	Compliance to be monitored by the SEO and verified

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		artefacts or fossils.		Agency (SAHRA) and where applicable, the local police (SAPS). Permits issued by SAHRA.	or paleontological significance, a Phase 2 rescue operation may be required subject to permits issued by SAHRA.			by ECO and IEA.
33	Chance Find Protocol and Clearing/Grubbing and Grading	Earthmoving activities could damage or destroy artefacts or fossils.	Protection and preservation of heritage resources.	Site of discovery has been cordoned off.	Ensure the heritage site remains safeguarded until clearance is given by the Heritage Specialist and/or SAHRA for work to resume.	Contractor, SEO, ECO	Construction	Compliance to be monitored by the SEO and verified by ECO and IEA.
33	Linear Infrastructure Crossings	Damage to rocky outcrop with engravings at heritage site 1 during construction.	Preservation of cultural heritage resources.	5 m-wide working corridors for pipelines	Construction activities on the water pipeline between borehole No. 13 (and/or 14) and the OH water storage tank on the solar field (Cluster 1) footprint shall be restricted to a 5 m-wide working corridor.	Contractor, SEO, ECO	Construction	Compliance to be monitored by the SEO and verified by ECO and IEA.
33	Linear Infrastructure Crossings	Damage to rocky outcrop with engravings	Preservation of cultural	No go area	Heritage site 1 (GPS Coordinates of site 1: S30 51 32.10 E24	Contractor, SEO, ECO	Construction	Compliance to be monitored

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		at heritage site 1 during construction.	heritage resources.		18 43.00), located approximately 230 m north of the proposed pipeline route, is a no-go area for the purposes of this project.			by the SEO and verified by ECO and IEA.
33	Linear Infrastructure Crossings	Disturbance to or destruction of a scatter of low-density stone tools at heritage site 18. Disturbance to or destruction of sites 19, 20 and 21 during construction. Damage to heritage site 36, as well as stone-walled enclosures (kraals) and homesteads at GPS Coordinates S30 51 25.58 E24 14 33.51 (stone-walled enclosure/kraal; S30 51 25.58 E24 14 33.51	Preservation of heritage resources.	19 m – wide road servitude	Construction activities on the access road to the MTS shall be restricted to the fenced 19 m-wide road servitude.	Contractor, SEO, ECO	Construction	Compliance to be monitored by the SEO and verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		(homestead remains) along the public access road route.						
33	Linear Infrastructure Crossings	Disturbance to or destruction of a scatter of low-density stone tools at heritage site 18. Disturbance to or destruction of sites 19, 20 and 21 during construction. Damage to heritage site 36, as well as stone-walled enclosures (kraals) and homesteads at GPS Coordinates S30 51 25.58 E24 14 33.51 (stone-walled enclosure/kraal; S30 51 25.58 E24 14 33.51 (homestead remains) along the public	Preservation of heritage resources.	No-go areas	Those heritage sites alongside the district road, including Site 36 (S30.85412 E24.27465), the stone-walled enclosure/kraal (S30 51 25.58 E24 14 33.51) and homestead remains (S30 51 25.58 E24 14 33.51), heritage site 18 (S30.89070 E24.31404), located approximately 70 m south of the proposed access road, as well as sites 19 (S30.89076 E24.31306), 20 (S30.89010 E24.31322) & 21 (S30.88885 E24.31347) and their 30 m buffers are no-go areas for	Contractor, SEO, ECO	Construction	Compliance to be monitored by the SEO and verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		access road route.			the purposes of this project.			

Assessment with mitigation:

Alternative Route No. 1 (preferred)

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

Residual Risk (feeds back into "Mitigations"):

- Previous archaeological and heritage assessments for Cluster 1 (preferred Alternative Route No. 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 (A Heritage Scoping Report Impact Assessment prepared by APelser Archaeological Consulting cc (APAC) dated February 2023).
- The potential for rare, largely unpredictable fossil sites of High Palaeosensitivity within the Permian bedrocks or associated with older alluvial and pan deposits hidden in the subsurface cannot be entirely discounted. Consequently, **a Chance Fossil Finds Protocol shall be included within the EMPr** in case any fossiliferous deposits are exposed by surface clearance or excavations during the construction phase of the development (Palaeontological Heritage Comment prepared by John E. Almond (PhD) of Natura Viva cc and dated January 2023).

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