BIOTHERM ENERGY

Proposed Construction of the Helena 3 75MW Solar Photovoltaic (PV) Energy Facility near Copperton, Northern Cape Province

Final Environmental Impact Assessment Report

DEA Ref No: 14/12/16/3/3/2/767
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Signature:	
For:	SiVEST Environmental Division

KEY PROJECT INFORMATION

FARM DESCRIPTION	21 DIGIT SURVEYOR GENERAL CODE
Portion 3 of the farm Klipgats Pan No 117 (Project Site)	C06000000000011700003
Portion 4 of the farm Klipgats Pan No 117 (Power Lines)	C06000000000011700004

DEVELOPMENT AREAS			
PROJECT	AREA (HECTARES)	CENTRE POINT COORDINATES	
		SOUTH	EAST
HELENA SOLAR 3 DEVELOPMENT AREA	527.20	S30° 2' 46.836"	E22° 17' 6.137"

APPLICATION SITE CORNER POINT CO-ORDINATES		
POINT	SOUTH	EAST
H3_01 (NW)	S30° 1' 51.060"	E22° 16' 45.257"
H3_02 (NE)	S30° 2' 14.598"	E22° 17' 53.548"
H3_03 (SE)	S30° 3' 41.085"	E22° 17' 20.964"
H3_04	S30° 3' 35.771"	E22° 17' 9.924"
H3_05 (SW)	S30° 3' 34.475"	E22° 16' 20.953"

HELENA SOLAR 1 FINAL PREFERRED LAYOUT			
PV ARRAY LAYOUT			
SECTION	POINT	SOUTH	EAST
WEST	WEST_HS3_01 (NW)	S30° 1' 52.793"	E22° 16' 45.497"
WEST	WEST_HS3_02	S30° 1' 52.812"	E22° 16' 49.079"
WEST	WEST_HS3_03	S30° 1' 54.206"	E22° 16' 49.069"
WEST	WEST_HS3_04	S30° 1' 54.225"	E22° 16' 52.652"
WEST	WEST_HS3_05	S30° 1' 55.716"	E22° 16' 52.641"
WEST	WEST_HS3_06	S30° 1' 55.737"	E22° 16' 56.484"
WEST	WEST_HS3_07	S30° 1' 57.131"	E22° 16' 56.474"
WEST	WEST_HS3_08	S30° 1' 57.150"	E22° 17' 0.057"
WEST	WEST_HS3_09	S30° 1' 58.641"	E22° 17' 0.046"

WEST	WEST_HS3_010	S30° 1' 58.662"	E22° 17' 3.890"
WEST	WEST_HS3_011	S30° 2' 0.056"	E22° 17' 3.880"
WEST	WEST_HS3_012	S30° 2' 0.075"	E22° 17' 7.462"
WEST	WEST_HS3_013	S30° 2' 1.696"	E22° 17' 7.450"
WEST	WEST_HS3_014	S30° 2' 1.736"	E22° 17' 14.876"
WEST	WEST_HS3_015	S30° 2' 3.130"	E22° 17' 14.866"
WEST	WEST_HS3_016	S30° 2' 3.149"	E22° 17' 18.449"
WEST	WEST_HS3_017	S30° 2' 4.640"	E22° 17' 18.438"
WEST	WEST_HS3_018 (NE)	S30° 2' 4.660"	E22° 17' 22.020"
WEST	WEST_HS3_19	S30° 2' 7.447"	E22° 17' 22.001"
WEST	WEST_HS3_20	S30° 2' 7.427"	E22° 17' 18.418"
WEST	WEST_HS3_21	S30° 2' 10.442"	E22° 17' 18.397"
WEST	WEST_HS3_22	S30° 2' 10.423"	E22° 17' 14.814"
WEST	WEST_HS3_23	S30° 2' 13.307"	E22° 17' 14.793"
WEST	WEST_HS3_24	S30° 2' 13.286"	E22° 17' 10.950"
WEST	WEST_HS3_25	S30° 2' 19.185"	E22° 17' 10.907"
WEST	WEST_HS3_26	S30° 2' 19.166"	E22° 17' 7.325"
WEST	WEST_HS3_27	S30° 2' 25.065"	E22° 17' 7.283"
WEST	WEST_HS3_28	S30° 2' 25.045"	E22° 17' 3.700"
WEST	WEST_HS3_29	S30° 2' 30.944"	E22° 17' 3.658"
WEST	WEST_HS3_30	S30° 2' 30.883"	E22° 16' 52.387"
WEST	WEST_HS3_31	S30° 2' 33.897"	E22° 16' 52.365"
WEST	WEST_HS3_32	S30° 2' 33.877"	E22° 16' 48.783"
WEST	WEST_HS3_33 (SE)	S30° 2' 39.776"	E22° 16' 48.740"
WEST	WEST_HS3_34	S30° 2' 39.737"	E22° 16' 41.575"
WEST	WEST_HS3_35	S30° 2' 38.343"	E22° 16' 41.585"
WEST	WEST_HS3_36 (SW)	S30° 2' 38.324"	E22° 16' 38.002"
WEST	WEST_HS3_37	S30° 2' 25.132"	E22° 16' 38.098"
WEST	WEST_HS3_38	S30° 2' 25.152"	E22° 16' 41.680"
WEST	WEST_HS3_39	S30° 2' 7.455"	E22° 16' 41.809"
WEST	WEST_HS3_40	S30° 2' 7.475"	E22° 16' 45.391"
EAST	EAST_HS3_01 (NW)	S30° 2' 12.815"	E22° 17' 22.476"
EAST	EAST_HS3_02 (NE)	S30° 2' 12.834"	E22° 17' 26.058"
EAST	EAST_HS3_03	S30° 2' 19.997"	E22° 17' 26.007"
EAST	EAST_HS3_04	S30° 2' 20.016"	E22° 17' 29.590"
EAST	EAST_HS3_05 (SE)	S30° 2' 27.309"	E22° 17' 29.538"
EAST	EAST_HS3_06	S30° 2' 27.231"	E22° 17' 15.207"
EAST	EAST_HS3_07	S30° 2' 28.625"	E22° 17' 15.197"

EAST	EAST_HS3_08 (SW)	S30° 2' 28.605"	E22° 17' 11.615"
EAST	EAST_HS3_09	S30° 2' 24.425"	E22° 17' 11.645"
EAST	EAST_HS3_010	S30° 2' 24.444"	E22° 17' 15.227"
EAST	EAST_HS3_011	S30° 2' 19.939"	E22° 17' 15.260"
EAST	EAST_HS3_012	S30° 2' 19.958"	E22° 17' 18.842"
EAST	EAST_HS3_013	S30° 2' 15.680"	E22° 17' 18.873"
EAST	EAST_HS3_014	S30° 2' 15.699"	E22° 17' 22.455"
SOUTH	SOUTH_HS3_01 (NW)	S30° 2' 38.552"	E22° 17' 18.228"
SOUTH	SOUTH_HS3_02 (NE)	S30° 2' 38.669"	E22° 17' 39.985"
SOUTH	SOUTH_HS3_03	S30° 2' 47.355"	E22° 17' 39.924"
SOUTH	SOUTH_HS3_04	S30° 2' 47.336"	E22° 17' 36.341"
SOUTH	SOUTH_HS3_05	S30° 2' 56.119"	E22° 17' 36.279"
SOUTH	SOUTH_HS3_06	S30° 2' 56.100"	E22° 17' 32.696"
SOUTH	SOUTH_HS3_07	S30° 3' 5.013"	E22° 17' 32.632"
SOUTH	SOUTH_HS3_08	S30° 3' 4.973"	E22° 17' 25.205"
SOUTH	SOUTH_HS3_09 (SE)	S30° 3' 7.858"	E22° 17' 25.185"
SOUTH	SOUTH_HS3_10 (SW)	S30° 3' 7.701"	E22° 16' 56.259"
SOUTH	SOUTH_HS3_11	S30° 2' 56.130"	E22° 16' 56.343"
SOUTH	SOUTH_HS3_12	S30° 2' 56.150"	E22° 16' 59.925"
SOUTH	SOUTH_HS3_13	S30° 2' 45.746"	E22° 17' 0.000"
SOUTH	SOUTH_HS3_14	S30° 2' 45.765"	E22° 17' 3.583"
SOUTH	SOUTH_HS3_15	S30° 2' 41.357"	E22° 17' 3.615"
SOUTH	SOUTH_HS3_16	S30° 2' 41.377"	E22° 17' 7.198"
SOUTH	SOUTH_HS3_17	S30° 2' 39.886"	E22° 17' 7.208"
SOUTH	SOUTH_HS3_18	S30° 2' 39.945"	E22° 17' 18.218"
OTHER INFRASTRUCTURE			
DEVELOPMENT AREA		**CENTRE POINT**	
OPS BUILDING		S30° 2' 20.228"	
		E22° 17' 14.199"	
LAYDOWN AREA		S30° 2' 33.241"	
		E22° 17' 43.196"	
POWER LINE			
POINT		**SOUTH**	**EAST**
1		S30° 1' 18.687"	E22° 17' 55.913"
2		S30° 1' 49.701"	E22° 17' 48.697"

3	S30° 2' 10.082"	E22° 17' 42.790"
4	S30° 2' 37.208"	E22° 18' 57.278"
5	S30° 2' 28.914"	E22° 19' 21.370"
6	S30° 1' 33.924"	E22° 20' 9.635"
7 (KRONOS SUBSTATION)	S30° 1' 29.947"	E22° 20' 22.526"

PREFERRED HELENA 3 (ALT 2)SUBSTATION SITE				
NORTH-WEST CORNER	**NORTH-EAST CORNER**	**CENTRE POINT**	**SOUTH-WEST CORNER**	**SOUTH-EAST CORNER**
S30° 2' 12.826"	S30° 2' 15.006"	S30° 2' 16.435"	S30° 2' 17.789"	S30° 2' 20.069"
E22° 17' 29.582"	E22° 17' 35.633"	E22° 17' 31.323"	E22° 17' 26.946"	E22° 17' 33.137"

Refer to Appendix 9 for the full list of coordinates.

TITLE DEEDS: These are included in Appendix 1

PHOTOGRAPHS OF SITE:

General Characteristics of the study area

TYPE OF TECHNOLOGY: Solar Photovoltaic (PV)

STRUCTURE HEIGHT: Estimated to be approximately 4m although the final design details are yet to be confirmed. These details will become available during the detailed design phase of Helena 3.

SURFACE AREA TO BE COVERED: The total EIA assessment area of the site for the proposed Helena 3 facility is 527 ha and each substation assessment site comprises of approximately 3 ha. The substation will occupy a footprint area of 2.25 ha. The Helena 3 PV array layout will require approximately 190 ha. The laydown area will require an area of 5.5 ha. The final design details are yet to be confirmed and will become available during the detailed design phase of Helena 3.

STRUCTURE ORIENTATION: Structures will either be single axis tracking or fixed tilt structures. This will be confirmed during the detailed design phase of Helena 3. For single axis tracking the structures will be mounted on a north-south horizontal axis and will track the sun from east to west. For fixed tilt structures the modules will be north facing tilted at an angle of between 15-30 degrees.

PV DESIGN: The energy facility will comprise of either fixed tilt or horizontal single axis tracking structures. Either thin film or crystalline silicon modules will be used. The modules will be mounted in rows on the support structures. The modules will be connected in series to make up strings and the strings in parallel to the inverters. DC power from the panels will be converted into AC power in the inverters and the voltage will be stepped up to medium voltage in the inverter transformers. The medium voltage cables will run underground in the facility, unless there are environmental or technical concerns that result in the need for an overhead line, to a common point before being fed to the onsite substation. The onsite substation will house the transformer(s) for voltage step up from medium voltage to high voltage up to 132kV for evacuation to the National Grid.

FOUNDATIONS: Depending on the final geotechnical conditions of the sites the foundations will either be concrete footings or rammed piles. The final foundation design will be determined at the detailed design phase of Helena 3.

TEMPORARY LAYDOWN AREA DIMENSIONS: Approximately 5.5hectares is required.

GENERATION CAPACITY: The project will have a total generation capacity of 75MW.

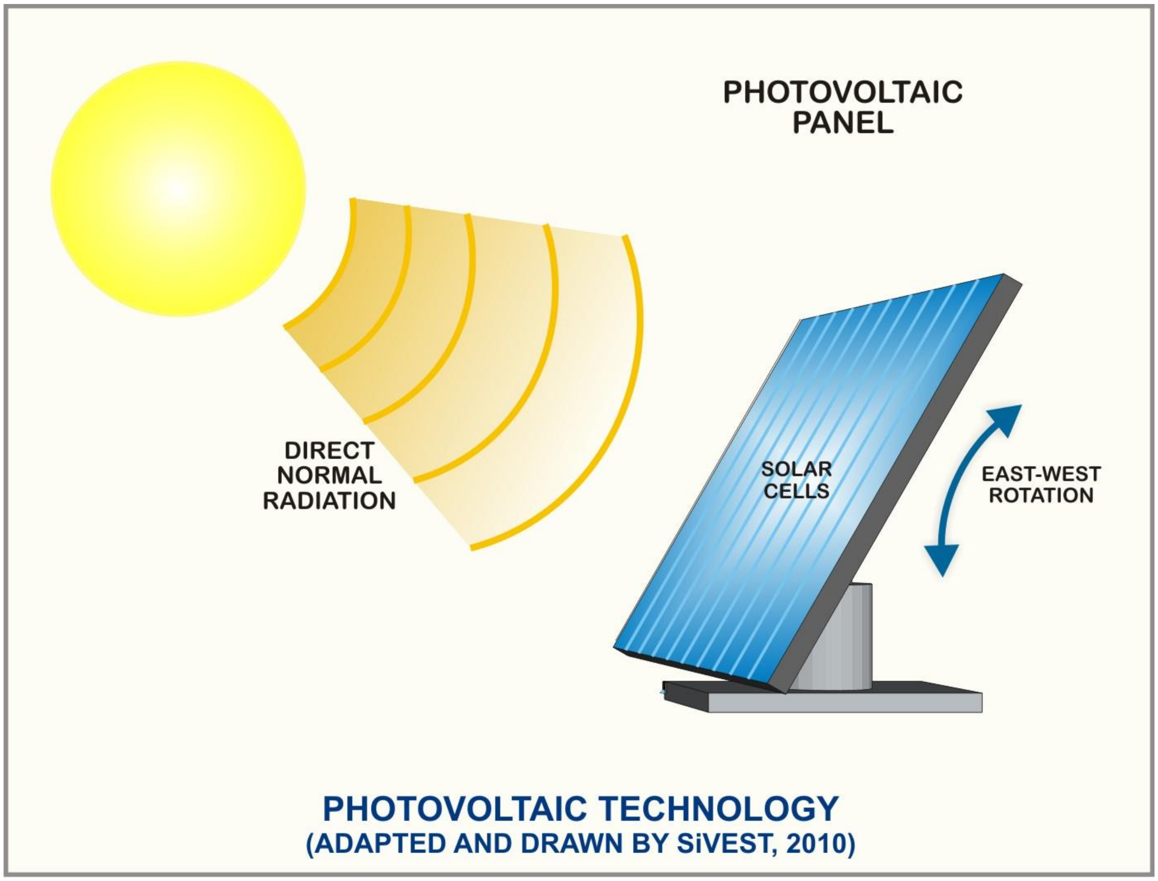

Figure i. Example of a Photovoltaic Panel with tracking capability.

TECHNICAL DETAILS:

Component	**Description / Dimensions**
Generation capacity	Maximum of 75MW
Capacity of the on-site substation	132kV
Number of Panels	Approx. 275 000
Area occupied by each panel	Approx. 2m^2 per panel
Dimensions of panels	1956mm x 992mm x 40mm
Max panel height from the ground	Approx. 4m
Area of the application site	527 ha
Area of preferred PV array	Approx. 190 hectares
Area of preferred substation assessment site	Approx. 3 hectares
Footprint of Substation	Substation will occupy a footprint area of 2.25ha
Footprint of O&M building(s)	Approx. 225 sq.m^2
Area of construction laydown area	Approx. 5.5 hectares

Area of permanent laydown area	Permanent laydown for the containers will be required for the storage of spares, which is to be located close to the O&M building. Approximately 6, 3x12m containers will be required.
Width of internal roads	Up to 8m wide.
Length of internal roads	To be confirmed once the EPC contractor has been selected and the design is finalised.
Number of inverters required	To be confirmed once the EPC contractor has been selected and the design is finalised. (Based on current technology approx.. 43 x 2MW inverter stations)
Area occupied by inverter / transformer stations / substations	To be confirmed once the EPC contractor has been selected and the design is finalised.(based on current technology approx.. 50m^2 per inverter station)
Proximity to grid connection	Grid connection is to the Kronos substation. A **power line** with a voltage of 132kV is proposed and will run from the onsite substation to the Eskom Kronos substation. The distance will be about 5km. The final grid connection voltage will be below 275kV.
Width of the power line servitude	31-36m.
Power line tower types and height	Tower (suspension / strain) / Steel monopole structure, which may be self-support or guyed suspension. Height will vary based on the terrain, but will ensure minimum OHL line clearances with buildings and surrounding infrastructure. Standard Eskom DT- T drawings will be applied.
Diagrams of tower types	DT-T 7649, DT-T7645.
Approximate distance between towers	250m to 350m.
Height of fencing	Approx. 2m high.
Type of fencing	Galvanized steel.

A3 Maps of all smaller maps included in the report are included in Appendix 7.

BIOTHERM ENERGY

PROPOSED CONSTRUCTION OF THE HELENA 3 SOLAR PHOTOVOLTAIC (PV) ENERGY FACILITY NEAR COPPERTON, NORTHERN CAPE PROVINCE

FINAL ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Executive Summary

BioTherm Energy (Pty) Ltd (hereafter referred to as BioTherm) intends to develop the Helena 3 solar photovoltaic (PV) energy facility and associated infrastructure near Copperton in the Northern Cape Province of South Africa. SiVEST Environmental Division has been appointed as independent Environmental Assessment Practitioner (EAP) to undertake the Environmental Impact Assessment (EIA) for the proposed energy facility and associated infrastructure. The overall objective of the project is to generate electricity to feed into the National Grid by constructing a solar PV energy facility (and associated infrastructure).The proposed project will consist of a 75MW export capacity solar PV energy facility.

This proposed PV energy facility forms part of three PV energy facilities each with a 75MW export capacity that BioTherm is proposing to develop on Portion 3 of the farm Klipgats Pan No 117 (Figure ii). In order to accommodate the Department of Energy's (DoE) competitive bidding process for procuring renewable energy from Independent Power Producers in South Africa each PV energy facility will be developed under a separate Special Purpose Vehicle (SPV) and therefore each requires a separate Environmental Authorisation. Although each PV energy facility has been assessed separately, a single public participation process is being undertaken to consider all three proposed developments and the potential environmental impacts associated with all three PV developments were assessed during the EIA phase as part of the cumulative impact assessment. Additionally, the possibility to allow shared associated infrastructure will be considered. The reference numbers allocated for the other two proposed PV energy facilities are as follows:

- **Helena Solar 1:**
  DEA Ref. No.: 14/12/16/3/3/2/765
- **Helena Solar 2:**
  DEA Ref. No.: 14/12/16/3/3/2/766

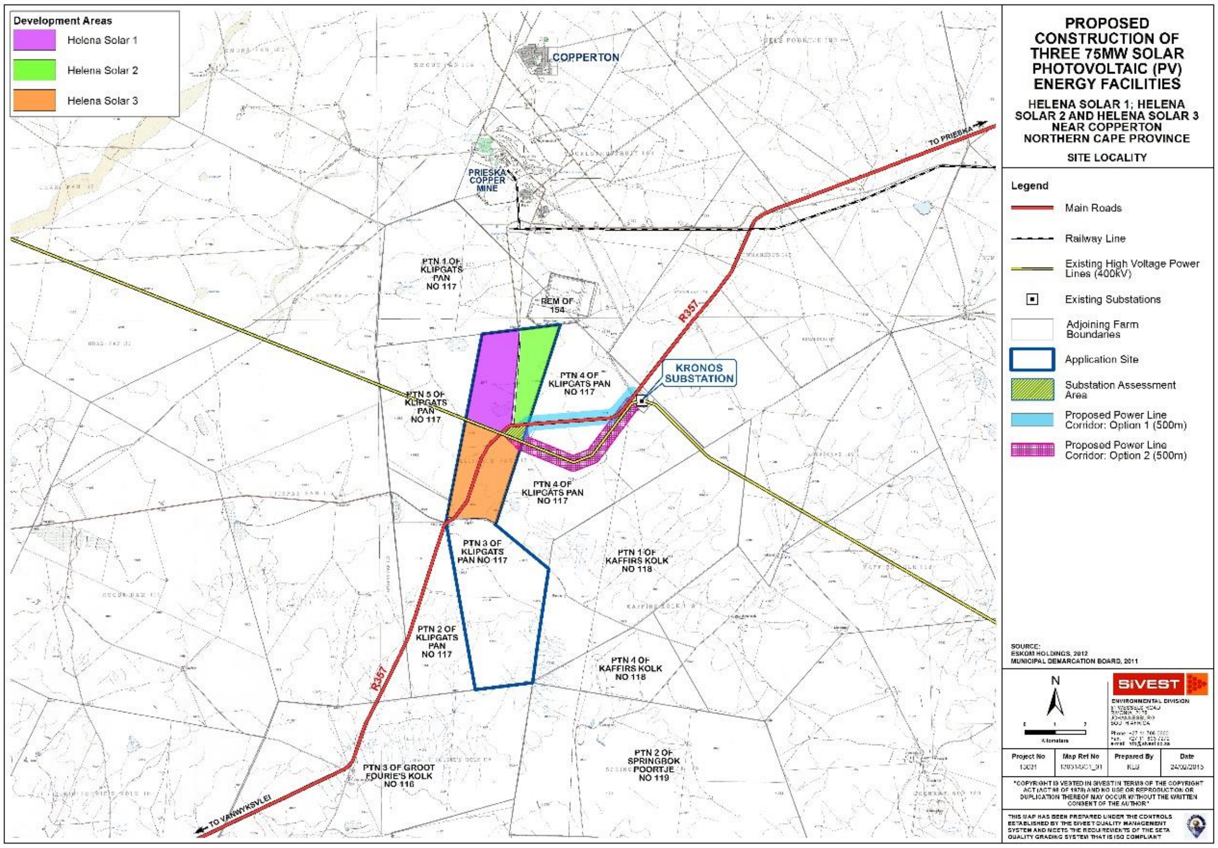

Figure ii: Site locality for the proposed PV energy facility

DEVELOPMENT AREAS			
PROJECT	AREA (HECTARES)	CENTRE POINT COORDINATES	
		SOUTH	EAST
HELENA SOLAR 3 DEVELOPMENT AREA	527.20	S30° 2' 46.836"	E22° 17' 6.137"

Refer to Appendix 9 for the full project coordinates.

The entire assessed site for the proposed solar PV facility is approximately 527 ha. The Helena 3 PV array layout will require approximately 190 ha.

The proposed development requires Environmental Authorisation from the Department of Environmental Affairs (DEA). However, the provincial authority was also consulted (i.e. the Northern Cape Department of Environment and Nature Conservation (NCDENC). The EIA for the proposed development will be conducted in terms of the 2010 EIA Regulations promulgated in terms of Chapter 5 NEMA (National Environmental Management Act), as the EIA was initiated in December 2014 prior to the 2014 EIA Regulations coming into effect. In terms of these regulations, a full EIA is required for the proposed project.

All relevant legislations and guidelines (including Equator Principles) were consulted during the EIA process and will be complied with at all times.

The proposed project involves the construction of one 75MV solar PV energy facility and associated infrastructure.

No site alternatives for this project are being considered because the placement of solar PV installations is dependent on several factors, all of which are favorable at the proposed site location. These include solar resource, climate, topography, grid connections suitability, competition and access to the site. A prefeasibility study was conducted by BioTherm prior to the EIA process, during which six (6) site alternatives were considered and assessed. The site alternatives assessed during the prefeasibility study are described below:

Table i: Site Alternatives assessed during the prefeasibility study conducted by BioTherm.

Project Name	**Project Location**	**Province**	**Size of area assessed**	**Feasibility Fatal Flaws Identifies**
Kathu	Kathu	Northern Cape	12 000	Site was excluded for the proposed development of 3 x 75MW PV plants due to environmental sensitivity of the proposed development area.
Virginia	Virginia	Free State	5000	Site was excluded as there was no grid capacity on 132kV for loop-in loop-out to connect the PV facility to the national grid. Grid connection costs were found to be too high to connect facility.
Bloemfontein	Bloemfontein	Free State	7 000	Site was excluded from a land perspective, as during the prefeasibility studies a large number of landowners were identified. This complicated the proposed development due to the amount of landowners that would be required to sign up and agree to the proposed development.
Viljoenskroon	Viljoenskroon	Free State	3 000	Site was excluded as during the prefeasibility study the solar

				resources were identified as low. Additionally, the cost to connect the PV facility to the national grid was too high.
Petrusville	Petrusville	Free State	5 000	Site was excluded as the proposed development site would be located 50km from closest grid connection point. Therefore, the cost to connect the PV facility to the national grid was too high.
Kimberly	Kimberly	Free State	5000	Site was excluded as during the prefeasibility study the solar resources were identified as low. Additionally, the cost to connect the PV facility to the national grid was too high.

As a result of the prefeasibility studies the proposed development site near Copperton has been identified as the preferred development site for the proposed PV facility. This was based on an estimation of the solar energy resource as well as weather, dust, dirt, and surface albedo, in comparison to the other site alternatives. Grid connection and land availability were also important initial considerations. The Northern Cape has the highest levels of solar potential in the country, and the proposed project site has a relatively flat topography that makes this site suitable for facilities of this kind. The project site also has advantageous grid connection potential, with the existing Eskom Kronos substation approximately 4km away. The site is also easily accessible, as the R357 transects the farm. The proposed site is therefore considered highly suitable for the proposed development and no other site locations were considered.

Layout alternatives have been investigated which relate to the location of the infrastructure on the site and the proposed power line corridor. These are illustrated below:

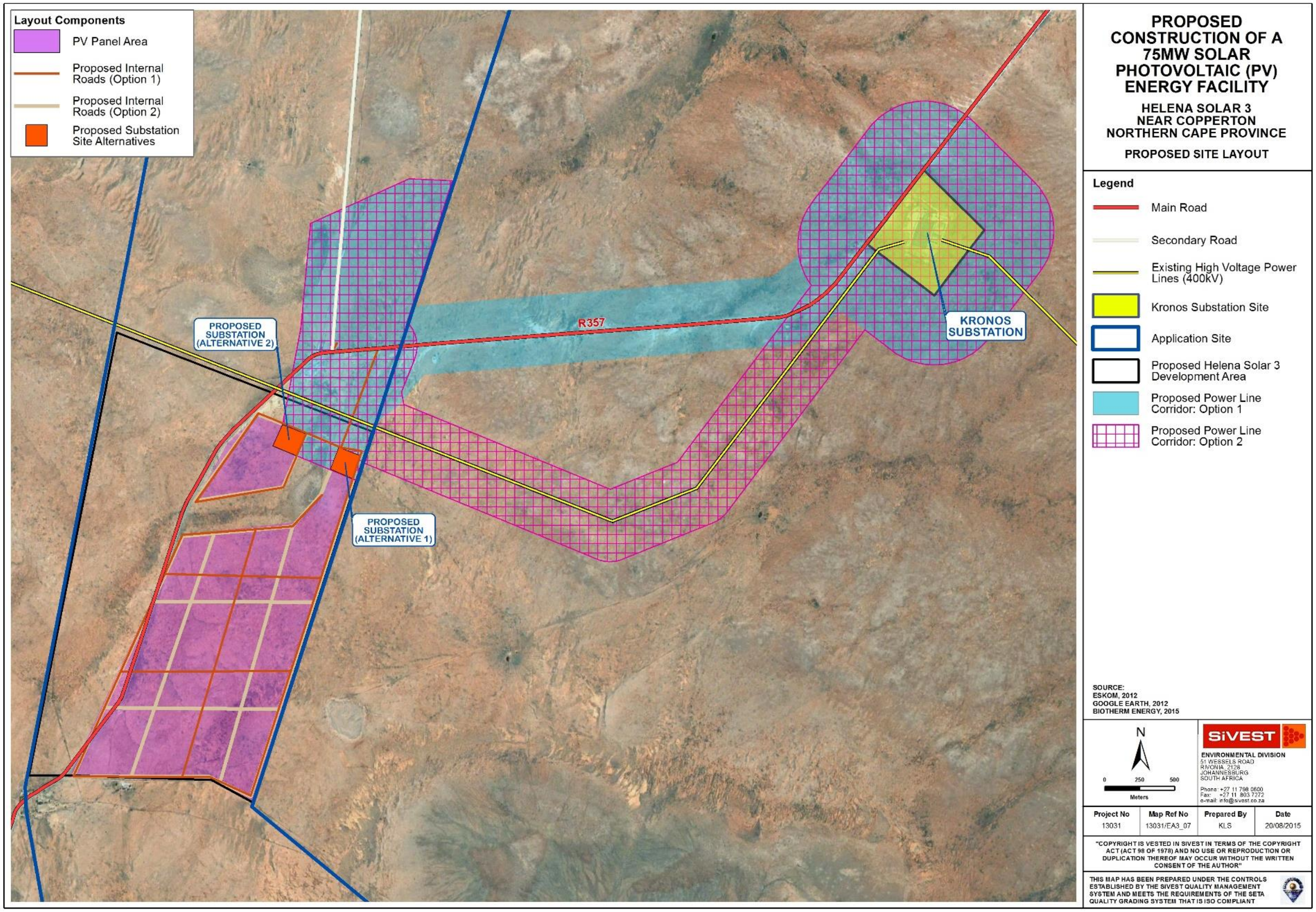

Figure iii: Helena 3 Layout Alternatives

The site is covered by the Bushmanland Basin Shrubland vegetation type, which is characterised by dwarf shrubland dominated by a mixture of low sturdy and spiny shrubs. The aridity of the area has restricted the vegetation cover to this typically short scrub-type vegetation.

Specialist studies were conducted for the following environmental parameters, as part of the EIA phase and as stipulated in the Plan of Study for EIA:

- Biodiversity (flora and fauna);
- Avifauna;
- Surface water;
- Visual;
- Soil and agricultural potential;
- Heritage and palaeontology; and
- Socio-economic.

Table ii: Summary of findings

Environmental Parameter	Summary of Major Findings	Recommendations
Biodiversity	The vegetation types that occur on site (Bushmanland Basin Shrubland, Bushmanland Vloere and possibly floristic elements of Bushmanland Arid Grassland) are classified as Least Threatened and also have a wide distribution and extent. The natural vegetation on the sites is therefore not considered to have high conservation status. The area is not within a Centre of Plant Endemism, nor does it occur in close proximity to an area identified as part of the National Parks Area Expansion Strategy or in areas identified in Provincial Conservation Plans to be of concern. Local factors that may lead to parts of the sites having elevated ecological sensitivity are the presence of the following: ▪ Presence of natural vegetation on site, although of low conservation priority. ▪ Presence of pans and drainage lines. ▪ Potential presence of plant species protected according to the Northern Cape Nature Conservation Act. ▪ Potential presence of the following animals of potential conservation concern: o Honey Badger (NT) o Geoffroy's Horseshoe Bat (NT/LC) o Darling's Horseshoe Bat (NT) o Leseuer's Wing-gland Bat (NT) o Kori Bustard (VU), o Ludwig's Bustard (VU), o Blue Crane (VU), o Martial Eagle (VU),	Control measures for some potential impacts are relatively well-known and easy to implement and it is recommended that these be applied as mitigation measures for some potential impacts. These mitigation measures are described in Chapter 10. Mitigation measures include: ▪ Implement alien plant management plan. ▪ Undertake regular monitoring. ▪ Implement surface Runoff and Stormwater Management Plan. ▪ Establish a Rehabilitation Programme. ▪ Undertake a botanical walk-through survey. ▪ Obtain permits for protected plants.

	○ Lanner Falcon (NT), ○ Lesser Kestrel (NT), ○ Secretarybird (NT). ▪ Potential invasion of natural habitats by alien invasive plants, thus causing additional impacts on biodiversity features. Potential ecological impacts for the project were determined to be as follows: 1. Impacts on indigenous natural vegetation; 2. Impacts on a plant species of low conservation concern; 3. Impacts on protected plant species; 4. Impacts on a protected tree species; 5. Impacts on pans / drainage lines; 6. Mortality of sedentary animals; 7. Displacement of mobile fauna; 8. Mortality of birds by collision with power lines; 9. Establishment and spread of declared weeds and alien invader plants. Following a field assessment of the site, four of these impacts were assessed as unlikely to occur (Impacts 2, 4, 6 and 7).	
Avifauna	An estimated 121 species could potentially occur in the study area. Of these, 10 are South African Red Data species, 18 are southern African endemics and 29 are near-endemics. This means that 8.2% of the species that could potentially occur in the study area are Red Data species, and 38.8% are southern African endemics or near-endemics. Overall, the study area potentially contains a total of 47 endemics and near-endemics, which is 28% of the 167 southern African endemics and near-endemics (Hockey et al. 2005).	▪ Construction and decommissioning activity should be restricted to the immediate footprint of the infrastructure. ▪ Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. ▪ Measures to control noise and dust should be applied according to current best practice in the industry.

	The potential impact on avifauna associated with the proposed development is as follows: ▪ Temporary displacement due to disturbance associated with the construction of the solar facility and associated infrastructure; ▪ Collisions with the solar panels; ▪ Permanent displacement due to habitat transformation; and ▪ Collisions with the associated power lines resulting in mortality. The negative impacts of the proposed Helena PV solar facility on local priority avifauna will range from low to high, depending on the type of impact. In the case of the PV facility and associated infrastructure, the displacement impact due to disturbance during construction is rated as high to start with, and will remain as such after application of mitigation measures. In the case of habitat transformation during operation, the displacement impact is medium – negative and will remain as such after the application of mitigation measures. The impact of direct mortality due to collisions with the solar panels is likely to be low. The displacement impact associated with the construction of the on-site substation will be low, but should not be viewed in isolation, but rather as part of the overall displacement impact associated with the PV facility. The proposed 132kV circuit grid connection will have a medium negative collision impact on avifauna during operation which should be reduced to low-negative through the application of anti-collision mitigation measures. The impact of displacement caused by the construction of the power line will be medium negative, but it could be reduced to low if the Martial Eagle nest on the Hydra-Kronos 400kV line next to Kronos MTS could be re-	▪ Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum. ▪ An avifaunal specialist must be appointed to oversee all aspects of operational phase monitoring (including carcass searches) and assist with the on-going management of bird impacts that may emerge as the monitoring programme progresses. ▪ As an absolute minimum, operational phase monitoring should be undertaken for the first two years of operation, and then repeated again in year 5, and again every five years thereafter. ▪ Carcass searches should be implemented to search the ground between arrays of solar panels on a weekly basis (every two weeks at the longest) for at least one year to determine the magnitude of collision fatalities. ▪ A range of mitigation measures will have to be considered if mortality levels turn out to be significant. ▪ To protect the Martial Eagle nest site located at Tower 519 of the Hydra-Kronos 400kV line, it shall be necessary to relocate the nest site to a more distant, less disturbed area. The extent and distribution of other renewable energy developments planned for the immediate vicinity probably precludes a short-range relocation, and a dedicated structure,

	located. It is unknown at this stage if the nest is active, the pair of Martial Eagles may have been displaced already due to the ongoing activity in the area, if an artificial nesting platform is provided, and the project could have a positive impact on Martial Eagles. The cumulative impacts of the facility on priority avifauna will range from major to minor on a local scale, and minor to insignificant on a regional scale.	strategically situated off the power line network aggregated around the Kronos substation, may be the best option. The requirements of such an undertaking shall be further investigated if the development is authorised by the DEA and selected as a preferred site by the DoE. ▪ The 132kV grid connection should be inspected at least once a quarter for a minimum of two years by the avifaunal specialist to establish if there is any significant collision mortality. ▪ The proposed transmission line for evacuation of the electricity generated by the PVs should be marked with Bird Flight Diverters (BFDs) for their entire length on the earth wire of the line, 5m apart, and alternating black and white.
Surface Water	A surface water delineation and impact assessment is provided in this report for the proposed development. Findings were based on a method for delineating wetlands and riparian habitat as per the DWAF 2005 guidelines. Ultimately, it was found that there are two (2) ephemeral depression wetlands. One is located on the proposed Helena 3 PV study site and the other on the power line alternative corridors. The power line component of the proposed development was found to contain one (1) man-made impoundment (Power Line Alternative 1). In addition, an old borrow pit excavation area and a drainage pathway was identified within both the Power Line Alternative 1 and 2 corridors. The drainage pathway was also identified to extend to the PV study site. An additional drainage pathway was identified in the south eastern area of the PV study site. A 50m buffer zone was applied to the wetland and drainage pathways which	It has been identified that the PV panel area and an internal access road are directly located in the ephemeral depression wetland on the PV study site as well as the drainage pathways. It is strongly recommended that the layout is revised to avoid directly impacting on this surface water resource. Furthermore, as it is uncertain at this stage where some infrastructure and buildings/substations are to be placed, it is strongly recommended that when final designs are established, the identified surface water resources that could potentially be affected (as highlighted in the surface water specialist report**)** are to be avoided. Importantly,

	was applied with guidance from the Gauteng Minimum Requirements for Biodiversity Studies (GDACE, 2009). A comparative assessment was undertaken to determine which of the proposed substation, internal access roads and power line corridor alternatives would be most suitable from a surface water perspective. Accordingly, there was no preference for the substation locations as there were no surface water resources that could be directly affected in these areas. In terms of the internal access road layouts, internal road access layout 1 was viewed as favourable since only a segment of the road layout routes directly through the ephemeral depression wetland as well as the drainage pathway. This option has slightly less environmental impact on surface water resources. On the other hand, internal road layout 2 routes directly through the ephemeral wetland and both drainage pathways. Due to potential increased impact to surface water resources, this option was viewed as not preferred. Finally, both power line corridor alternatives were found to be favourable since the potential impact will be similar for both alternative corridors in that both share the same area for the initial part of the power line and will therefore have the same diversion and/or spanning issues. The impact is not seen as significant since with careful placement of the electricity pylons/towers, the surface water features can be spanned and direct impact can be avoided. In terms of potentially applicable environmental and water related legislature, several listed activities and water uses have provisionally been identified that may be applicable to the proposed development. In terms of NEMA and the EIA Regulations (2010), Activities 11 and 18 of Government Notice R544 (Activities 12 and 19 of Government Notice 983 of 2014) have been identified as being applicable where the proposed development will take place within 32m or directly within the identified	with careful placement of the structures, roads and electricity pylons/towers, the surface water features can be avoided or spanned (for power lines). Should no direct impacts need to take place to the identified surface water resources, the need for water use licensing can be avoided where it can be demonstrated to the Department Water and Sanitation (DWS) that significant impacts will not take place and/or where other water uses (other than those identified in the surface water specialist report) are not required. Where impacts to surface water resources is not avoidable, the relevant water use license is to be applied for before construction is allowed to commence. In this instance, where any structures are within 50m of any surface water resource, adequate run-off mitigation measures need to be accounted for as stipulated in Section 10 above to prevent/minimize accelerated run-off, erosion and sedimentation impacts. All the identified triggered activities and water uses identified in the surface water specialist report should be confirmed with the relevant government authoritative departments.

	surface water resources respectively. With respect to the NWA, water uses (c) and (i) will be applicable where the proposed development will be directly with the identified surface water resources. The above identified activities and water uses should however be confirmed with the relevant government departments. Foreseen potential negative impacts in terms of the pre-construction, construction, operation and decommissioning phases of the proposed development were identified and assessed. Mitigation measures have been stipulated and must be included and implemented as part of the Environmental Management Programme (EMPr) for the proposed development.	
Agricultural Potential and Soils	The soils are virtually all shallow to very shallow (<500 mm), usually sandy and calcareous, overlying either rock or cemented hardpan calcrete. Some rock outcrops occur in places in the landscape. Virtually the entire Helena 3 study area comprises shallow, calcareous soils with rock (land type **Ah93),** as can be seen from the information contained in Chapter 8 and the agricultural potential and soils specialist report. Coupled with these shallow soils, the very low rainfall in the area means that the only means of cultivation would be by irrigation and the Google Earth image of the area shows absolutely no signs of any agricultural infrastructure and certainly none of irrigation. The climatic restrictions mean that this part of the Northern Cape is suited at best for grazing and here the grazing capacity is low, around 20-25 ha/large stock unit.	▪ Minimise removal of surface vegetation. ▪ Re-vegetate with local species as soon as possible. ▪ Ensure all access roads/tracks are surfaced/treated to increase cohesion.

Visual	The Visual Impact Assessment (VIA) conducted for the proposed PV energy facility and associated infrastructure has demonstrated that much of the study area has a rural visual character and is not valued for its tourism significance. It was ascertained that due to the limited human habitation in the surrounding area, very few sensitive receptors are present in the study area and the proposed development would have a medium impact on most of these receptors. The assessment revealed that overall the proposed PV energy facility would have a low visual impact during construction and a medium visual impact during operation, with very few mitigation measures available. The associated infrastructure would have a low visual impact during construction and operation. The substation, internal road and power line corridor alternatives were comparatively assessed. It was established that there is no preference for the substation site and internal road alternatives, but Alternative 2 is preferred from a visual perspective for the power line. Overall it can be concluded that although the visual impact of the PV energy facility would be reduced due to the lack of visual receptors present, the facility does not correspond with the typical land use and would visually contrast with the natural earthly tones of the prevailing Karoo vegetation by creating a dark grey mass within the relatively uniform flat landscape.	▪ Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. ▪ Maintain a neat construction site by removing rubble and waste materials regularly. ▪ Make use of existing gravel access roads where possible. ▪ Ensure that dust suppression techniques are implemented on all access roads. ▪ All reinstated cable trenches should be re-vegetated with the same vegetation that existed prior to the cable being laid. ▪ Light fittings for security at night should reflect the light toward the ground and prevent light spill. ▪ If the operations and maintenance buildings are unstaffed they should not be illuminated at night. ▪ Bury cables under the ground where possible. ▪ The operation and maintenance building should be painted with natural tones that fit with the surrounding environment. Non-reflective surfaces should be utilised where possible. ▪ Select the alternatives that will have the least impact on visual receptors
Heritage	The Heritage Scoping Report has shown that the proposed Helena Solar project may have heritage resources present on the property. This has been confirmed through archival research and evaluation of aerial photography of the sites.	**Find Spots** ▪ The final alignment and pylon positions of the power line needs to be walked down and heritage features demarcated;

	A total of a 110 find spots were logged of which 13 (9 in proposed power line corridors and 4 in Helena 3 footprint area) can be described as archaeological sites.
	
	The find spots varied from Later Stone Age (LSA) scatters consisting of flakes, chips and some cores manufactured from fine-grained quartzite, chalcedony, and cryptocrystalline (ccs) material; Middle Stones Age (MSA) lithics consisting of cores, chips and flakes with a low occurrence of formal tools. The majority of the material utilised were either lideanite that occur in the form of medium sized boulders or round washed pebbles in the area or coarse-grained quartzite that occur as sporadic outcrops.
	
	Earlier Stone Age (ESA) lithics found at some of these finds spots consisted of hand axes, cleavers and large flakes. Most of the lithics were either rolled or heavily weathered with patination evident on 95% of the lithics.
	
	All these site have a low significance, however the possibility of subsurface deposits cannot be discounted and was kept in mind with the development of the mitigation recommendations.
	
	During the fieldwork 13 archaeological sites were identified of which all were archaeological sites representing the Earlier, Middle and Later Stone Age. The sites are all rated as having local heritage significance. All the sites will require mitigation prior to construction.
		▪ Where required the sites identified during the walkdown will then need mitigation measures developed that will need to be completed before construction can commence;
		▪ Such mitigation measures will require a permit from SAHRA before mitigation can be done as well as a final destruction permit on completion of the mitigation work.
		
		PV Footprint
		▪ All sites will require mitigation work before construction can commence.
		▪ The mitigation work will be at a minimum:
		    ▪ a controlled surface collection of the material,
		    ▪ excavation should be considered at 092-093
		    ▪ analysis of material and final report;
		▪ Such mitigation measures will require a permit from SAHRA before mitigation can be done as well as a final destruction permit on completion of the mitigation work.
		
		Due to the large amount of Stone Age material present on site it is recommended that the ECO must have an archaeological background or undergo training, as appropriate, to identify newly discovered sites. Should the finds be significant, an archaeologist may need to be

		appointed to determine appropriate mitigation measures.
Socio-economic	The proposed Helena 3 Solar Photovoltaic Energy Facility is to be located near Copperton in the Siyathemba Local Municipality, Northern Cape Province. It was assumed that the construction of the facility will last for about one year to 18 months and will require an investment of about R1 500million. It was also assumed that the facility's operations will generate about R50 million per year in revenue for about 20 years. Updated estimates suggest that the required investment will be R1 750 million and that R250 million will be generated in revenue annually. The national, provincial, and local government policy and strategy documents analysed in the report support the establishment of renewable energy projects as they have been recognised as potential stimulants of local economic growth, job creation, and also with regards to their contribution to sustainable development. The NCPGDS also notes that "sustainable utilisation of the natural resource base on which agriculture depends is critical in the Northern Cape with its fragile eco-systems and vulnerability to climatic variation". In this regard, care needs to be taken to ensure that renewable energy facilities do not impact negatively on the region's natural environment. However, there will be no significant threats to the natural environment as has been noted during the impact assessment. The economy of the Siyathemba LM is in need of diversification and the establishment of the solar PV facility in the area will offer such an opportunity. Furthermore, if the other proposed projects are approved, this could contribute to the growth of this sector as well as stimulate economic development further. The project will have the potential to	In order to optimise the stimulation of the local economy through direct, indirect, and induced effects, the following should be applied where possible: ▪ Procure construction materials, goods, and products from local suppliers if feasible. ▪ Employ local contractors where possible. ▪ Recruit local labour. ▪ Sub-contract to local construction companies. ▪ Use local suppliers where viable and arrange with the local Small and Medium Enterprises to provide transport, catering, and other services for the construction crew. ▪ Employ labour-intensive measures in construction ▪ Set-up a skills desk at the local municipal office and in the nearby communities to identify skills available in the community and assist in recruiting local labour during both construction and operation. ▪ Contractors should consider providing learnerships and on-job training, if possible. ▪ Where specialist training can be provided, candidates from local communities should be prioritised for training; and ▪ Share knowledge with the sub-contracting companies during the construction period.

	improve the standard of living of the communities located within a 50 km radius given the commitments towards socio-economic and enterprise development. The construction and operation of the facility will result in the following various positive economic impacts: ▪ It was estimated that the capital expenditure on the 75 MW solar facility will be R1 500 million, however updated estimates indicate that this may be R1 750 million. At minimum, 129 employment opportunities will be created during the construction phase. The majority of the employment opportunities, specifically for unskilled and semi-skilled individuals are likely to be available to local community members. Employment opportunities for skilled individuals are likely to be associated with contractors appointed during the construction phase. It is thus assumed that 80% of the positions will be filled by local people. ▪ The annual revenue generated by the plant was estimated at amounting to up to R50 million, however updated estimates indicate that this may be R250 million. Furthermore, it is expected that, at minimum, 43 jobs per annum will be created during operations. It is clear from the impact assessment that the proposed solar PV facility will have a significant positive effect on the national economy in terms of stimulation of domestic production, job creation, government revenue, and export earnings. The project has the ability to increase the size of the local economy by about 5%, and reduce local unemployment. Furthermore, the project falls within the developmental priorities of the local municipality that have identified the promotion of the renewable energy sector as one of the means to reverse the current trends of decline	▪ Goods and services are procured domestically instead of imported, where possible. ▪ Engage with local authorities and inform them of the development as well discuss with them the ability of the municipality to meet the demands for social and basic services created by the migrant construction workers. ▪ Where feasible, assist the municipality in ensuring that the quality of the local social and economic infrastructure does not deteriorate further (especially the local roads). ▪ Control the movement of workers between the site and areas of residence to minimise loitering. ▪ The contractors should make the necessary arrangements for allowing workers from outside the area to return home over weekends and/ or on a regular basis. This would reduce the risk posed to local family structures and social networks. ▪ Implementing health awareness campaigns to curb the potential of spreading disease, use of drugs, or alcohol abuse for example. ▪ Local small businesses should also be approached to investigate the possibility of supplying inputs for maintenance and operations where viable, this should increase local indirect employment creation. ▪ In order to improve the chances of skills being developed during the operational period it is

	and lack in diversity of the economy and alleviate electricity shortages. Based on the above, it can be safely concluded that the proposed project will be highly beneficial for the national economy and local communities. From a socio-economic perspective, the project should be approved for development.	recommended that vocational skills transfer/training programmes be developed and knowledge sharing among employees encouraged. ▪ It is recommended that the project owner develops practical SED and ED programmes throughout the project's lifespan. The plan should be developed in consultation with local authorities and existing strategy documents to identify community projects that would result in the greatest social benefits. With regard to ED initiatives, focus should be on developing plans to support and create sustainable, self-sufficient enterprises. It is important that these plans be reviewed annually and where possible updated.

These specialist studies were conducted to address the potential impacts relating to the proposed development that were identified during the scoping phase. An impact assessment was conducted to ascertain the level of each identified impact, as well as mitigation measures which may be required. The potential positive and negative impacts associated within these studies have been evaluated and rated accordingly. The results of the specialist studies have indicated that no fatal flaws exist as a result of the proposed project. Additionally, the specialists comparatively assessed the alternatives as provided in Figure iii, the results of the comparative assessment are summarised below in Table iii.

Table iii: Summary of comparative assessment

ENVIRONMENTAL ASPECT	**PREFERENCE**					
	Substation Site		**Internal Road**		**Power Line Corridor**	
	Substation Site Alternative 1	**Substation Site Alternative 2**	**Internal Road Alternative 1**	**Internal Road Alternative 2**	**Power Line Corridor Alternative 1**	**Power Line Corridor Alternative 2**
Biodiversity	No Preference	No Preference	No Preference	No Preference	Favourable	Favourable
Avifauna	No Preference	No Preference	No Preference	No Preference	No Preference	No Preference
Surface Water	No Preference	No Preference	Favourable	Not Preferred	Favourable	Favourable
Agricultural Potential and Soils	No Preference	No Preference	No Preference	No Preference	No Preference	No Preference
Heritage	No Preference	No Preference	Favourable	Preferred	Favourable	Preferred
Visual	No Preference	No Preference	No Preference	No Preference	Favourable	Preferred
Socio-economic	No Preference	No Preference	No Preference	No Preference	No Preference	No Preference

Based on the findings of the specialist studies there is no preference between **Substation Site Alternative 1 and 2** as they will result in equal impacts. There is no Internal Road preferred because Alternative 1 would be preferred from a surface water perspective and Alternative 2 would be preferred from a heritage perspective. **Power Line Corridor Alternative 2** is preferred because it has a lower visual impact and would impact fewer heritage resources. Although the preferred power line corridor alternative traverses some sensitive areas, the final power line alignment can and should be routed to avoid these areas Substation Alternative 2 was selected as preferred by the EAP due to its close proximity to the road, and in order to optimise the PV panel array layout, the PV panel array area was amended to avoid sensitive areas to the south-east of the site. As a result of amended the PV panel array layout, the roads were amended to match the new layout. The final preferred road layout avoids all sensitive areas. The only sensitive areas that may be affected by the final Helena 3 preferred layout are those identified by the heritage and avifaunal specialists, impacts on heritage and avifauna are proposed to be addressed by the provided mitigation measures No fatal flaws were identified and therefore all the alternatives mentioned above are considered to be acceptable, although not necessarily preferable from an environmental perspective.

As such, the preferred site layout including the amended PV array layout and adjusted road is indicated in Figure iv below. The preferred site layout in relation to the sensitive areas identified by the specialists is indicated in Figure v.

It should be noted that some micro siting may be required at the construction phase within the authorised buildable area. This is to enable the avoidance of any unidentified features on site or any design constraints when the project reaches construction.

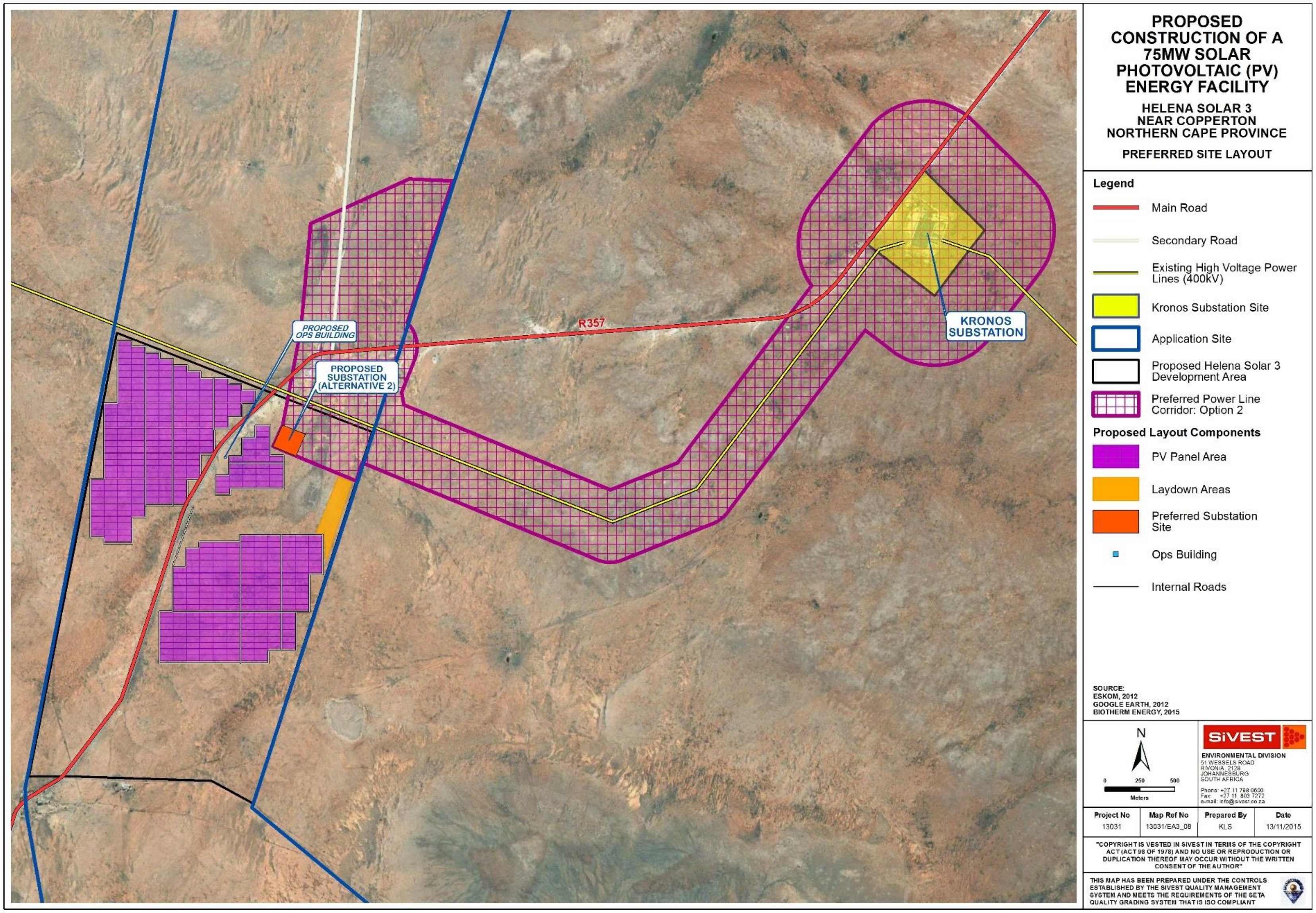

Figure iv: Preferred Site Layout

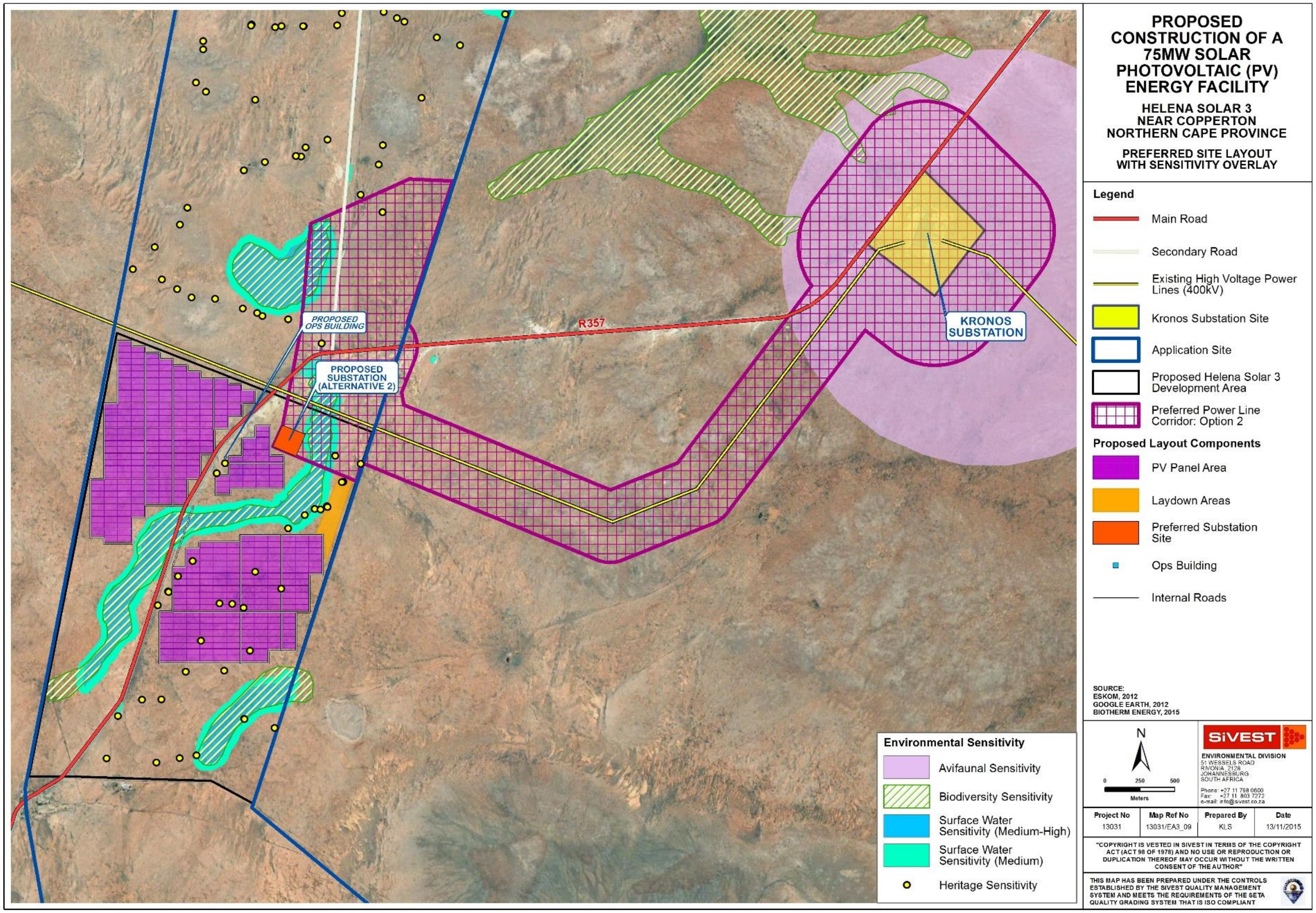

Figure v: Preferred Site Layout in relation to Sensitive Areas

It is the opinion of the EAP that the information and data provided in this FEIAr is sufficient to enable the DEA to consider all identified potentially significant impacts and to make an informed decision on the application. Further, it is the opinion of the EAP that based on the findings of the EIA that the proposed project should be granted an EA and allowed to proceed provided the following conditions are adhered to:

- The proposed PV array should be constructed within the final preferred PV array area.
- The substation should be constructed within **Substation Alternative 2.**
- Access to the grid should be provided by constructing a 132kV power line within **Corridor Alternative 2**.
- Final routing of the power line within the corridor should avoid tower placement within surface water and biodiversity sensitive areas.
- All specialist recommendations pertaining to the SKA should be adhered to.
- All practical and appropriate mitigation measures relating to the Martial Eagle nest, as suggested by the avifaunal specialist and included in the FEIAr and EMPr, should be adhered to.
- All feasible and practical mitigation measures recommended by the various specialists must be implemented, where applicable to the authorised PV array area, authorised associated infrastructure, and authorised substation site and grid line corridor route.
- Final EMPr should be approved by DEA prior to construction.

SiVEST as the EAP is therefore of the view that:

- A preferred site layout has been identified which is less environmentally sensitive compared to the other considered layouts.
- Preferred grid access options have been identified which are environmentally acceptable and will not result in significant impacts, provided that the recommended mitigation measures are implemented and the routing of the power line within the corridor avoids tower placement within surface water and biodiversity sensitive areas.
- Through the implementation of mitigation measures, together with adequate compliance monitoring, auditing and enforcement thereof by the appointed ECO as well as competent authority, the potential detrimental impacts associated with the solar PV energy facility can be mitigated to acceptable levels.

It is trusted that the FEIAr provides the reviewing authority with adequate information to make an informed decision regarding the proposed project.

BIOTHERM ENERGY

PROPOSED CONSTRUCTION OF THE HELENA 3 SOLAR PHOTOVOLTAIC (PV) ENERGY FACILITY NEAR COPPERTON, NORTHERN CAPE PROVINCE

FINAL ENVIRONMENTAL IMPACT ASSESSMENT REPORT

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Glossary of Terms

Alluvial: Resulting from the action of rivers, whereby sedimentary deposits are laid down in river channels, floodplains, lakes, depressions etc.

Biodiversity: The variety of life in an area, including the number of different species, the genetic wealth within each species, and the natural areas where they are found.

Cumulative Impact: In relation to an activity, cumulative impact means the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

"Equator Principles": A financial industry benchmark for determining, assessing and managing social & environmental risk in project financing

Environmental Impact Assessment: In relation to an application, to which Scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of the application.

Environmental Impact Assessment Report: In-depth assessment of impacts associated with a proposed development. This forms the second phase of an Environmental Impact Assessment and follows on from the Scoping Report.

Environmental Management Programme: A legally binding working document, which stipulates environmental and socio-economic mitigation measures which must be implemented by several responsible parties throughout the duration of the proposed project.

Heritage Resources: This means any place or object of cultural significance. See also archaeological resources above

Kilovolt (kV): a unit of electric potential equal to a thousand volts (a volt being the standard unit of electric potential. It is defined as the amount of electrical potential between two points on a conductor carrying a current of one ampere while one watt of power is dissipated between the two points).

Precipitation: Any form of water, such as rain, snow, sleet, or hail that falls to the earth's surface.

Red Data Species: All those species included in the categories of endangered, vulnerable or rare, as defined by the International Union for the Conservation of Nature and Natural Resources.

Riparian: The area of land adjacent to a stream or river that is influenced by stream induced or related processes.

Scoping Report: An "issues-based" report which forms the first phase of an Environmental Impact Assessment process

Stone Age: The first and longest part of human history is the Stone Age, which began with the appearance of early humans between 3-2 million years ago. Stone Age people were hunters, gatherers and scavengers who did not live in permanently settled communities. Their stone tools preserve well and are found in most places in South Africa and elsewhere.
Early Stone Age 2 000 000 - 150 000 Before Present
Middle Stone Age 150 000 - 30 000 BP
Late Stone Age 30 000 - until c. AD 200

List of Abbreviations

BID - Background Information Document
BLSA - Bird Life South Africa
CRM - Cost Recovery Mechanism
DEA - Department of Environmental Affairs
DEIAr - Draft Environmental Impact Assessment Report
DoE - Department of Energy
DSR - Draft Scoping Report
DWS - Department of Water and Sanitation
EAP - Environmental Assessment Practitioner
EHS - Environmental, Health, and Safety
EIA - Environmental Impact Assessment
EMC - Electromagnetic compatibility
EMI - Electromagnetic interference
EMPr - Environmental Management Programme
ENPAT - Environmental Potential Atlas
EP - Equator Principles
EPFI - Equator Principles Financial Institutions
FD - Frequency Domain
FEIAr - Final Environmental Impact Assessment Report
FGM - Focus Group Meeting
FSR - Final Scoping Report
GDP - Gross Domestic Product
GIIP - Good International Industry Practice
GIS - Geographic Information System
GPS - Global Positioning System
GW - Gigawatts
HIA - Heritage Impact Assessment
I&AP(s) - Interested and Affected Parties
IBA(s) - Important Bird Area(s)
IDP - Integrated Development Plan
IEP - Integrated Energy Plan
IFC - International Finance Corporation
IPP(s) - Independent Power Producers
IUCN - International Union for the Conservation of Nature and Natural Resources
KSW - Key Stakeholder Workshop
kV - Kilo Volt
MSA - Middle Stone Age
MW - Megawatt
NCDTEC- Northern Cape Department of Tourism, Environment and Conservation

NEA - The National Energy Act No. 34 of 2008
ERA - The Electricity Regulation Act No. 4 of 2006
IRP - Integrated Resource Plan
NEMA - National Environmental Management Act No. 107 of 1998
NEMBA - National Environmental Management: Biodiversity Act No. 10 of 2004
NFEPA - National Freshwater Ecological Priority Areas
NHRA - National Heritage Resources Act No. 25 of 1999
NSBA - National Spatial Biodiversity Assessment
NWA - National Water Act No. 36 of 1998
NEMAA - National Environmental Management: Air Quality Act of 2004
OHSA - Occupational Health and Safety Act No. 85 of 1993
PoS - Plan of Study
PM - Public Meeting
PPA - Power Purchase Agreement
PPP - Public Participation Process
PV - Photovoltaic
REFIT - Renewable Feed-In Tariff Programme
RFI - Radio frequency interference
RFP - Request for Proposals
RFQ - Request for Qualifications
SA - South Africa
SABAP 2 - Southern African Bird Atlas Project 2
SAHRA - South African Heritage Resources Agency
SANBI - South African National Biodiversity Institute
SDF - Spatial Development Framework
TD - Time Domain

BIOTHERM ENERGY

PROPOSED CONSTRUCTION OF THE HELENA 3 SOLAR PHOTOVOLTAIC (PV) ENERGY FACILITY NEAR COPPERTON, NORTHERN CAPE PROVINCE

FINAL ENVIRONMENTAL IMPACT ASSESSMENT REPORT

1 INTRODUCTION

BioTherm Energy (Pty) Ltd (hereafter referred to as BioTherm) intends to develop the Helena 3 solar photovoltaic (PV) energy facility (hereafter referred to as the “proposed development”) near Copperton in the Northern Cape Province of South Africa. The proposed project will consist of a 75MW export capacity solar PV energy facility. SiVEST Environmental Division has been appointed as independent Environmental Assessment Practitioner (EAP) to undertake the Environmental Impact Assessment (EIA) for the proposed development. The overall objective of Helena 3 is to generate electricity to feed into the National Grid by constructing a solar PV energy facility (and associated infrastructure).

This proposed PV energy facility forms part of three PV energy facilities with a 75MW export capacity that BioTherm is proposing to develop on Portion 3 of the farm Klipgats Pan No 117. In order to accommodate the Department of Energy’s (DoE) competitive bidding process for procuring renewable energy from Independent Power Producers in South Africa each PV energy facility will be developed under a separate Special Purpose Vehicle (SPV) and therefore each requires a separate Environmental Authorisation. Although each PV energy facility wereassessed separately, a single public participation process is being undertaken to consider all three proposed developments and the potential environmental impacts associated with all three PV developments will be assessed during the EIA phase as part of the cumulative impact assessment. Additionally, the possibility to allow shared associated infrastructure will be considered. The reference numbers allocated for the other two proposed PV energy facilities are as follows:

- **Helena Solar 1:**
  DEA Ref. No.: 14/12/16/3/3/2/765
- **Helena Solar 2:**
  DEA Ref. No.: 14/12/16/3/3/2/766

The National Environmental Management Act (No. 107 of 1998) (NEMA) EIA Regulations that were promulgated in December 2014 govern the EIA process. However the EIA for this proposed project was initiated in early December 2014 with the submission of the application form, prior to the promulgations of the new regulations, therefore in accordance with Regulation 53(1) of the 2014 EIA Regulations, any applications submitted in terms of the previous NEMA regulations must be undertaken as if the previous NEMA regulations were not repealed. This EIA has therefore been undertaken in accordance with the NEMA 2010 EIA Regulations which are contained in four Government Notices (GN 543, 544, 545 and 546) which were promulgated on 18 June 2010 and came into effect on 02 August 2010. In terms of the 2010 EIA Regulations, the proposed development is regarded as a listed activity under Government Notice R544 - R546 of. The Scoping Phase of the project has been completed and has been accepted by the National Department of Environmental Affairs (DEA). The EIA phase is currently in progress.

This report has been compiled in accordance with World Bank standards and the Equator Principles. The Equator Principles ("EP") is a financial industry benchmark for determining, assessing and managing social and environmental risk in project financing (Equator Principles, 2013). This PV project is considered a Category B project. Category B Projects are those with potential limited adverse social or environmental impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures (Equator Principles, 2013). The project will also comply with the International Finance Corporation's (IFC) Social and Environmental Performance Standards (2006).

1.1 Structure of this Report

This FEIAr is structured as follows:

- Chapter 1 introduces the project and discusses the experience of the Environmental Assessment Practitioners (EAP), including specialists, who have contributed to the report. It expands on the relevant legal ramifications applicable to the project and describes the Equator Principles, IFC Performance Standards and the relevant development strategies and guidelines.
- Chapter 2 details the approach used to undertake the study i.e. the scoping study, authority consultation and the FEIAr.
- Chapter 3 elaborates on the assumptions and limitations pertaining to the EIA process for the proposed development.
- Chapter 4 provides explanation to the need and desirability of the proposed project by highlighting issues such as security of power supply; local employment as well as regional and local income profile.
- Chapter 5 gives detailed technical descriptions of the solar PV energy facility as well as the alternatives involved.
- Chapter 6 provides a description of the region in which the proposed development is intended to be located. Although the chapter provides a broad overview of the region, it is also specific to the application. It contains descriptions of the site and the specialist studies conducted during scoping phase are also summarised.
- Chapter 7 describes the Public Participation Process (PPP) undertaken during the EIA Phase and tables issues and concerns raised by Interested and Affected Parties (I&APs).

- Chapter 8 documents the findings of the specialist studies and associated potential impacts of the proposed solar PV energy facility.
- Chapter 9 presents a rating of each environmental issue before and after mitigation measures.
- Chapter 10 identifies recommendations from the specialists that have a bearing on the layout alternatives as well as proposed mitigation measures.
- Chapter 11 identifies potential cumulative impacts per environmental issue (specialist study).
- Chapter 12 gives a comparative assessment of all identified alternatives based on the various environmental issues (specialist studies).
- Chapter 13 provides a description of the environmental monitoring and auditing process to be undertaken for the proposed solar PV energy facility.
- Chapter 14 presents a checklist that ensures that the report has been compiled according to the requirements of the World Bank Standards and Equator Principles.
- Chapter 15 summarises the findings and recommendations per specialist study and provides the overall conclusion.
- Chapter 16 lists references indicated in the FEIAr.

1.2 Expertise of Environmental Assessment Practitioner

SiVEST has considerable experience in the undertaking of EIAs. Staff and specialists who have worked on this project and contributed to the compilation of this report are detailed in Table 1 below.

Table 1: Project Team

Name and Organisation	Role
Rebecca Thomas **SiVEST** (until 4 November 2016)	Project Director
Andrea Gibb **SiVEST**	Project Leader
Lynsey Rimbault **SiVEST** (until 31 July 2016)	Environmental Consultant
Veronique Evans **SiVEST**	Environmental Consultant
David Hoare **David Hoare Consulting**	Biodiversity (Flora/Fauna)
Chris van Rooyen **Chris van Rooyen Consulting**	Avifauna
Shaun Taylor **SiVEST**	Surface Water and Wetlands
Martin Ferreira **Jeffares and Green**	Surface water external peer reviewer
Wouter Fourie **PGS**	Heritage and Palaeontology
Andrea Gibb **SiVEST**	Visual
Keagan Allan **SRK consulting**	Visual impact external peer reviewer
D.G. Paterson, **ARC Institute for Soil, Climate and Water**	Soils and Agricultural Potential
Elena Broughton **Urban Econ**	Socio-economic
Kerry Schwartz **SiVEST**	GIS and Mapping
Nicolene Venter **Zitholele Consulting**	Public Participation Practitioner

Please refer to Appendix 2 for CV's of each team member. Declarations of Independence are included in Appendix 4.

1.3 Key Legal and Administrative Requirements Relating to the Proposed Development

1.3.1 National Environmental Management Act (Act No 107 of 1998) – NEMA EIA Requirements

The National Environmental Management Act (Act No. 107 of 1998) was promulgated in 1998 but has since been amended on several occasions from this date. This Act replaces parts of the Environment Conservation Act (Act No 73 of 1989) with exception to certain parts pertaining to Integrated Environmental Management. The act intends to provide for:

- co-operative environmental governance by establishing principles for decision-making on matters affecting the environment;
- institutions that will promote co-operative governance and procedures for coordinating environmental functions exercised by organs of state;
- to provide for the prohibition, restriction or control of activities which are likely to have a detrimental effect on the environment;
- and to provide for matters connected therewith.

Activities that may significantly affect the environment must be considered, investigated and assessed prior to implementation.

1.3.2 NEMA EIA Requirements

Sections 24 and 44 of NEMA make provision for the promulgation of regulations that identify activities which may not commence without an environmental authorisation, the result being that of the NEMA now governs the EIA process with the said promulgation of EIA Regulations in December 2014 (Government Gazette No. 38282 of 04 December 2014). However the EIA for this proposed project was initiated in March 2014, therefore in accordance with Regulation 53 (1) of the 2014 EIA Regulations, any applications submitted in terms of the previous NEMA regulations must be undertaken as if the previous NEMA regulations were not repealed. This EIA has therefore been undertaken in accordance with the NEMA EIA 2010 Regulations which are contained in four Government Notices (GN 543, 544, 545 and 546) which were promulgated on 18 June 2010 and came into effect on 02 August 2010.

Apart from other matters regulating the EIA process and related matters, Government Notice (GN) No. R.543 sets out two distinct authorisation processes. Depending on the nature of listed activity that is proposed to be undertaken, either a so-called "basic assessment" process or a so-called "scoping and EIA" process is required to apply for an environmental authorisation in terms of NEMA. GN No. R.544 lists activities that require a Basic Assessment (BA), GN No. R.545 lists activities that require scoping and an Environmental Impact Assessment (EIA) and GN No. R.546 lists activities that only require an Environmental Authorisation, through a basic assessment process, if the activity is undertaken in a specific geographical area indicated in the listing notice.

The Listed Activities that are of relevance to the project in question identified in terms of the NEMA are listed below (Table 2). These include the following Schedules of GN No. R. 544 - 546 of 18 June 2010. The equivalent Schedules of GN R983 - 985 of 4 December 2014 are also provided.

Table 2: Listed activities in terms of the NEMA Regulations

GNR 543 Listed Activities originally applied for Listed activity as described in GN R.544, 545 and 546	GNR 982 Listed Activities, equivalent to Original GN R543 Activities applied for Listed activity as described in GNR 983, 984 and 985	Description of listed activity
GN R. 544 Item 10: *The construction of facilities or infrastructure for the transmission and distribution of electricity-* *i. outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts.*	**GN R. 983 Item 11:** *The development of facilities or infrastructure for the transmission and distribution of electricity-* *(i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts*	**The proposed project will entail the construction of a 132kV onsite substation. Power lines are proposed to connect the PV energy facility to the Eskom grid at the Kronos Substation. The proposed power lines will be located outside an urban area and will have a capacity of 132kV.**
GN R. 544 Item 11: *The construction of (iii) bridges…(xi) infrastructure or structures covering 50 square metres or more, where such infrastructure occurs within a water course or within 32 metres of a watercourse, measured from the edge of the water course….*	**GN R. 983 Item 12:** *The development of :* *iii) bridges exceeding 100 square metres in size;* *x) buildings exceeding 100 square metres in size;* *xii) infrastructure or structures with a physical footprint of 100 square metres or more;* *where such development occurs-* *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;*	**The surface water impact assessment revealed that there are natural and man-made surface water features occurring within the proposed PV array site and power line corridors. Although these were taken into account and avoided where possible when determining the final preferred layout within the development site, construction activities are still likely to take place within 32m of these surface water features.**
GN R. 544 Item 18: *The infilling or deposition of any material of more than 5 cubic metres into, or the dredging. Excavation, removal of moving of soil, sand, sand….pebbles or rock from a watercourse may occur during the construction of the access road or any other infrastructure associated with the proposed solar energy facility.*	**GN R. 983 Item 19:** *The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from-* *(i) a watercourse;* *But excluding where such infilling, depositing , dredging, excavation, removal or moving-* *(a) will occur behind a development setback;*	**The surface water impact assessment revealed that there are natural and man-made surface water features occurring within the proposed PV array site and power line corridors. Although these were taken into account and avoided where possible when determining the final preferred layout within the development site, construction activities are still likely to take place within 32m of these surface water features. Should construction activities take place within a watercourse soil is likely to be removed**.

	(b) is for maintenance purposes undertaken in accordance with a maintenance management plan; or *(c) falls within the ambit of activity 21 in this Notice, in which case that activity applies.*	
Not applicable in the 2010 regulations.	**GN R. 983 Item 28:** *Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 01 April 1998 and where such development:* *(ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare;* *excluding where such land has already been developed for residential, mixed, retail, commercial, industrial or institutional purposes.*	**The proposed project site is currently used for sheep farming, and the proposed project will result in an area greater than 1 hectare being transformed into an industrial land use.**
GN R. 544 Item 47: *The widening of a road by more than 6m, or the lengthening of a road by more than 1km:* *iii) where the existing reserve is wider than 13,5m; or* *iv) where no reserve exists, where the existing road is wider than 8m.*	**GN R. 983 Item 56:** *The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre -* *(i) where the existing reserve is wider than 13,5 meters; or* *(ii) where no reserve exists, where the existing road is wider than 8 metres –* *excluding where widening or lengthening occur inside urban areas.*	**It is likely that existing access roads will need to be upgraded in order to access the site.**
GN R. 545 Item 1: *The construction of facilities or infrastructure, including associated structures or infrastructure, for the generation of electricity where the electricity output is 20 megawatts or more.*	**GN R. 984 Item 1:** *The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more, excluding where such development of facilities or infrastructure is for photovoltaic installations and occurs within an urban area.*	**It is proposed that a solar PV energy facility with a maximum export capacity of 75MW will be constructed.**

GN R. 545 Item 15: *Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more;* *except where such physical alteration takes place for* *i) Linear development activities; or* *ii) Agriculture or afforestation where the activity 16 in this schedule will apply*	**GN R. 984 Item 15:** *The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for-* *(i) the undertaking of a linear activity; or* *(ii) maintenance purposes undertaken in accordance with a maintenance management plan.*	**The proposed development will transform more than 20 hectares of undeveloped land to industrial use (solar PV energy facility). The proposed development site is approximately 527.20 ha. However, the actual footprint of the proposed layout is 190 ha.**
GN R. 546 Item 14: *The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation* ***(a) In the Northern Cape*** *i) All areas outside urban areas*		**More than 5 hectares of vegetation would need to be cleared for the proposed solar PV energy facility and associated infrastructure. The sites fall within the Nama-Karoo Biome and includes the vegetation types of Bushmanland Basin Shrubland, Bushmanland Vloere, and Bushmanland Arid Grassland. The majority of vegetation on site is natural, although of low conservation priority.**
GN R. 546 Item 19: *The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre.* ***a) In the Northern Cape*** *ii) Outside urban areas, in:* *(ii) Areas on the watercourse side of the development setback line or within 100 metres from the edge of a watercourse where no such setback line has been determined.*	**GN R. 985 Item 18:** *The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre.* *(a) In Northern Cape provinces:* *ii. Outside urban areas, in:* *(ii) Areas on the watercourse side of the development setback line or within 100 metres from the edge of a watercourse where no such setback line has been determined.*	**It is likely that existing access roads will need to be upgraded in order to access the site. The surface water impact assessment revealed that there are natural and man-made surface water features occurring within the proposed PV array site and power line corridors. Although these were taken into account and avoided where possible when determining the final preferred layout within the development site, construction activities are still likely to take place within 100m of these surface water features.**

1.3.3 National Heritage Resources Act (Act No 25 of 1999)

The protection and management of South Africa's heritage resources is primarily regulated by the National Heritage Resources Act, 1999 (Act 25 of 1999) (NHRA). The law ensures community participation in the protection of national heritage resources and involves all three levels of government (national, provincial and local) in the management of the country's national heritage. The South African Heritage Resources Agency (SAHRA) is the enforcing authority for the NHRA.

In terms of the Act, various forms of heritage resources (such as graves, certain trees, archaeological artefacts, fossil beds etc.), are afforded protection and a permit may be required to destroy, damage, excavate, alter, etc. protected heritage resources).

Furthermore, in terms of section 38 of the NHRA, the responsible heritage resources authority can call for a Heritage Impact Assessment (HIA) where certain categories of development are proposed. The provisions of section 38 do not apply to a development if an evaluation of the impact of such development on heritage resources is required in terms of (among other legislation), NEMA. This is subject to the proviso that the consenting authority must ensure that the evaluation fulfils the requirements of the relevant heritage resources authority in terms of section 38(3) and that any comments and recommendations of the relevant heritage resources authority with regard to such development have been taken into account prior to the granting of the consent.

A heritage assessment has been conducted to explore how the proposed development may impact on heritage resources as protected by the Act.

1.3.4 National Water Act (Act No 36 of 1998)

The National Water Act, No 36 of 1998 (NWA) was promulgated on the 20th August 1998. This Act is important in that it provides a framework to protect water resources against over exploitation and to ensure that there is water for social and economic development, human needs and to meet the needs of the aquatic environment. The Act also recognises that water belongs to the whole nation for the benefit of all people.

It is important to note that water resources are protected under the Act. Under the act, water resources as defined include a watercourse, surface water, estuary or aquifer. A watercourse is defined as a river or spring, a natural channel in which water flows regularly or intermittently, or a wetland, lake or dam into which, or from which water flows.

One of the main aims of the Act is the protection of water resources. 'Protection' in relation to a water resource entails:

- Maintenance of the quality of the water resource to the extent that the water use may be used in a sustainable way;
- Prevention of degradation of the water resource
- The rehabilitation of the water resource

In the context of the proposed development and any potential impact on water resources, the definition of pollution and pollution prevention contained within the Act is relevant. ‘Pollution’, as described by the Act is the direct or indirect alteration of the physical, chemical or biological properties of a water resource, so as to make it (inter alia)

- less fit for any beneficial purpose for which it may reasonably be expected to be used; or
- harmful or potentially harmful to the welfare or human beings, to any aquatic or non-aquatic organisms, or to the resource quality.

This definition of pollution is quite wide ranging, and it applies to all types of water resource. Activities which cause alteration of the biological properties of a watercourse (i.e. the fauna and flora contained within that watercourse are also considered pollution).

In terms of section 19 of the Act owners / managers / people occupying land on which any activity or process undertaken which causes, or is likely to cause pollution of a water resource must take all reasonable measures to prevent any such pollution from occurring, continuing or recurring. These measures may include (inter alia):

- measures to cease, modify, or control any act or process causing the pollution
- comply with any prescribed waste standard or management practice
- contain or prevent the movement of pollutants
- remedy the effects of the pollution; and
- remedy the effects of any disturbance to the bed and banks of a watercourse

A surface water assessment has been conducted to explore how the proposed development may impact on water resources as protected by the Act.

In addition, it is anticipated that the proposed development might be located within a watercourse, river or wetland in the Northern Cape Province, triggering the need for a Water Use License. Projects of this nature cannot commence without an authorisation or license from the competent authority, and in this case, the competent authority is the Department of Water and Sanitation (DWS). The Water Use License will be conducted in line with the Chapter 4 of the National Water Act, 1998 (Act No. 36 of 1998) as per Section 40 of the Act which stipulates that each party proposing water usage as per section 21 of the Act must apply for a license from the competent authority prior to commencement of such water use.

1.3.5 Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009)

These are developed to protect both animal and plant species within the various provinces of the country which warrant protection. These may be species which are under threat or which are already considered to be endangered. The provincial environmental authorities are responsible for the issuing of permits in terms of this legislation. The Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009) and the Nature and Environmental Conservation Ordinance 19 of 1974 are of relevance to the Northern Cape Province.

The biodiversity assessment identified several plant and animal species that are protected according to the Act which may occur on site, if these are found to occur on site permits may be required.

1.3.6 National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)

The overarching aim of the National Environmental Management: Biodiversity Act 10 of 2004 (NEMBA), within the framework of NEMA, is to provide for:

- The management and conservation of biological diversity within South Africa, and of the components of such biological diversity;
- The use of indigenous biological resources in a sustainable manner; and
- The fair and equitable sharing among stakeholders of benefits arising from bio-prospecting involving indigenous biological resources.

The South African National Biodiversity Institute (SANBI) was established by the NEMBA, its purpose being (*inter alia*) to report on the status of the country's biodiversity and the conservation status of all listed threatened or protected species and ecosystems.

NEMBA provides for a range of measures to protect ecosystems and for the protection of species that are threatened or in need of protection to ensure their survival in the wild, including a prohibition on carrying out a "restricted activity" involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7. Lists of critically endangered, endangered, vulnerable and protected species have been published and a permit system for listed species has been established.

It is also appropriate to undertake a Faunal and Botanical Impact Assessment where developments in an area that is considered ecologically sensitive require an environmental authorisation in terms of NEMA, with such Assessment taking place during the basic assessment or EIA. These two studies have been undertaken during the project.

The NEMBA is relevant to the proposed project as the construction of the solar PV facility and other components such as power lines and the substations may impact negatively on biodiversity. The project proponent is therefore required to take appropriate reasonable measures to limit the impacts on biodiversity, to obtain permits if required and to also invite SANBI to provide commentary on any documentation resulting from the proposed development.

A biodiversity assessment has been conducted to explore how the proposed development may impact on biodiversity as protected by the Act. There are no fine-scale biodiversity conservation plans for the study area (bgis.sanbi.org). According to SANBI, "*Presently BGIS has no Systematic Biodiversity Conservation Plan for the Northern Cape other than the Namakwa District Biodiversity Sector Plan therefore the Biodiversity Summaries Map is used in its place for land use decision support in the province*." The Biodiversity Summary Map for the Pixley ka Seme District Municipality shows all natural vegetation within the municipal area, except along the Orange River, to be Least Threatened and no areas mapped as of particular biodiversity concern.

1.3.7 The National Forest Act, 1998 (Act 84 of 1998) (NFA)

The National Forest Act, 1998 (Act 84 of 1998) (NFA) was enacted to:

- Promote the sustainable management and development of forests for the benefit of all;
- Provide special measures for the promotion of certain forests and trees;
- Promote the sustainable use of forests for environmental, economic, educational, recreational, cultural, health and spiritual purposes;
- Promote greater participation in all aspects of forests and the forest products industry by persons disadvantaged by unfair discrimination.

The NFA enforces the necessity for a license to be obtained prior to destroying any indigenous tree in a natural forest and, subject to certain exemptions, cutting, disturbing, damaging, destroying or removing any protected tree. The list of protected trees is currently contained in GN 877 of 22 November 2013. Licenses are issued by the Minister and are subject to periods and conditions as may be stipulated.

The NFA is relevant to the proposed project as the removal and/or disturbance and/or clearance of indigenous vegetation may be required and a license in terms of the NFA may be required for this to be done.

1.3.8 Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA)

The Conservation of Agricultural Resources Act (CARA) No. 43 of 1983 controls the utilization of natural agricultural resources in South Africa. The Act promotes the conservation of soil, water sources and vegetation as well as the combating weeds and invader plants. The Act has been amended in part by the Abolition of Racially Based Land Measures Act, No. 108 of 1991.

The primary objective of the Act is to conserve natural agricultural resources by:

- maintaining the production potential of land;
- combating and preventing erosion and weakening or destruction of the water resources;
- protecting vegetation; and
- combating weeds and invaders plants.

The CARA is relevant to the proposed project as the construction of the solar PV energy facility as well as other components (such as power lines and the substations) may impact on agricultural resources and vegetation on the site. The Act prohibits the spreading of weeds and prescribes control measures that need to be complied with in order to achieve this. As such, measures will need to be taken to protect agricultural resources and prevent weeds and exotic plants from invading the site as a result of the proposed development.

An agricultural potential assessment has been conducted to explore how the proposed development may impact on the agricultural production potential of the proposed site.

1.3.9 Subdivision of Agricultural Land Act No. 70 of 1970, as amended

The Subdivision of Agricultural Land Act No. 70 of 1970 controls the subdivision of all agricultural land in South Africa; prohibiting certain actions pertaining to agricultural land. Under the Act the owner of agricultural land is required to obtain consent from the Minister of Agriculture in order to subdivide agricultural land.

The purpose of the Act is to prevent uneconomic farming units from being created and degradation of prime agricultural land. To achieve this purpose the act also regulates leasing and selling of agricultural land as well as registration of servitudes.

The Act is of relevance to the proposed development as any land within the study area that is zoned for agricultural purposes will be regulated by this Act.

Although the whole of this Act has been repealed by section 1 of the Subdivision of Agricultural Land Act Repeal Act 64 of 1998, this Repeal Act has not been implemented and no date of coming into operation has been proclaimed.

It is important to note that the implementation of this Act is problematic as the Act defines 'Agricultural Land' as being any land, except land situated in the area of jurisdiction of a municipality or town council, and subsequent to the promulgation of this Act uninterrupted Municipalities have been established throughout South Africa.

1.3.10 National Road Traffic Act No. 93 of 1996, as amended

The National Road Traffic Act (NRTA) No. 93 of 1996 provides for all road traffic matters and is applied uniformly throughout South Africa. The Act enforces the necessity of registering and licensing motor vehicles. It also stipulates requirements regarding fitness of drivers and vehicles as well as making provision for the transportation of dangerous goods.

All the requirements stipulated in the NRTA will need to be complied with during the construction and operational phases of the proposed development.

1.3.11 Astronomy Geographic Advantage Act No. 21 of 2007

The Astronomy Geographic Advantage Act No. 21 of 2007 provides for:

- The preservation and protection of areas that are uniquely suited for optical and radio astronomy;
- Intergovernmental cooperation and public consultation on matters concerning nationally significant astronomy advantage areas and matters connected therewith.

In terms of section 7(1) and 7(2) of this Act, the Minister declared core astronomy advantage areas on 20 August 2010 under Regulation No. 723 of Government Notice No. 33462. As such, all land within a 3 Kilometre radius of the centre of the Southern African Large Telescope (SALT) dome located in the Northern Cape Province, falls under the Sutherland Core Astronomy Advantage Area. The declaration also applies to the core astronomy advantage area containing the MeerKAT radio telescope and the core of the planned Square Kilometre Array (SKA) radio telescope.

Under Section 22(1) of the Act the Minister has the authority to protect the radio frequency spectrum for astronomy observations within a core or central astronomy advantage area. As such, the Minister may still under section 23(1) of the Act, declare that no person may undertake certain activities within a core or central astronomy advantage area. These activities include the construction, expansion or operation; of any fixed radio frequency interference source, facilities for the generation, transmission or distribution of electricity, or any activity capable of causing radio frequency interference or which may detrimentally influence the astronomy and scientific endeavours.

The South African SKA was notified of the proposed project and provided with the opportunity to comment. During the scoping phase of the project the SKA submitted comments noting that based on distance to the nearest SKA station, detailed design of the solar installation, and the cumulative impact of multiple renewable energy facilities of a similar nature in the same vicinity, the proposed facility poses a high risk of detrimental impact on the SKA. The SKA project office recommended that further Electromagnetic Interference (EMI) and Radio Frequency Interference (RFI) detailed studies be conducted as significant mitigation measures would be required to lower the risk of detrimental impact to an acceptable level.

As per the SKA's request a baseline EMI and RFI study has been undertaken and attached as Appendix 11. From the results in the initial report, it is clear that at lower frequencies, emissions below the international special committee on radio interference's (CISPR) standards are required especially in the case of the closest telescope. This is mainly due to the absence of any Terrain Loss (TL) over this short distance. Towards telescopes in the core site, the allowable measured levels increase slightly due to the additional TL. The possibility exists that the overall lower levels would have to be achieved to limit interference to the closest telescopes as much as possible.

Following the baseline study and after consultation between BioTherm and the SKA, BioTherm commissioned MESA Solutions to investigate possible EMI generated from the existing Sishen Solar Energy Facility in the Northern Cape. The EMI Characterisation report is confidential, however the conclusion of the report is summarised below. The particular facility that was investigated makes use of similar technology that will be used for the Helena Solar facility. Both radiated and conducted measurements in the Frequency Domain (FD) and Time Domain (TD) were made. Comparison of these various results helped to confirm, as far as possible, the level of interference generated by the facility. Measurements were made for the facility ON and in STANDBY modes of operation. The report concluded that the amount by which identified interferences exceed limits can be mitigated through proper Electromagnetic Compatibility (EMC) shielding cabinets for the inverter station and String and Tracking cabinets. Recommendations include metallic enclosures with improved shielding through RFI gasketting on all seams and doors, as well as honeycomb filters on ventilation openings and cable entry interfaces. The other areas of concern are the fast transient switching noise (which are very broadband in nature) when the tracking motors switch on and off during the course of day. These levels exceeded the limits and further investigation into the driving hardware (including relays, switches and limiters) will be required. Another concern is the strong presence of 2.1 GHz WiFi network communication throughout the plant. This could be associated with security infrastructure, and it is recommended that all WiFi communication be replaced with fixed line alternatives with shielded Ethernet cables and connectors (typically CAT-7). Although the full EMI Characterisation report has not been included in the FEIAr, it was supplied to the SKA for consideration and comment. The draft report was submitted to Adrian Tiplady of the SKA on the 18th of November 2015 for comment. Comments on the report from the SKA were received on 17 December 2016 and have been included in the FEIAr within Appendix 5D. The SKA stated that technical proof of concepts would need to be implemented and measured. This would entail taking measurements at an operational facility, a test facility or in a laboratory, where such technical concepts can be installed and measured. In order to satisfy the additional SKA request, the Applicant engaged with international PV technology suppliers and EMI consultants to identify additional mitigation measures to be implemented.

Below are examples of methods used to reduce PV facility EMI and RFI which would be achieved by a thorough power cable, control hardware and earthing / bonding wiring review during the final design phase:

- Improved Shielding: RFI gasketting on all seams and doors. RFI honeycomb filtering on ventilation openings, improved cable entry interfaces.
- Replace existing fibreglass enclosures with metallic versions specified for purposes of RFI reduction.
- Improved cable entry interfaces.

- Improve earthing of weather station.
- Replace conventional mechanical relays with solid state versions.
- Improved String combiner cabinet shielding and grounding..
- Replace all wireless communication in particular any WiFi network with fixed line communication.
- Fluorescent lights replaced by LED.

A site test programme will be done in accordance with guidelines and methodologies by an SKA approved EMI/EMC expert such as MESA on completion of the project to prove the effectiveness of the mitigation techniques applied to the facility.

The mitigation of risk associated with EMI on the SKA will be confirmed by measurements following construction to the satisfaction of the SKA. Should the EMI still exist, based on the site measurements, further mitigation methods would need to be implemented.

1.3.12 Additional Relevant Legislation

- Occupational Health and Safety Act (Act 85 of 1993)
- National Environmental Management: Air Quality Act, 2004
- National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)
- Civil Aviation Act No. 13 of 2009
- Development Facilitation Act No. 67 of 1995
- Northern Cape Planning and Development Act, 1998 (Act No. 7 of 1998)
- National Protected Areas Act (Act No. 25 of 2003)

1.4 Equator Principles (EPs)

The Equator Principles are a financial industry benchmark for determining, assessing and managing social and environmental risk in project financing. A number of banks, exchanges and organisations worldwide have adopted the Principles as requirements to be undertaken for project funding on application and approval. Furthermore, certain funding institutions have not formally adopted the Principles, but require clients to be compliant with them in order to qualify for loans. The Equator Principles III (2013) are summarised below:

Principle 1: Review and Categorisation
When a project is proposed for financing, the Equator Principles Funding Institution (“EPFI”) will categorise the project based on the magnitude of its potential environmental and social impacts and risks.

Principle 2: Environmental and Social Assessment
For each project assessed as being either Category A or Category B, the client / borrower must conduct a Social and Environmental Assessment (“Assessment”) process to address the relevant impacts and risks

of the proposed project. The Assessment should also propose mitigation and management measures relevant and appropriate to the nature and scale of the proposed project.

Principle 3: Applicable Environmental and Social Standards

The Assessment will refer to the applicable IFC Performance Standards and applicable Industry Specific EHS Guidelines.

Principle 4: Environmental and Social Management System and Equator Principles Action Plan

The client / borrower must prepare an Environmental and Social Management System (ESMS). Further, an Environmental and Social Management Plan (ESMP) must be prepared by the client to address issues raised in the Assessment process and incorporate actions required to comply with the applicable standards. Where applicable standards are not met to the EPFI's satisfaction, the client and the EPFI will agree to an Equator Principles Action Plan to outline gaps and commitments.

Principle 5: Stakeholder Engagement

For all Category A and Category B Projects, the EPFI will require the client to demonstrate effective Stakeholder Engagement as an ongoing process in a structured and culturally appropriate manner with Affected Communities and, where relevant, Other Stakeholders. For Projects with potentially significant adverse impacts on Affected Communities, the client will conduct an Informed Consultation and Participation process. The client will tailor its consultation process to: the risks and impacts of the Project; the Project's phase of development; the language preferences of the Affected Communities; their decision-making processes; and the needs of disadvantaged and vulnerable groups.

Principle 6: Grievance Mechanism

The EPFI will require the client, as part of the ESMS, to establish a grievance mechanism designed to receive and facilitate resolution of concerns and grievances about the Project's environmental and social performance. The grievance mechanism is required to be scaled to the risks and impacts of the Project and have Affected Communities as its primary user. It will seek to resolve concerns promptly, using an understandable and transparent consultative process that is culturally appropriate, readily accessible, at no cost, and without retribution to the party that originated the issue or concern. The mechanism should not impede access to judicial or administrative remedies.

Principle 7: Independent Review

For all Category A projects and, as appropriate, for Category B projects, an independent social or environmental expert not directly associated with the borrower must review the Assessment, Action Plan (AP) and consultation process documentations in order to assist the EPFIs due diligence, and assess EP compliance.

Principle 8: Covenants

An important strength of the Principles is the incorporation of covenants linked to compliance.

For all Projects, the client will covenant in the financing documentation to comply with all relevant host country environmental and social laws, regulations and permits in all material respects. For Category A and B projects, the client / borrower will covenant in financing documentation:

- To comply with the ESMPs and Equator Principles AP (where applicable) during the construction and operation of the Project in all material respects; and
- To provide periodic reports in a format agreed with the EPFI (with the frequency of these reports proportionate to the severity of impacts, or as required by law, but not less than annually), prepared by in-house staff or third party experts, that i) document compliance with the ESMPs and Equator Principles AP (where applicable), and ii) provide representation of compliance with relevant local, state and host country environmental and social laws, regulations and permits; and
- To decommission the facilities, where applicable and appropriate, in accordance with an agreed decommissioning plan.

Principle 9: Independent Monitoring and Reporting

To ensure ongoing monitoring and reporting over the life of the loan, EPFIs will, for all Category A projects, and as appropriate, for Category B projects, require appointment of an independent environmental and/or social expert, or require that the borrower to retain qualified and experienced external experts to verify its monitoring information, which would be shared with EPFIs.

Principle 10: Reporting and Transparency

For all Category A and, as appropriate, Category B Projects:

- The client will ensure that, at a minimum, a summary of the ESIA is accessible and available online.
- The client will publicly report GHG emission levels (combined Scope 1 and Scope 2 Emissions) during the operational phase for Projects emitting over 100,000 tonnes of CO_2 equivalent annually.

Although this report is not written in terms of the EPs, it fully acknowledges that EPs will need to be complied with should funding for the project be required. In general, the following documentation will need to be considered in that regard:

- The “Equator Principles” 2013
- International Finance Corporations Performance Standards on Social and Environment, IFC, April, 2006 namely:
    - Performance Standard 1: Social and Environmental Assessment and Management Systems
    - Performance Standard 2: Labour and Working Conditions
    - Performance Standard 3: Pollution Prevention and Abatement
    - Performance Standard 4: Community Health, Safety and Security
    - Performance Standard 5: Land Acquisition and Involuntary Resettlement
    - Performance Standard 6: Biodiversity Conservation and Sustainable Natural Resource Management

- Performance Standard 7: Indigenous Peoples
- Performance Standard 8: Cultural Heritage

- International Finance Corporation – World Bank Guidelines, General EHS Guidelines 2007.

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). These EHS Guidelines are applied as required by the World Bank's respective policies and standards. These General EHS Guidelines are designed to be used together with the relevant Industry Sector EHS Guidelines which provide guidance to users on EHS issues in specific industry sectors.

- The EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs.

1.5 Key Development Strategies and Guidelines

1.5.1 Integrated Development Plans

An Integrated Development Plan (IDP) is defined in the Local Government: Municipal Systems Act, 2000 (Act 32 of 2000), as an inclusive and strategic plan that:

- Links, integrates and co-ordinates plans and takes into account proposals for the development of the municipality;
- Aligns the resources and capacity of the municipality with the implementation of the plan
- Forms the policy framework on which annual budgets must be based; and,
- Is compatible with national and provincial development plans and planning requirements binding on the municipality in terms of legislation.

The main purpose of the IDP is for the enhancement of service delivery and fighting poverty through an integrated and aligned approach between different role-players and stakeholders.

Each municipality is required to produce an IDP which would address pertinent issues relevant to their municipality. However, common concerns include municipal transformation and development, and service delivery and infrastructural development.

The proposed solar PV energy facility falls within the Siyathemba Local Municipality (LM), which is located within the greater Pixley ka Seme District Municipality (DM). The Siyathemba LM IDP for 2014/2015 identified alternative energy development as an anchor economic activity, and highlighted renewable energy development as an opportunity for the municipality. Additionally, energy has been identified as a priority growth sector. The Pixley ka Seme DM IDP for 2013/2014 references the National Development Plan's proposal to procure about 20,000MW of renewable electricity by 2030. The IDP also identifies the need for the attraction and retention of investors, which can largely be through the development of renewable energy projects.

It is therefore evident that the proposed development is aligned with the goals of the municipal IDPs and SDFs in the study area.

1.5.2 Integrated Energy Plan for the Republic of South Africa, 2003

The Integrated Energy Plan (IEP), developed by the former DME, was formulated to address the energy demand of the country balanced with energy supply, transformation, economics and environmental considerations in concourse with available resources. One of the main objectives of the plan is to promote universal access to clean and affordable energy, with emphasis on household energy supply being co-ordinated with provincial and local integrated development programmes. Another objective is to ensure that the environment is considered with regard to energy supply, transformation and end use. This project is thus in line with the goals of the IEP and will assist with implementing the plan.

1.5.1 Integrated Resource Plan for Electricity for the Republic of South Africa, 2011; and Update Report, 2013

The Integrated Resource Plan (IRP) for Electricity (2013) comprehensively examines the current and future demands for electricity, and outlines a plan for meeting these demands. The plan is derived from a cost-optimal scenario for new build options balanced with qualitative factors such as job creation. The IRP encourages the development of renewables in order to foster the development of local industry clusters and assist in fulfilling South Africa's climate change mitigation commitments. The IRP recommends a continuation of the current renewable bid programme with additional annual rounds of 1000 MW PV capacity; 1000 MW wind capacity and 200 MW CSP capacity. A 2015 update to the IRP is in progress, and is due to be released in early 2016.

1.5.2 DEA Draft National Renewable Energy Guideline, 2013

The Guideline was produced to provide a review of Renewable Energy technologies, a summary of the impacts of each technology and associated authorisation processes required, an overview of some good industry mitigation practices, a review of National legislation, a schematic of the NEMA approvals process and a list of relevant contact details. Assuming an Independent Power Producer (IPP) project triggers the need for Basic Assessment (BA) or an Environmental Impact Assessment (EIA) under the National Environmental Management Act (NEMA), included in the assessment process is the preparation of an environmental management programme (EMPr). Project-specific measures designed to mitigate negative impacts and enhance positive impacts should be informed by good industry practice and are to be included in the EMPr.

1.5.3 Independent Power Producer Process

(The following information was extracted from the Eskom website: Guide to Independent Power Producer (IPP) processes in South Africa and Eskom**,** June 2010
http://www.eskom.co.za/live/content.php?Item_ID=14324)

The objective of this section is to provide an overview of the processes in the country and within Eskom relating to IPPs. It is important that certain enabling policies, rules and regulations are in place to provide certainty and transparency in the introduction of IPPs.

- Country Process

South Africa has two acts that direct the planning and development of the country's electricity sector:

i. The National Energy Act of 2008 (No. 34 of 2008)
ii. The Electricity Regulation Act (ERA) of 2006 (No. 4 of 2006).

In August 2009, the Department of Energy (DoE) gazetted the Electricity Regulations on New Generation Capacity under the ERA. The New Generation Regulations establish rules and guidelines that are applicable to the undertaking of an IPP Bid Programme and the procurement of an IPP for new generation capacity. They also facilitate the fair treatment and non-discrimination between IPPs and the buyer of the energy.

- Formal Programmes

In terms of the New Generation Regulations, the Integrated Resource Plan (IRP) will be developed by the DoE and will set out the new generation capacity requirement per technology, taking energy efficiency and the demand-side management projects into account. This requires new generation capacity to be met through the technologies and projects listed in the IRP and all IPP procurement programmes will be executed in accordance with the specified capacities and technologies listed in the IRP.

The table below highlights the energy plan that has been proposed until 2030.

Table 3: Government Energy Plans up until 2030 in terms of the IRP

New Build Options								
	Coal	**Nuclear**	**Import Hydro**	**Gas - CCGT**	**Peak - OCGT**	**Wind**	**CSP**	**Solar PV**
2010	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	300
2013	0	0	0	0	0	0	0	300
2014	500	0	0	0	0	400	0	300
2015	500	0	0	0	0	400	0	300
2016	0	0	0	0	0	400	100	300

2017	0	0	0	0	0	400	100	300
2018	0	0	0	0	0	400	100	300
2019	250	0	0	237	0	400	100	300
2020	250	0	0	237	0	400	100	300
2021	250	0	0	237	0	400	100	300
2022	250	0	1143	0	805	400	100	300
2023	250	1600	1183	0	805	400	100	300
2024	250	1600	283	0	0	800	100	300
2025	250	1600	0	0	805	1600	100	1000
2026	1000	1600	0	0	0	400	0	500
2027	250	0	0	0	0	1600	0	500
2028	1000	1600	0	474	690	0	0	500
2029	250	1600	0	237	805	0	0	1000
2030	1000	0	0	948	0	0	0	1000
	6250	**9600**	**2609**	**2370**	**3910**	**8400**	**1000**	**8400**

A decision that additional capacity be provided by an IPP must be made with the concurrence of the Minister of Finance. Once such a decision is made, a procurement process needs to be embarked upon to procure that capacity in a fair, equitable and transparent process.

The New Generation Regulations set out the procurement process. The stages within a bid programme are prescribed as follows:

i. Request for Qualifications (RFQ)
ii. Request for Proposals (RFP)
iii. Negotiation with the preferred bidder(s).

A successful bidder will be awarded a Power Purchase Agreement (PPA) subject to approval by the Regulator. Once the Regulator has approved the bidder’s associated PPA, the bidder may be licensed as a generator and grid connection may be possible.

2 APPROACH TO UNDERTAKING THE STUDY

The Environmental Impact Assessment was undertaken in accordance with the EIA 2010 Regulations listed in Government Gazette No. 33306 of 18 June 2010 (GN 543, 544, 545 and 546 of 18 June 2010, as amended), in terms of Section 24 and 44 of the National Environmental Management Act, (No 107 of 1998) (NEMA) as amended; the World Bank Standards (IFC Guidelines) and the Equator Principles, as well as with the relevant legislation and guidelines mentioned above.

2.1 Environmental Scoping Study

The Scoping Study identified the potential positive and negative impacts associated with the proposed development as well as the studies which were required to be undertaken as part of the EIA-phase of the project. The Draft Scoping Report (DSR) was made available for public review from Thursday the 28th May 2015 to Monday 29th June 2015. Comments received on the Draft Scoping Report were included in the Final Scoping Report (FSR) which was submitted to the DEA on the 17th of August 2015. The DEA accepted the FSR and EIA Plan of study on the 20th of October 2015.

The following studies were taken through into the EIA Phase:

- Biodiversity (including fauna and flora)
- Avifauna
- Surface Water
- Agricultural Potential and Soils
- Visual
- Heritage
- Socio-economic

2.2 Authority Consultation

The National Department of Environmental Affairs (DEA) are the determining authority on this application. The following consultation took place with DEA:

- An application was submitted to the DEA on the 5th of December 2014.
- The DEA accepted the application on the 15th of January 2015, and the following reference number was allocated to Helena 3 DEA Ref. No.: 14/12/16/3/3/2/767.
- The Draft Scoping Report (DSR) was submitted to the DEA on the 27th of May 2015 and the Department confirmed receipt of the DSR on the 11th of June 2015.
- The Final Scoping Report (FSR) was submitted to the DEA on the 17th of August 2015 and the Department confirmed receipt of the FSR on the 31st of August 2015.
- Acceptance of the FSR and the Plan of Study (PoS) for the EIA was received on 20 October 2015.
- The Draft Environmental Impact Assessment Report (DEIAr) was submitted to the DEA on the 10th of December 2015 and received by the DEA on the 4th January 2016. The Department confirmed receipt of the DEIAr on the 18th January 2016.
- A request for the extension of the EIA timeframes was submitted and received by the DEA on 10 June 2016, due to comments received from the SKA during the DEIAr comment period.
- The DEA accepted the request for extension of the EIA timeframes on the 6th July 2016.

As part of the letter from the DEA accepting the FSR, it was requested that additional information be included in the DEIAr. The table below provides details as to how the DEIAr and FEIAr fulfils the main information requested by the DEA in the FSR acceptance letter. For a further details, refer to Appendix 3 for the FSR Acceptance Letter.

Table 4: Compliance with the DEA requirements detailed in the FSR acceptance letter, and incorporated in the DEIAr, as well as this FEIAr.

Additional Information Required by the DEA	**Notes / Comments**
Comments and recommendations made by all stakeholders and I&APs in the scoping report and submitted as part of the scoping report must be taken into consideration when preparing an FEIAr in respect of the proposed development.	The Comments and Response Report is included in Appendix 5E. All correspondence between authorities and I&APs is included in Appendix 5D. A record of distribution to Organs of States, including attempts made to obtain comments, is included in Appendix 5I.
All mitigation measures and recommendations in the specialist studies must be addressed in the Final Impact Assessment Report (FEIAr) and EMPr.	Specialist recommendations and mitigation measures are included in Chapters 9 and 10, as well as in Chapter 15.1, the summary of findings. All mitigation measures are detailed in the EMPr, included as Appendix 8.
Comments from all relevant stakeholders, including additional stakeholders identified by the DEA in the FSR acceptance letter, must be submitted to the DEA with the FEIAr. The EAP is required to address all issues raised by Organs of State and I&APs prior to the submission of the FEIAr to the DEA.	All comments from stakeholders are included in the comments and response report. See Appendix 5E. All issues raised by stakeholders are addressed in the comments and response report. See Appendix 5E.
Proof of correspondence with the various stakeholders must be included in the DEIAr. If the EAP is not able to obtain comments, proof should be submitted to the DEA of the attempts that were made to obtain comments.	Proof of correspondence with stakeholders is included in Appendix 5B and 5D. Proof of attempts made to obtain comments in included will be included in the Chapter 7 of the FEIAr and in Appendix 5B of the FEIAr.
The EAP must, in order to give effect to Regulation 56(2), give registered I&APs access to, and an opportunity to comment on the report in writing within 21 days before submitting the FEIAr to the DEA.	The EAP will give I&APs opportunity to comment within 21 days before submitting the FEIAr. See Chapter 7 for a description of the PPP followed.
The following information must form part of the DEIAr as well as a separate document for ease of reference: • An amended application form with an indication of all of the 2010 listed activities that are still listed; • An indication of the similarly listed 2014 activities;	The amended application form will be submitted with the FEIAr. All relevant 2010 and 2014 listed activities are detailed in section 1.3.2. All impacts related to listed activities according to the 2010 and 2014 regulations are assessed and mitigated for in Chapters 9 and 10 respectively. A letter from the EAP will

• An indication if there are any new 2014 activities that are listed; • An indication where in the report all the 2014 activities have been assessed and mitigated for; and • A letter/affidavit from the EAP indicating that the above is true and correct.	be attached indicating that all information relating to listed activities is true and correct.
It is imperative that the relevant authorities are continuously involved throughout the EIA process as the development property possibly falls within geographically designated areas in terms of GN R. 546 Activity 4; 12; 13; 14; 16; and 19.	All relevant provincial authorities will be involved in the EIA process and given the opportunity to comment on the project, particularly as it pertains to the relevant GN R 546 listed activities. All correspondence is included in Appendix 5D and the comments and response report is included in Appendix 5E.
A graphical representation of the proposed development within the respective geographical areas must be provided.	All applicable A3 maps are included in Appendix 7.
The EAP must provide motivation for the applicability for Item 26 of GNR 544. In addition the list gazetted under Section 53(1) of NEMBA must be provided in the DEIAr. The EAP must chose the correct sub item as described in Item 22 and 39 of GNR 544 and adequately assess the impacts in the DEIAr.	The full list of applicable listed activities is included in section 1.3.2 and has been updated to ensure that only those activities which are applicable have been included.
The DEIAr must provide an assessment of the impacts and mitigation measures for each of the listed activities applied for.	The listed activities that are being applied for as part of this project are detailed in Chapter 1. Impacts and mitigation measures identified by the specialists are included in Chapter 9, and mitigation measures are also detailed in Chapter 10.
Cumulative impacts of similar developments in the area must form part of the studies that must be assessed as part of the EIA process.	Each of the specialist reports addresses the cumulative impact of renewable energy projects in the area. These are included in Appendix 6. Chapter 11 provides a detailed summary of all of the cumulative impacts potentially associated with the proposed project.
The following activities applied for may trigger Section 19 and Section 21 of the National Water Act No. 36 of 1998: GN R. 544 Activities 11 (xi) and 18(i). The EAP	A specialist surface water study was conducted as part of the scoping and impact phases of the EIA. The study includes the

is advised to conduct a surface hydrological study as part of the DEIAr. The terms of this study must include, inter alia the following: • Identification and sensitivity rating of all surface water courses for the impact phase of the proposed development; • Identification, assessment of all potential impacts to water courses and suggestion of mitigation measures; and, • Recommendations of the preferred placement of photovoltaic panels and associated infrastructure.	identification and sensitivity rating of the surface water resources found on site, including the identification and assessment of all potential impacts and how these can be mitigated. The surface water specialist report is included as Appendix 6C and surface water findings are included in sections 8.3; 9.2.3; and 10.1.3. Surface water sensitive areas guided the design of the placement of PV panels and other infrastructure and the final preferred layout avoids all sensitive surface water areas. All applicable A3 maps are included in Appendix 7.
The listed activities represented in the DEIAr and the application form must be the same and correct.	The listed activities in the FEIAr and application form are identical and correct.
The DEIAr must provide technical details of the proposed facility in a table format as well as their description and/or dimensions. A sample for the minimum information required is listed under point 2 of the EIA information required for solar energy facilities below (see Appendix 3).	Technical details of the project are provided in table format on from page ii to page v of the report.
The DEIAr must provide the four corner coordinate points for the proposed development site (not that if the site has numerous bend points, at each bend point coordinates must be provided) as well as the start, middle and end point of all linear activities.	Coordinates are included on pages iii and iv of the report and in Chapter 6, and also included in further detail in Appendix 9.

The DEIAr must provide the following:
• Clear indication of the envisioned area for the proposed solar energy facility
• Clear description of all associated infrastructure. This description must include, but it not limited to the following:
  • Power lines;
  • Internal roads infrastructure; and
  • All supporting onsite infrastructure such as laydown area, guard house and control room
  • All necessary details regarding all possible locations and sizes of the proposed satellite substation and the main substation
	Technical details of the project are included in Chapter 5 and from page ii to page v of the report. The receiving environment is discussed in Chapter 6. The final preferred layout, including all related infrastructure, is shown on the map included in Chapter 12 and in Appendix 7.

The DEIAr must include a comments and response report in accordance with regulation 28(m) of the EIA regulations 2010	The comments and response report is included in Appendix 5E.
The DEIAr must the include detail inclusive of the PPP in accordance with Regulation 54 of the EIA Regulation.	Chapter 7 includes a detailed breakdown of the Public Participation Process followed, and all public participation documents are included in Appendix 5.
Details of the future plans for the site and infrastructure after decommissioning and the possibility of upgrading the proposed infrastructure to more advanced technologies should be included in the report.	The site will either be upgraded with more advance technology or returned to the previous land use.
An Avifaunal Assessment must be conducted to determine the impact that the proposed activity (including the power line) may have on avifauna. Mitigation measures must be proposed and included in the DEIAr and EMPr.	An avifaunal assessment, including avifauna, is included in Appendix 6B. Various sections of the avifaunal report are also included in Chapters 6.7, 8.2, 9.2.2, and 10.1.2.
Engagement with the SKA must take place due to the proximity of the facility to the SKA infrastructure. The EMI and RFI study must look at cumulative impacts as well.	Engagement with the SKA has taken place throughout the EIA, including through commissioning of the EMI and RFI study. Details are included in sections 1.3.11 and 10.1.8.
Information on services required on the site should be included including proof of agreements if applicable.	Information on services provision and availability is included in Appendix 10.
The DEIAr must provide a detailed description of need and desirability, not only providing motivation on the need for clean energy in South Africa of the proposed activity. The need and desirability must also indicate if proposed development is needed in the region and if the current proposed location is desirable for the proposed activity compared to other sites.	Project need and desirability is provided in Chapter 4, and in the discussion of alternatives in Chapter 5.2.
A final site layout map, indicating features as per the FSR acceptance letter, and an environmental sensitivity map must be included in the final report (See Appendix 3 for the FSR acceptance letter).	The project description (Chapter 5) details all of the project components shown on various maps throughout the report. Specific technical details may not be available at this stage as they will be determined by the EPC during the detailed design phase. All applicable A3 maps are included in Appendix 7.
All shapefiles must be submitted to the DEA. Shapefiles must be created using the methodology detailed in the FSR acceptance letter.	Project shapefiles will be submitted to the DEA with the FEIAr.

An EMPr must be submitted as part of the FEIAr, including all maps, specialist mitigation measures, recommendations, management plans, monitoring systems, and measures to protect hydrological features. Detailed specifications for the EMPr, including details of all required management plans, are included in the FSR acceptance letter, shown in Appendix 3.	The EMPr, prepared according to the specifications of the FSR acceptance letter, is included in Appendix 8.
The DEIAr must include a cumulative impact assessment of the facility if there are other similar facilities in the region. The specialist studies, including all of those outlined in the EIA plan of study which was included in the FSR, must also assess the facility in terms of potential cumulative impacts.	Each of the specialist reports addresses the cumulative impact of renewable energy projects in the area. These are included in Appendix 6. Chapter 11 provides a detailed summary of all of the cumulative impacts potentially associated with the proposed project.
All relevant listed activities should be applied for, these should be specific and should be able to be linked to the project description.	A description of listed activities applied for is included in Chapter 1.3.
The applicant must comply with the requirements of Regulation 67 with regard to the time period allowed for complying with the requirements of the Regulations, and Regulations 56 and 57 with regard to the allowance of a comment period for interested and affected parties on all reports submitted to the DEA. The reports referred are listed in Regulation 56(3a-3h).	All regulated timeframes will be complied with. A description of the public participation process to be followed is included in Chapter 7.
Should the application for Environmental Authorisation be subject to the provisions of Chapter II, Section 38 of the National Heritage Resources Act, Act 25 of 1999, then the DEA will not be able to make nor issue a decision in terms of the application for Environmental Authorisation pending a letter from the pertinent heritage authority categorically stating that the application fulfils the requirements of the relevant heritage resources authority as described in Chapter II, Section 38(8) of the National Heritage Resources Act, Act 25 of 1999. Comments from SAHRA and/or the provincial department of heritage must be provided in the DEIAr.	The relevant officials from the SAHRA have been included on the project database, notified of the project progress and sent copies of the Scoping phase Heritage Report and DSR. Comments from SAHRA were received on 22 September 2015 and are
Two hard copies and 2 electronic copies of the DEIAr and FEIAr must be submitted to the department.	Two hard copies and 2 electronic copies of the report will be submitted to the DEA.
General site information as per point 1 in the EIA information required for solar facilities must be included in the DEIAr (See Appendix 3 for the FSR acceptance	General site information as per point 1 of the FSR acceptance letter is included on pages ii to v of the report.

letter detailing EIA information required for solar facilities).	
Maps as per point 3 and 4 in the EIA information required for solar facilities must be included in the DEIAr (See Appendix 3 for the FSR acceptance letter)	All applicable A3 maps are included in Appendix 7.
Important stakeholders as per point 5 in the EIA information required for solar facilities must provide comment on the proposed project (See Appendix 3 for the FSR acceptance letter)	All listed important stakeholders will be included as Organs of State and efforts will be made to obtain comments from them. A record of distribution to Organs of States, including attempts made to obtain comments, is included in Appendix 5I.
An agricultural potential study must form part of the EIA process, as per point 3 in the FSR acceptance letter (see Appendix 3).	Different sections of the agricultural potential study are included in Chapters 6.9, 8.4, 9.2.4, and 10.1.4. The full agricultural potential report is also included in Appendix 6D.
The EAP is requested to indicate the applicability of the Astronomy Geographic Advantage Act, Act No. 21 of 2007 on the application in the DEIAr. Comments must be obtained from the Southern African Large Telescope (SALT) if the proposed development is situated within a declared astronomy advantage area.	Engagement with the SKA has taken place throughout the EIA, including through commissioning of the EMI and RFI study. Details are included in sections 1.3.11 and 10.1.8. All comments from SKA and other relevant authorities are include in Appendix 5D and 5E.

A record of all authority consultation is included within Appendix 3.

Consultation with other relevant authorities was and is also being undertaken via meetings and telephonic consultation in order to actively engage them and provide them with information and gain their feedback.

Authorities and key stakeholders consulted include the following:

- National Government
- Northern Cape Provincial Government
- Northern Cape Department of Environment and Nature Conservation (NCDENC).
- Pixley ka Seme District Municipality
- Siyathemba Local Municipality
- Department of Water and Sanitation (DWS)
- Department of Mineral Resources
- Department of Rural Development and Land Reform
- Department of Communications
- Department of Agriculture Forestry and Fisheries (DAFF)
- South African National Roads Agency Limited (SANRAL)
- Northern Cape Department of Roads and Public Works

- South African Heritage Resources Agency (SAHRA)
- Eskom
- Square Kilometre Array (SKA)
- Air Traffic Navigation Services (ATNS)
- South African Civil Aviation Authority (SACAA)
- Transnet Freight Rail
- Telkom SA
- SENTECH
- Endangered Wildlife Trust (EWT)
- Wildlife and Environment Society of South Africa (WESSA)
- Birdlife South Africa

2.3 Environmental Impact Assessment Report

The EIA phase of the project has focused on consulting with Interested and / or Affected Parties as well as conducting specialist studies to address the potential impacts identified during the scoping phase.

The purpose of the FEIAr is to:

- address issues that have been raised during the scoping phase;
- assess alternatives to the proposed activity in a comparative manner;
- assess all identified impacts and determine the significance of each impact; and
- formulate mitigation measures.

3 ASSUMPTIONS AND LIMITATIONS

- It is assumed that all information provided by the Applicant to the Environmental Team was correct and valid at the time it was provided.
- It is not always possible to involve all Interested and / or Affected Parties (I&APs) individually, however, every effort has / is been made to involve as many interested parties as possible. It is also assumed that individuals representing various associations or parties convey the necessary information to these associations / parties.
- It is assumed that the information provided by the various specialists is unbiased and accurate.
- The following assumptions, uncertainties and gaps in knowledge were encountered by the various specialists:

- Biodiversity:
  - Red List species are, by their nature, usually very rare and difficult to locate. Compiling the list of species that could potentially occur in an area is limited by the paucity of collection

records that make it difficult to predict whether a species may occur in an area or not. The methodology used in this assessment is designed to reduce the risks of omitting any species, but it is always possible that a species that does not occur on a list may be unexpectedly located in an area.
    - The biodiversity study excludes invertebrates.

- Avifauna:
  This study made the basic assumption that the sources of information used are reliable. However, the following must be noted:
    - The focus of the study is primarily on the potential impacts on Red Data species, endemics and near-endemics (hereafter called priority species).
    - The impact of solar installations on avifauna is a new field of study, with only one scientific study published to date (McCrary *et al*. 1986). Strong reliance was therefore placed on expert opinion and data from existing monitoring programmes at solar facilities in the USA which have recently (2013 - 2015) commenced with avifaunal monitoring. The pre-cautionary principle was applied throughout as the full extent of impacts on avifauna at solar facilities is not presently known.
    - The assessment of impacts is based on the baseline environment as it currently exists in the study area. Future changes in the baseline environment are not taken into account. This aspect is dealt with under the section dealing with cumulative impacts.

- Surface Water:
    - This study has only focused on the delineation of surface water resources within the proposed development area. Aquatic studies of fish, invertebrates, amphibians etc. have not been included in this report. Nor has a hydrological or groundwater study been included. Wetland or river health, ecosystem services and the ecological importance and sensitivity category have also not been assessed in this study.

- Agricultural Potential and Soils:
    - It should be clearly noted that, since the information contained in the land type survey is of a reconnaissance nature, only the general dominance of the soils in the landscape can be given, and not the actual areas of occurrence within a specific land type. Also, other soils that were not identified due to the scale of the survey may also occur.
    - The site was not visited during the course of this study, and so the detailed composition of the specific land types has not been ground-truthed.

- Visual:
    - For the purpose of this visual study, the study area is assumed to encompass a zone of 5km from the PV panel area and associated infrastructure. This area was assigned as distance is a critical factor when assessing visual impacts. This area was assigned, as the height of the development in combination with distance are critical factors when assessing visual impacts. Beyond 5km the solar energy facility may still be visible; however the

degree of visual impact would diminish considerably and thus the need to assess the impact on potential receptors beyond this distance would not be warranted.

- The identification of visual receptors has been based on a combination of desktop assessment as well as field-based observation. Initially Google Earth imagery was used to identify potential receptors within the study area. Thereafter a site visit was undertaken to verify the sensitive visual receptors within the study area and assess the visual impact of the development from these receptor locations. A number of broad assumptions have been made in terms of the sensitivity of the receptors to the proposed development. It should be noted that not all receptor locations would necessarily perceive the proposed development in a negative way. This is usually dependent on the use of the facility and the economic dependency on the scenic quality of views from the facility. Sensitive receptor locations typically include sites that are likely to be adversely affected by the visual intrusion of the proposed development. They include; tourism facilities and scenic sites within natural settings.
- No viewsheds were generated during this visual study, as the topography within the study area is relatively flat. Within this context, minor topographical features, vegetative screening, or man-made structures would be important factors which would influence the degree of visibility and which would not be factored in by the viewsheds.
- A matrix has been developed to assist in the assessment of the potential visual impact at each receptor location. The limitations of quantitatively assessing a largely subjective or qualitative type of impact should be noted. The matrix is relatively simplistic in considering five main parameters relating to visual impact, but provides a reasonably accurate indicative assessment of the degree of visual impact likely to be exerted on each receptor location by the proposed solar energy facility. The matrix should therefore be seen as a representation of the likely visual impact at a receptor location.
- The assessment of receptor-based impacts has been based on the solar energy facility layout and alternatives provided by the proponent. It is recognised however that this layout is a preliminary one, and is subject to changes based on a number of potential factors, including the findings of the EIA studies. The PV panel area and associated infrastructure may thus move, which may result in greater or lesser visual impacts on receptor locations.
- A cumulative impact assessment has been undertaken to provide a representation of the number of proposed renewable energy facilities likely to be visible from each potentially sensitive receptor location, if they were all constructed. Factors affecting visibility, such as localised screening from trees or topographical undulations have not been factored into the cumulative impact assessment.
- Visualisation modelling has not been undertaken for the proposed development due to budget limitations. Should the need for visualisation modelling be proven by stakeholder / I&AP feedback, then this will be able to be incorporated into this assessment. To date however, no feedback regarding the visual impact of the PV energy facility has been received from the public participation process, although any feedback from the public will be incorporated into further drafts of this report.

- No feedback related to the visual environment was received during the scoping phase Public Participation Process. Any additional feedback relevant to the visual environment received during the impact phase public comment period will be incorporated into further drafts of this report.
- Operational and security lighting will be required for the PV facility and substation proposed within the development footprint. At the time of undertaking the visual study no information was available regarding the type and intensity of lighting required and therefore the potential impact of lighting at night has not been assessed at a detailed level. General measures to mitigate the impact of additional light sources on the ambiance of the nightscape have been provided.
- It should be noted that the 'experiencing' of visual impacts is subjective and largely based on the perception of the viewer or receptor. The presence of a receptor in an area potentially affected by the proposed development does not thus necessarily mean that a visual impact will be experienced.

- Heritage:
  - Not detracting in any way from the fieldwork undertaken, it is necessary to realise that the heritage sites located during the fieldwork do not necessarily represent all the heritage sites present within the area. Should any heritage features or objects not included in the inventory be located or observed, a heritage specialist must immediately be contacted. Such observed or located heritage features and/or objects may not be disturbed or removed in any way, until such time that the heritage specialist has been able to make an assessment as to the significance of the site (or material) in question. This applies to graves and cemeteries as well.
  - The survey was conducted over 3 days over the extent of the total footprint area. It must be stressed that the extent of the fieldwork was based on the available field time and was aimed at determining the heritage character of the area.
  - The fieldwork that covered the Helena 3 Solar site as well as the proposed power line corridors covered approximately 45km in total with an evaluation field of 20 meters for small finds (10 meters either side of the archaeologist) and 100 meters for larger finds such as marked cemeteries and historical structures (50 meters either side of the archaeologist).

- Socio-Economic:
  - **Proposed project related assumptions**

    Cost related and employment assumptions for the construction and operational phases are based on information provided by the client. Some assumptions are also based on information reported by the Department of Energy (DoE) for the approved Bid Window 4 projects.

  - **Construction-phase assumptions**

    It is envisaged that the construction phase will last for a period of about 18 to 21 months. Based on the information provided, it is estimated that about R1500 million will be spend during the construction period and 129 skilled and unskilled employment opportunities will be created

The majority of the employment opportunities, specifically for unskilled and semi-skilled individuals are likely to be available to local community members. Employment opportunities for skilled individuals are likely to be associated with contractors appointed during the construction phase. It is thus assumed, that 80% of the positions will be filled by local people.

- **Operational-phase assumptions**
  It is expected that the proposed Helena Solar 3 PV facility will be in operation for 20 years. The average annual electricity generated by the proposed 75 MW plant will amount to about 140 000 MWh per annum. The annual revenue generated by the plant could amount to up to R50 million. Furthermore, it is expected that 43 jobs per annum will be created during operations.

- **Assumptions regarding affected land uses and economic activities**
  The proposed development area covers an area of 430 ha on Portion 3 of the farm Klipgats Pan No 117, however it is envisaged that the project footprint will only require an area of about 250 ha. The proposed power line corridor runs on Portion 4 of the farm Klipgats Pan No 117.

  In order to obtain baseline information on the socio-economic conditions characterising the potentially affected land parcels in terms of current and predicted future changes with and without the project, telephonic interviews were conducted.

  Out of the list of eleven farms that were included in the zone of influence, eight farmers were engaged with. No contact details were available for the owners of Portions 1, 2 and 5 of Klipgats Pan 117 and hence they could not be contacted for comment. Owners of the Remainder of Slimes Dam 154, Portion 2 of Springbok Poortje 119, Portion 2 of Kaffirs Kolk 118 and Portion 1 of Kaffirs Kolk 118 did not wish to be engaged with.

  Table 5 summarises information that was obtained during the interviews. All respondents were of the view that the proposed development would bring about positive socio-economic benefits to the area and would not be a threat to existing activities.

Table 5: Land-uses – site and adjacent land

Farm	Land use	Demographics	Sensitivity
Portion 3 of Klipgats Pan 117	• Small private sheep farm	• 4 people living on the farm • 1 labourer	Directly affected (PV site)
Portion 4 of Klipgats Pan 117	• No activities currently taking place	• No one lives on the land	Directly affected (power lines)

Portion 3 of Groot Fouries Kolk 116	• Commercial sheep farming	• 4 people living on the farm • 4 labourers	Adjacent

Source: Telephonic interviews with landowners

4 PROJECT NEED AND DESIRABILITY

4.1 National Renewable Energy Requirement

In 2010 South Africa (SA) had 44,157MW of power generation capacity installed. Current forecasts indicate that by 2025, the expected growth in demand will require the current installed power generation capacity to be almost doubled to approximately 74,000MW (SAWEA: 2010).

South Africa has embarked on a renewable energy infrastructure growth programme supported by various government initiatives. These include; the National Development Plan (NDP), the Presidential Infrastructure Coordinating Commission (PICC), the Department of Energy's Integrated Resource Plan, the National Strategy for Sustainable Development, the National Climate Change Response White Paper, the White Paper on Renewable Energy, the National Treasury's Carbon Tax Policy Paper, and the Presidency of the Republic of South Africa's Medium-Term Framework.

The Department of Energy has set a target of contributing 17,8*GW* of renewable energy to the final energy consumption by 2030. This target is to be produced mainly through, wind and solar; but also through biomass and small scale hydro (DME, 2003; IRP, 2010).

4.2 Solar PV Power Potential in South Africa and Internationally

Internationally, PV is the fastest-growing power generation technology, South Africa has some of the highest levels of solar radiation in the world and as much as 8GW PV could potentially be installed by 2020 (DEA Guideline for Renewable Energy, 2013). Between 2000 and 2009 the installed capacity globally grew on average by 60% per year. Worldwide more than 35GW of PVs are installed and operating, and in South Africa as much as 8GW PV could potentially be installed by 2020.

4.3 Site Specific Suitability

The placement of solar PV installations is dependent on several factors, all of which are favorable at the proposed site location. These include solar resource, climate, topography, grid connections suitability, competition and access to the site (Figure 1). If one of these vital aspects cannot be met then the entire Helena solar PV facility cannot proceed into the development phase.

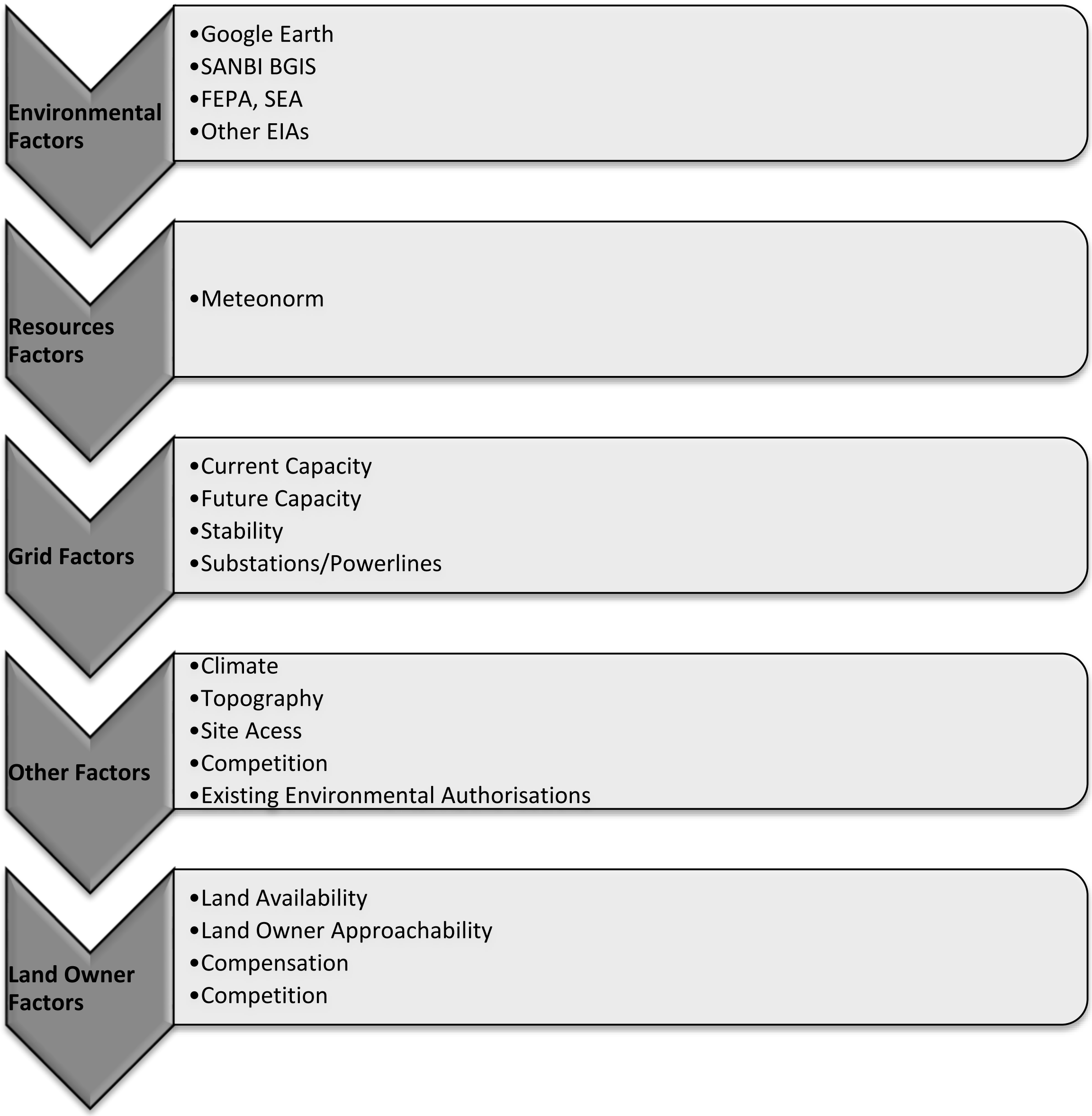

Figure 1: Process flow diagram describing the process followed during prefeasibility site selection.

According to the solar map (Figure 2) the Northern Cape Province of South Africa has a solar energy concentration of between 8001 and 9500 MJ/m^2. The Northern Cape is the province in South Africa with the highest solar potential. The project site falls within the range of 8501 – 9000 MJ/m^2 and is thus suitable for the establishment of solar PV energy facilities. Based on an estimation of the solar energy resource as well as weather, dust, dirt, and surface albedo, pre-feasibility studies conducted by BioTherm have identified the site as optimal for the proposed Helena 3 PV project. The project site receives an annual global horizontal irradiation of approximately 2248 kWh/m^2/year.

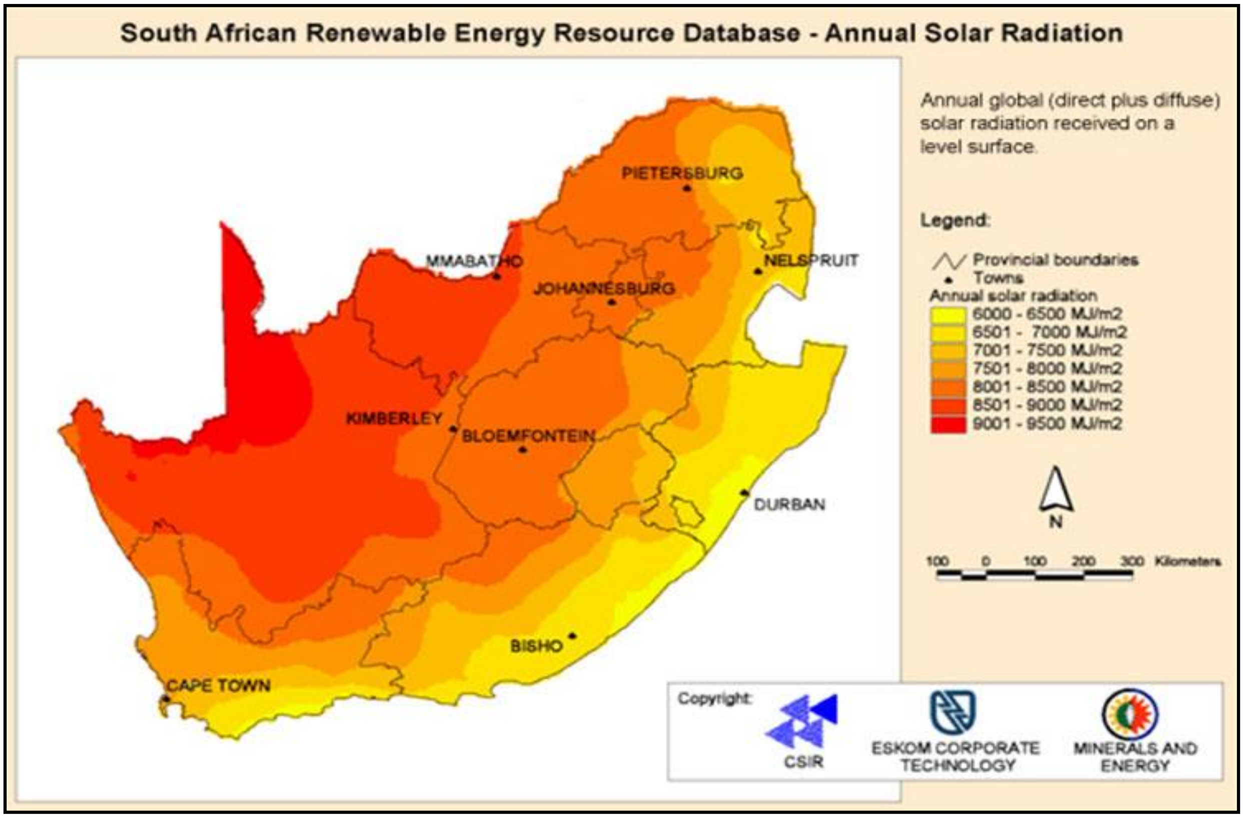

Figure 2: National Solar Resource Map (Source: Solar Vision, 2010)

The proposed solar PV energy facility is situated on the farm Portion 3 of Klipgats Pan No 117 and the proposed power line alternatives transect Portion 4 of Klipgats Pan No 117. Portion 3 of Klipgats Pan No 117 is a small private sheep farm with four people living on the farm and one labourer working there. Therefore any employment losses on the farm would be compensated by employment opportunities created by the solar facility. The land owner is of the opinion that the project will have a positive impact. Portion 4 of Klipgats Pan No 117, which will be transected by the power line, currently has no activities taking place on the farm and no one lives on the land. The proposed development will therefore have very little impact on current land use on affected farms. The site is therefore considered to be suitable from a land use perspective.

As a result of the prefeasibility studies the proposed development site near Copperton has been identified as the preferred development site for the proposed PV facility. This was based on an estimation of the solar energy resource as well as weather, dust, dirt, and surface albedo, in comparison to the other site alternatives. Grid connection and land availability were also important initial considerations. The proposed project site has a relatively flat topography that makes this site suitable for facilities of this kind. The project site also has advantageous grid connection potential, with the existing Eskom Kronos substation approximately 4km away. The site is also easily accessible, as the R357 transects the farm. The proposed site is therefore considered highly suitable for the proposed development and no other site locations are being considered.

4.4 Local Need

The proposed project falls within the Siyathemba LM, which is located within the greater Pixley ka Seme DM. The Siyathemba LM IDP for 2014/2015 identified alternative energy development as an anchor economic activity, and highlighted renewable energy development as an opportunity for the municipality. Additionally, energy has been identified as a priority growth sector. The project is therefore desirable from a municipal viewpoint.

The Northern Cape Provincial Growth and Development Strategy highlights the need to ensure the availability of affordable energy, it also notes that, "development of energy sources such as solar energy, the natural gas fields, bio-fuels, etc., could be some of the means by which economic opportunity and activity is generated in the Northern Cape". The Northern Cape Provincial SDF (2011) states that the energy sector could benefit the economy significantly through created economic spin-offs or multiplier effects and it is widely acknowledged that the Northern Cape province's comparative advantage lies, among others, in solar resource. The proposed project would therefore be advantageous for the province.

According to Census 2011 data, the employed labour in the Siyathemba LM was estimated at 5 356, while the unemployed population was estimated at 1 757, reflecting an unemployment rate of 24.7%. This was lower than the country's unemployment rate of 29.7% and lower than the provincial unemployment rate that was recorded at 27.4%. In the smaller towns, the unemployment situation was worse, with unemployment rates ranging between 33.6% and 41% in Marydale and Nierkerkshoop respectively (Stats SA, 2014). The Copperton community is very small and isolated from employment opportunities and amenities. The proposed project could therefore contribute to employment in the region, which would be particularly significant for the town of Copperton. The proposed project will likely encounter widespread support from government, civil society and businesses, all of whom see potential opportunities for revenues, employment and business opportunities locally. The main employment industry is farming, followed by mining. The proposed project would therefore introduce a new skill to the project area.

The proposed solar PV energy facility will benefit the country by tapping into an energy resource that is sustainable, by reducing the overall carbon footprint of the nation's generating fleet, by implementing a cost effective source of energy, by promoting a renewable energy culture, and by creating local jobs and training opportunities.

5 TECHNICAL PROJECT DESCRIPTION

5.1 Project Description

The proposed project will encompass the installation of a solar PV field and associated components, in order to generate electricity that is to be fed into the Eskom grid. The facility will have a maximum export capacity of 75MW. The total development area of the site for the proposed Helena 3 facility is 527 ha and each substation assessment site comprises of approximately 3 ha. The substation will occupy a footprint area of 2.25 ha. The Helena 3 PV array layout will require approximately 190 ha. The laydown area will require an area of 5.5 ha. The final design details are yet to be confirmed and will become available during the detailed design phase of Helena 3

The project (including associated infrastructure) is proposed on the following farm portions:

- Portion 3 of the farm Klipgats Pan No 117 (Project Site)
- Portion 4 of the farm Klipgats Pan No 117 (Power Lines)

As mentioned above, the generated electricity will be fed into the national distribution network at Kronos Substation via a 132kV power line from the onsite switching substation, with a length of approximately 5km. The objective of the solar project is to generate electricity to feed into the national grid.

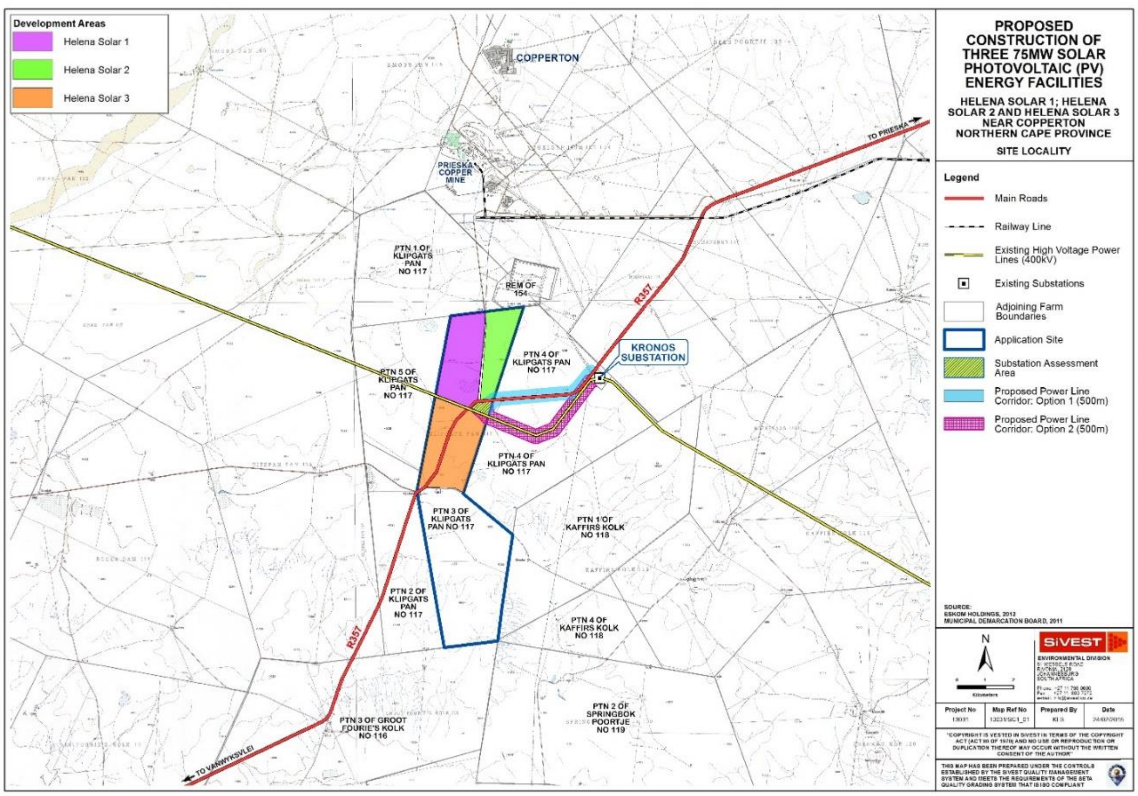

Figure 3: Proposed solar PV energy facility study area

The key technical details and infrastructure required is presented in the table below (Table 6).

Table 6: Helena Solar 3 summary

Project Name	DEA Reference	Farm name and area	Technical details and infrastructure necessary for each phase

Helena Solar 3	14/12/16/3/3/2/767	Portion 3 of Klipgats Pan No 117 (PV site) and Portion 4 of Klipgats Pan No 117 (power lines) Development Area: 527 ha	▪ Approximately 275 000 **solar PV panels** with a total export capacity of 75MW; ▪ Panels will be either **fixed axis mounting or single axis tracking solutions**, and will be either crystalline silicon or thin film technology; ▪ Onsite **switching station**, with the transformers for voltage step up from medium voltage to high voltage; ▪ The panels will be connected in strings to inverters, approximately **43 inverter stations** will be required throughout the site. Inverter stations will house 2 x 1MW inverters and 1 x 2MVA transformers; ▪ DC power from the panels will be converted into AC power in the inverters and the voltage will be stepped up to 22 or 33kV (medium voltage) in the transformers. ▪ The **22 or 33kV cables** will be run underground in the facility to a common point, unless there are environmental or technical concerns that result in the need for an overhead line, before being fed to the **onsite substation** where the voltage will typically be stepped up to 132kV. ▪ Grid connection is to the Kronos substation. A **power line** with a voltage of 132kV is proposed and will run from the onsite substation to the Eskom Kronos substation. The distance will be about 5km. The final grid connection voltage will be below 275kV. ▪ A **laydown area** for the temporary storage of materials during the construction activities; ▪ **Access roads and internal roads**; ▪ Construction of a **car park and fencing** around Helena 3; and ▪ **Administration, control and warehouse buildings**

As previously mentioned, this proposed PV energy facility forms one of three PV energy facilities with a 75MW export capacity that BioTherm are proposing to develop on Portion 3 of the farm Klipgats Pan No 117. In order to accommodate the Department of Energy's (DoE) competitive bidding process for procuring renewable energy from Independent Power Producers in South Africa each PV energy facility will be developed under a separate Special Purpose Vehicle (SPV) and therefore each requires a separate Environmental Authorisation. However, the possibility to allow shared associated infrastructure will be considered.

The key components of the project are detailed below.

5.1.1 Solar Field

Solar PV panels are usually arranged in rows or 'arrays' consisting of a number of PV panels. The area required for the PV panel arrays will likely need to be entirely cleared or graded. Where tall vegetation is present, this vegetation will be removed from the PV array area.

Approximately 275 000 solar PV panels will be required for the project for a total export capacity of 75MW. Support structures will be either fixed axis mounting or single axis tracking solutions and the modules will be either crystalline silicon or thin film technology. The solar PV panels are variable in size, and are affected by advances in technology between project inception and project realisation. The actual size of the PV panels to be used will be determined in the final design stages of Helena 3. The PV panels are mounted onto metal frames which are usually aluminium. For foundations, concrete footings or rammed piles are commonly used to support the panel arrays (Figure 4).

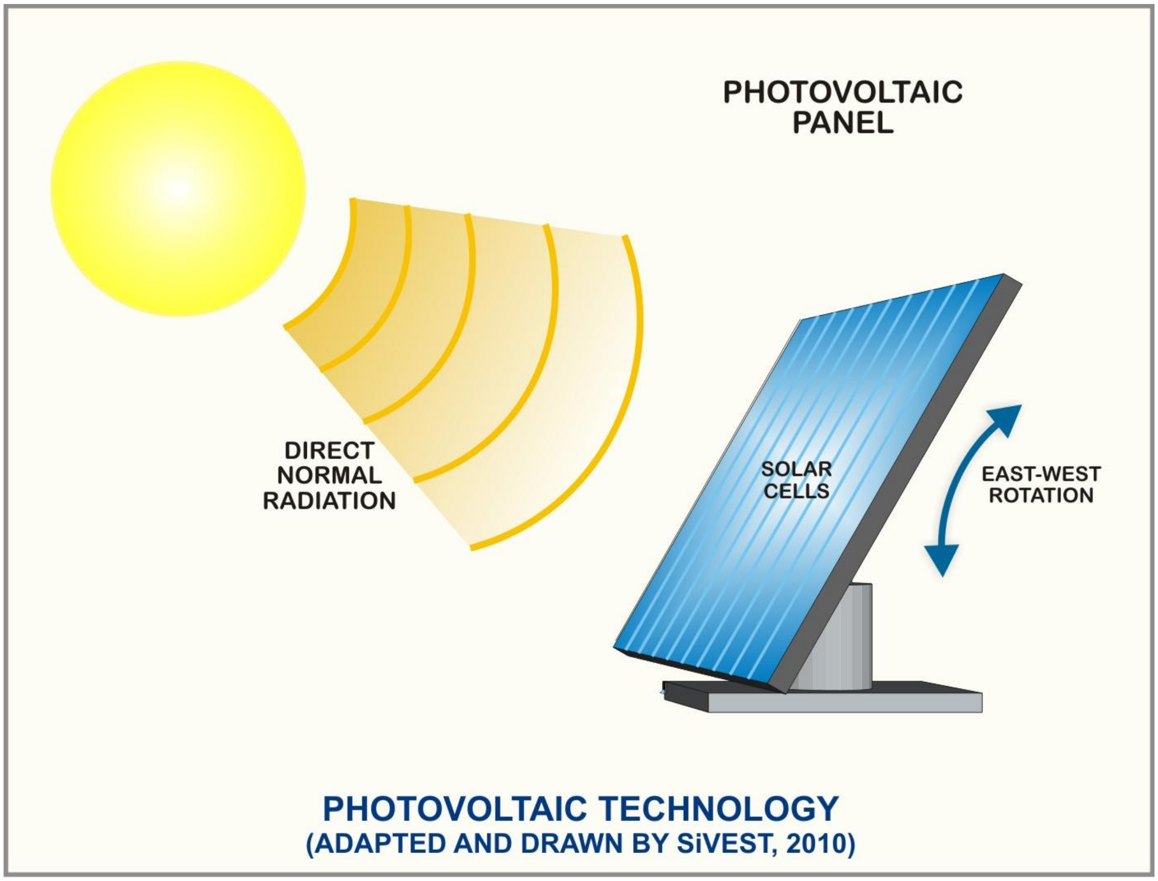

Figure 4: Example of a Photovoltaic Panel with tracking capability.

5.1.2 Electrical Infrastructure

The solar PV panel arrays are connected to each other in strings, which are in turn connected to inverters. For a 75MW size facility, typically 2MW inverter stations which are containerised stations housing 2x1MW inverters and 1x2MVA transformers will be used; therefore approximately 43 inverter stations will be required throughout the site for the proposed solar PV energy facility (Figure 5). DC power from the panels will be converted into AC power in the inverters and the voltage will be stepped up to 22 or 33kV (medium voltage) in the transformers. The 22 or 33kV cables will be run underground in the facility, unless there are environmental or technical concerns that result in the need for an overhead line, to a common point before being fed to the onsite substation and switching station where the voltage will typically be stepped up to 132kV. A Power line with a voltage of up to 132kV will run from the onsite substation to the existing Kronos substation. The distance will be about 5km.

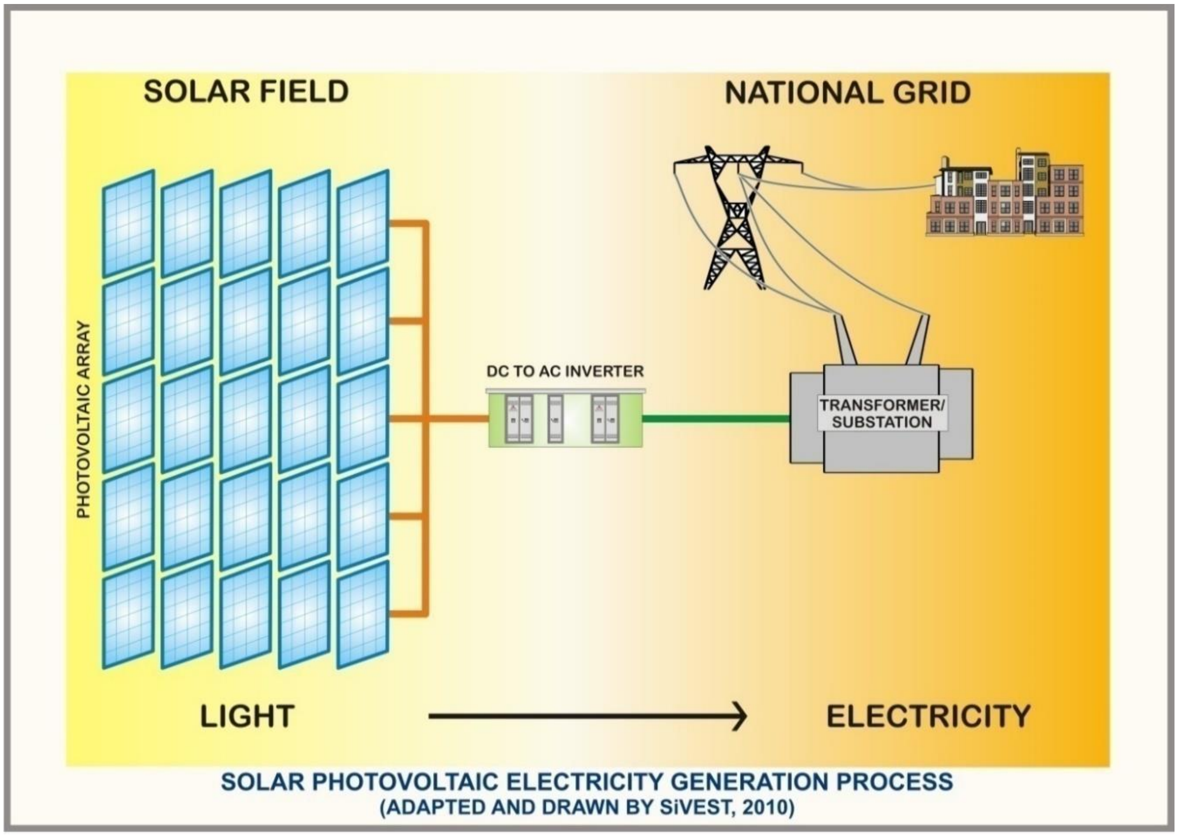

Figure 5: PV process

5.1.3 Buildings

The solar field will require onsite buildings which will be used in the daily operation of the energy facility and includes an administration building (office). The location for the administration building was determined during the EIA process based on environmental constraints identified and design factors that need to be considered. The footprint of the buildings will be approximately 225m^2.The buildings will likely be single storey buildings which will be required to accommodate the following:

- Control room
- Workshop
- High Voltage (HV) switchgear
- Mess Room
- Toilets
- Warehouse for storage

5.1.4 Construction Lay-down Area

A general construction lay-down area will be required for the construction phase of the proposed solar PV energy facility. The size of this area is approximately 5.5 hectares. The location of the construction laydown area was determined during the EIA process based on environmental constraints identified and design factors that need to be considered.

5.1.5 Other Associated Infrastructure

Other associated infrastructure includes the following:

- Access roads and internal roads;
- A car park; and
- Fencing around Helena 3.

5.2 Alternatives

As per Chapter 1 of the EIA regulations (2010), feasible and reasonable alternatives are required to be considered during the EIA process. Alternatives are defined at “different means of meeting the general purpose and requirements of the activity” These alternatives may include:

(a) The property on which or location where it is proposed to undertake the activity;
(b) The type of activity to be undertaken;
(c) The design or layout of the activity;
(d) The technology to be used in the activity;
(e) The operational aspects of the activity; and
(f) The option of not implementing the activity.

Each of this alternatives is discussed in relation to the proposed project in the sections below.

5.2.1 The property on which or location where it is proposed to undertake the activity

As previously mentioned, No site alternatives for this project are being considered because the placement of solar PV installations is dependent on several factors, all of which are favorable at the proposed site location. These include solar resource, climate, topography, grid connections suitability, competition and access to the site. A prefeasibility study was conducted by BioTherm prior to the EIA process, during which six (6) site alternatives were considered and assessed. The site alternatives assessed during the prefeasibility study are described below:

Table 7: Site Alternatives assessed during the prefeasibility study conducted by BioTherm.

Project Name	Project Location	Province	Size of area assessed	Feasibility Fatal Flaws Identifies
Kathu	Kathu	Northern Cape	12 000	Site was excluded for the proposed development of 3 x 75MW PV plants due to environmental sensitivity of the proposed development area.
Virginia	Virginia	Free State	5000	Site was excluded as there was no grid capacity on 132kV for loop -in loop-out to connect the PV facility to the national grid. Grid connection costs were found to be too high to connect facility.
Bloemfontein	Bloemfontein	Free State	7 000	Site was excluded from a land perspective, as during the prefeasibility studies a large number of landowners were identified. This complicated the proposed development due to the amount of landowners that would be required to sign up and agree to the proposed development.
Viljoenskroon	Viljoenskroon	Free State	3 000	Site was excluded as during the prefeasibility study the solar resources were identified as low. Additionally, the cost to connect the PV facility to the national grid was too high.
Petrusville	Petrusville	Free State	5 000	Site was excluded as the proposed development site would be located 50km from closest grid connection point. Therefore, the cost to connect the PV facility to the national grid was too high.
Kimberly	Kimberly	Free State	5000	Site was excluded as during the prefeasibility study the solar resources were identified as low. Additionally, the cost to connect the PV facility to the national grid was too high.

As a result of the prefeasibility studies and the elimination of alternative development sites the proposed development site near Copperton has been identified as the preferred development site for the proposed PV facilities.

The placement of solar PV installations is dependent on several factors as mentioned above, all of which are favourable at the proposed site location. Prior to site selection a site screening process was undertaken by BioTherm, the entire area around Copperton was assessed due to a high solar resource potential, and grid availability for the PV facility. Based on the solar resource, grid connection location, topography, available land, and competition, the farm Klipgats was selected as the preferred site. On the farm Klipgats, the southern or northern potions were comparatively assessed as potential sites for the facility. On a high level screening it was decided that the southern portion of the farm had higher environmental sensitivities as it is located further from the grid. The project site has highly advantageous grid connection potential, with the existing Eskom Kronos substation approximately 4km to the north-east. The site is also easily accessible as the R357 transects the farm. Hence it was decided that the northern portion of the farm would be most suitable. Following the site selection screening process the EIA was initiated on the environmentally preferred northern site. The site is therefore considered highly suitable for the proposed development and no other locations are being considered during the EIA.

5.2.2 The type of activity to be undertaken

. Renewable energy development in South Africa is highly desirable from a social, environmental and development point of view. Prior to project initiation BioTherm considered various renewable energy sources for the development. Wind energy installations were found not to be feasible on the site as there is not enough of a wind resource. Concentrated solar power (CSP) installations are also not feasible because they have a high water requirement and the project site is located in an arid area. Solar PV is therefore the preferred activity being considered for the proposed site. No other activity alternatives are being considered during the EIA.

5.2.3 The design or layout of the activity

Design or layout alternatives are being considered in the EIA process. Various environmental specialists assessed the site during the scoping phase. Their assessments encompassed the entire proposed development site and included the identification of sensitive areas. These sensitive areas were used during the scoping phase to guide layout design for the proposed solar PV energy facility (Figure 6). These layouts have been extensively investigated in the EIA phase of the project. The design and layout alternatives will include; power line routes, internal roads and alternative locations for the substation. The layout alternatives will be based on both environmental constraints and design factors. The layout alternatives, including maps, are presented in Chapter 12.

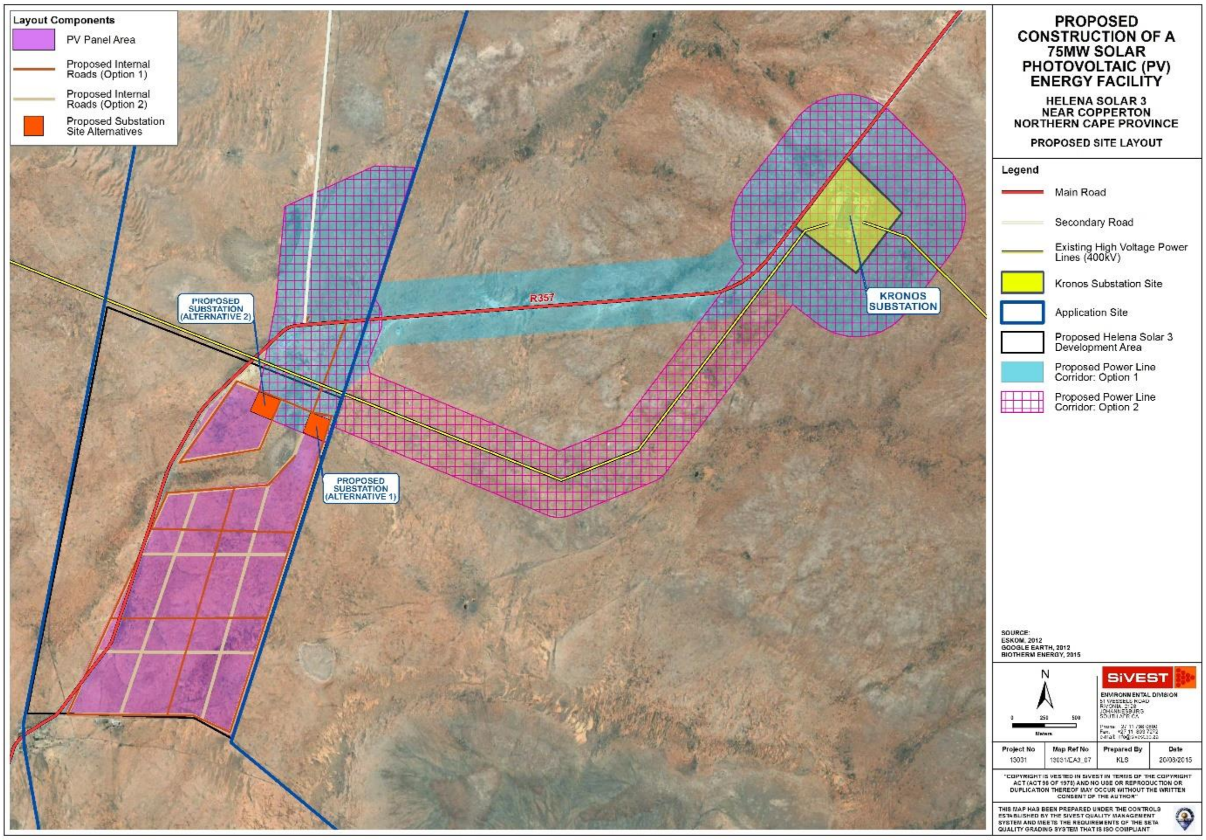

Figure 6: Proposed Layout Alternatives

The alternatives take the sensitive areas identified by the specialists in the Scoping phase into account and these have been precluded from the buildable areas. Sensitivity maps have been compiled based on the negative mapping / sensitivity assessment exercise that was undertaken by all the specialists. These are indicated in Figure 7 below.

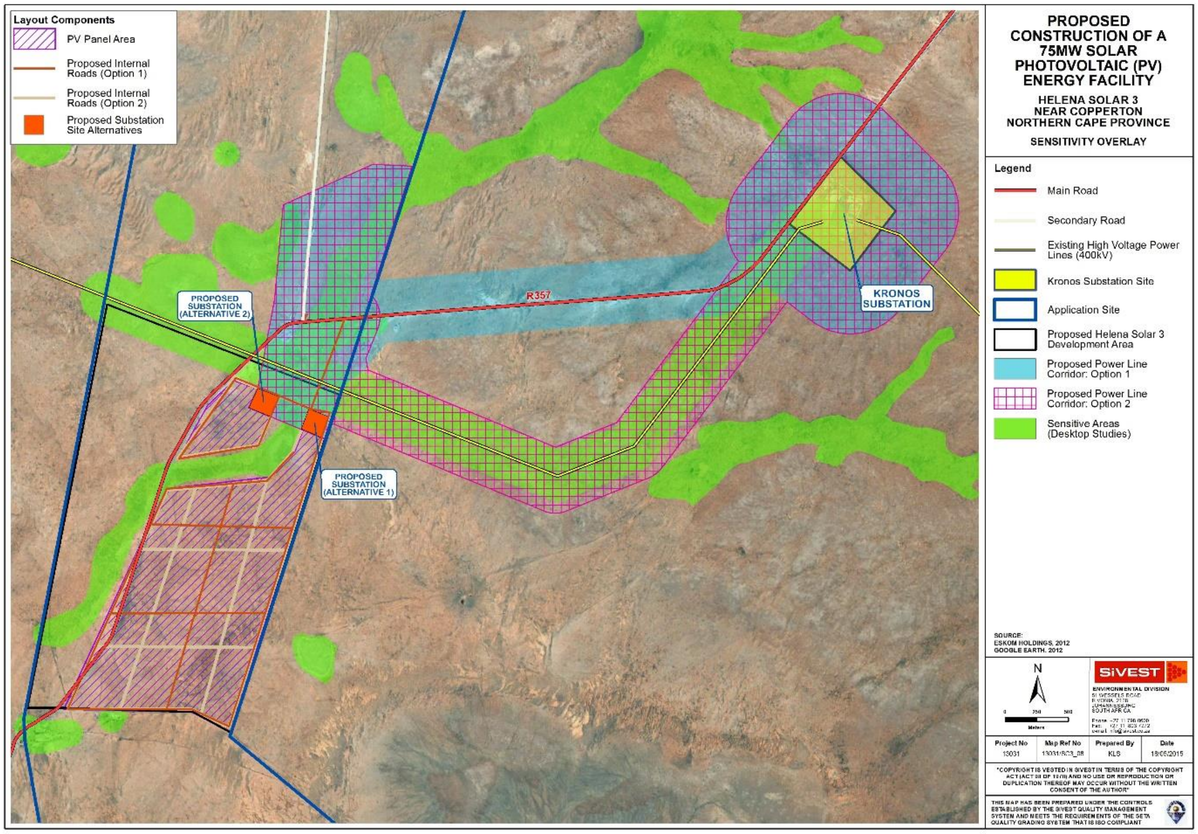

Figure 7: Scoping Phase Composite Sensitivity Map

Due to the elimination of all sensitive areas from the potential buildable area, the proposed layouts were severely constrained in terms of the area available. It was therefore not possible to have two layout alternatives for the PV array area, however the two substation alternatives were positioned as far apart as possible and the two power line alternatives follow entirely different routes. Identifying two relatively similar layouts that are both environmentally feasible was considered more beneficial to the EIA process than only considering one alternative against the option of not implanting the activity or no-go alternative.

5.2.1 The technology to be used in the activity

There are very few technological alternatives for PV technology. For the Helena 3 solar energy facility the mounting structures will be either fixed axis mounting or single axis tracking solutions, and the modules will be either crystalline silicon or thin film technology. The impacts on the environment of the different types of PV technology are the same during construction, operation and decommissioning. Therefore no technology alternatives will be considered during the EIA. The choice of technology used will ultimately be determined by technological and economic factors at a later stage.

5.2.2 The operational aspects of the activity

No operational alternatives were assessed in the EIA, as none are available for solar PV installations.

5.2.3 The option of not implementing the activity

The option of not implementing the activity, or **the 'no-go' alternative, is considered in the EIA**. South Africa is under immense pressure to provide electricity generating capacity in order to reduce the current electricity demand in the country. With the global focus on climate change, the government is under severe pressure to explore alternative energy sources in addition to coal-fired power stations. Although solar power is not the only solution to solving the energy crisis in South Africa, not establishing the proposed solar PV energy facility would be detrimental to the mandate that the government has set to promote the implementation of renewable energy. It is a suitable sustainable solution to the energy crisis and this project could contribute to addressing the problem. Additionally, the project will uplift the community in terms of job creation and local investment into the area, not implementing the activity would remove this positive impact. This project will aid in achieving South Africa's goals in terms of sustainability, energy security, mitigating energy cost risks, local economic development and national job creation.

6 DESCRIPTION OF THE RECEIVING ENVIRONMENT

The Northern Cape Province is considered to be a suitable region for the establishment of solar PV energy facility. Accordingly, a land portion located near Copperton has been identified as a potential site. A general description of the study area is outlined in the section below. The receiving environment in relation to each specialists study is also provided.

6.1 Locality

The proposed development site is situated near Copperton in the Siyathemba LM of the greater Pixley ka Seme DM, within the Northern Cape Province (Figure 8). The site is located approximately 10km south of Copperton, and 60km south-west of Prieska, and 280km south-west of Kimberley. Copperton is an abandoned town which previously serviced a mine that has subsequently closed. The proposed solar PV energy facility will be accessed by the R357 which transects the site. The centre point co-ordinates for the development site as well as the start and end point coordinates for the power line alternatives, are included in Table 8 and Table 9.

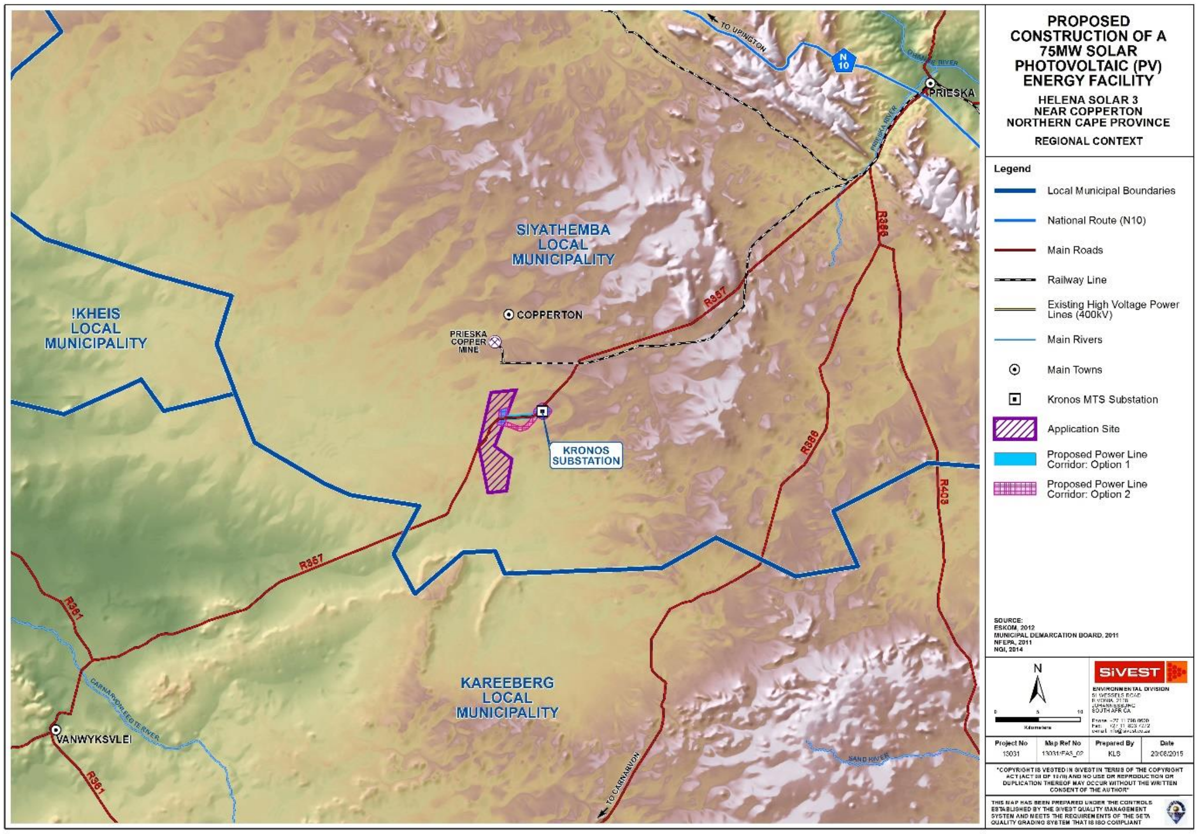

Figure 8: Regional Study Area.

Table 8: Proposed Site Location

FACILITY NAME	CENTRE POINT CO-ORDINATES	
	SOUTH	EAST
HELENA SOLAR 3 DEVELOPMENT AREA	S30° 2' 46.836"	E22° 17' 6.137"

Table 9: Proposed Power Line Alternatives

POWER LINE ALTERNATIVES			
ALTERNATIVE	LENGTH (KMS)	COORDINATES	
		START	END
OPTION 1	4.38	S30° 2' 2.692"	S30° 1' 27.878"
		E22° 17' 54.321"	E22° 20' 18.716"
OPTION 2	5.11	S30° 2' 7.012"	S30° 1' 31.611"
		E22° 17' 52.457"	E22° 20' 17.451"

The site that is proposed for the Helena 3 Solar PV energy facility near Copperton is located on the following farms:

- Portion 3 of Klipgats Pan No 117 (solar PV energy facility); and
- Portion 4 of Klipgats Pan No 117 (power lines).

Please note that all maps within the report are included in Appendix 7 and are in A3 format.

6.2 Land Use

The prevailing land use in the wider study area is classified as undeveloped low shrubland (Figure 9). The highly arid nature of the area's climate, has resulted in livestock rearing (of sheep) dominating within the area. As such, the typical low, woody shrub, karoo-type communities have been retained across the vast majority of the study area, as sheep graze on natural vegetation (Geoterraimage, 2015).

The nature of the climate and corresponding land use has also resulted in low stocking densities and relatively large farm properties across the area. Therefore the area is very sparsely populated, and little human-related infrastructure exists.

Built form, in areas where livestock rearing occurs, is limited to isolated farmsteads, gravel access roads, ancillary farm buildings, telephone lines, windmills, fences and the remnants of old workers' dwellings (Figure 10).

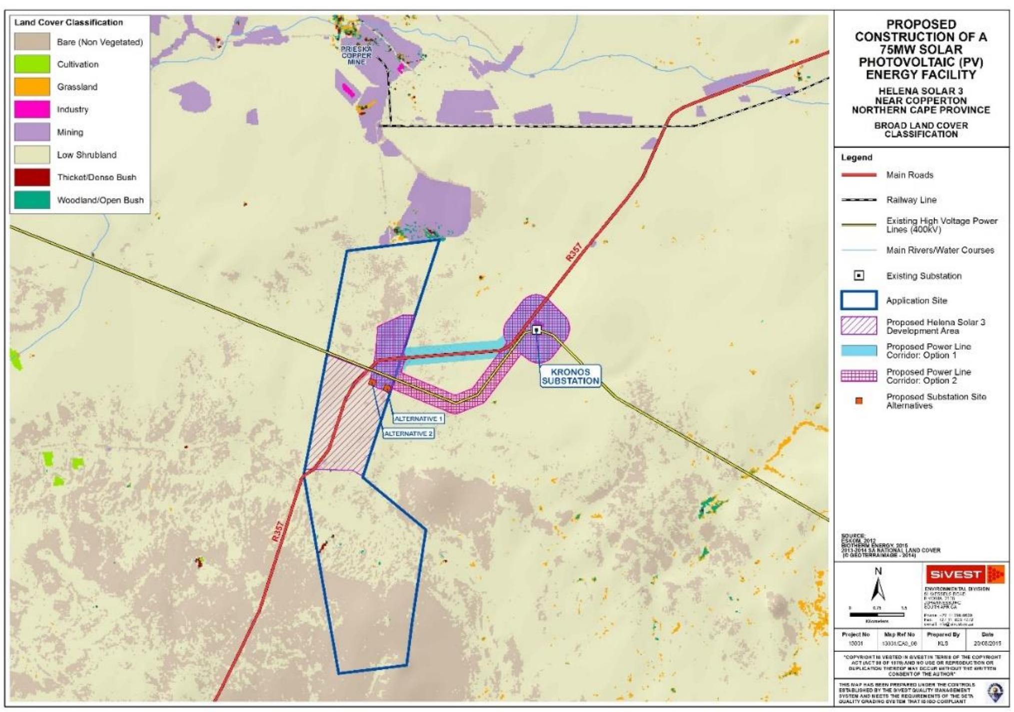

Figure 9: Land Use of the Study Area

Figure 10: Typical built form present within the study area

6.3 Topography and Slope

The topography within and in the immediate vicinity of the proposed application site is characterised by a flat to gently undulating landscape (typical of much of the Karoo), that gently slopes down in a south-westerly direction. A slight variation in form can be seen to the north of the site where an old slimes dam is still present (Figure 11).

Figure 11: View north from the R357 within the application site showing the typically flat terrain and derelict slimes dam within the study area

The topography in the wider area is characterised by a mix of very flat plains, as well as areas of slightly more undulating relief, including some low ridges and a number of isolated low koppies (Figure 12). In the wider area a low mountain range marks a change in topography; the Doringberge form a line of hills to the north-east of the site.

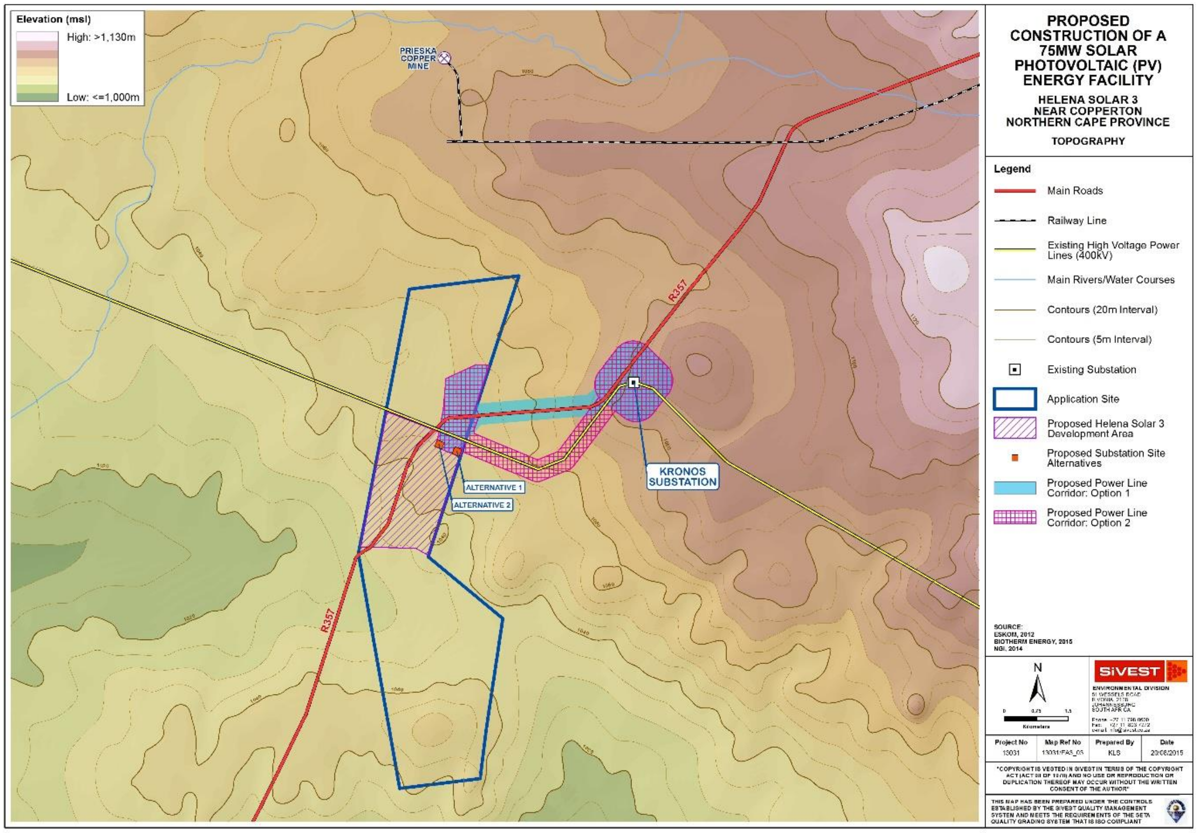

Figure 12: Topography of the study area

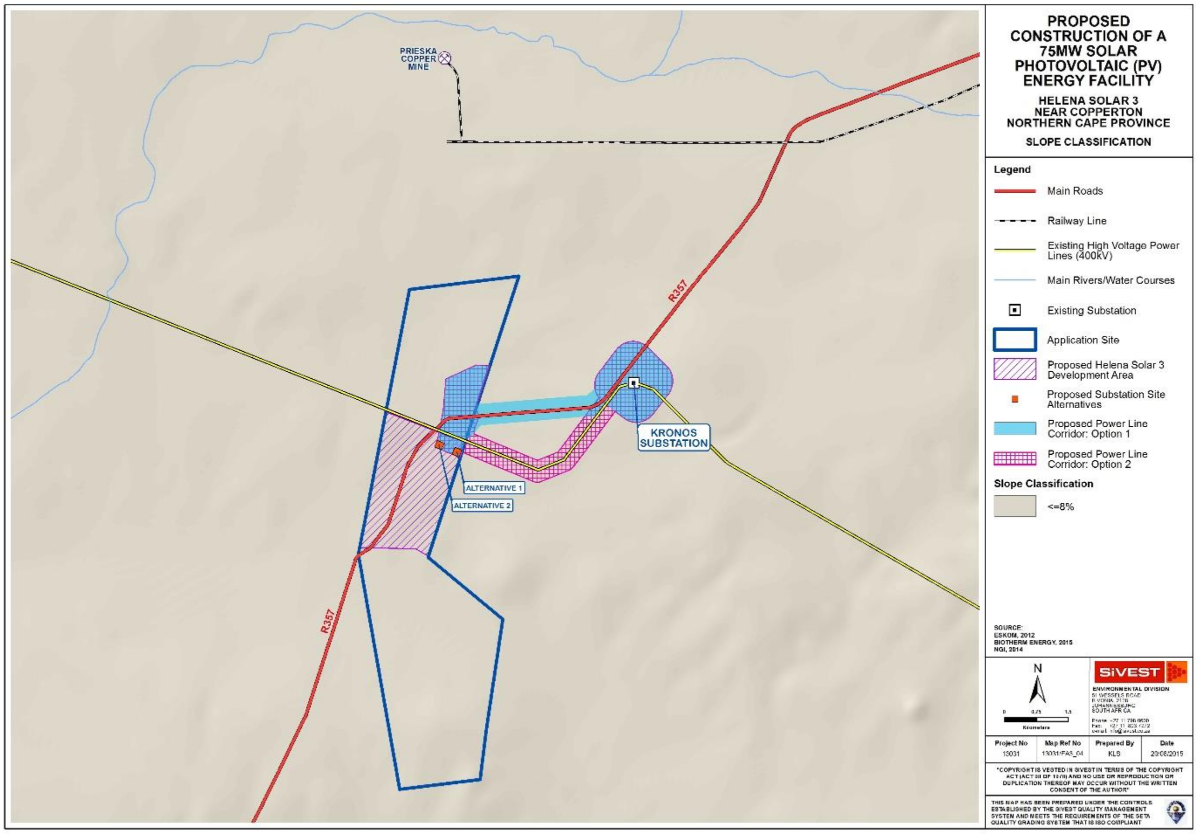

Figure 13: Slope of the study area

6.4 Climate

The climate of the study area (Monnik & Malherbe, 2005) can be regarded as warm to hot with occasional rain in summer and dry winters. The long-term average annual rainfall in this region of the Northern Cape is only 198 mm, of which 138 mm, or 69%, falls from November to April. Rainfall is erratic, both locally and seasonally and therefore cannot be relied on for agricultural practices. The average evaporation is over 2 100 mm per year, peaking at over 8.5 mm per day in December.

Temperatures vary from an average monthly maximum and minimum of 31.6ºC and 11.8ºC for January to 15.9ºC and 1.0oC for July respectively. The extreme high temperature that has been recorded is over 42oC and the extreme low –10.0ºC. Frost occurs most years for 30-40 days on average between early May and mid-September.

6.5 Geology

The geology of the Helena 3 area comprises tillite of the Dwyka Formation (Geological Survey, 1977).

The distribution of the geological units in the area is shown in Figure 14.

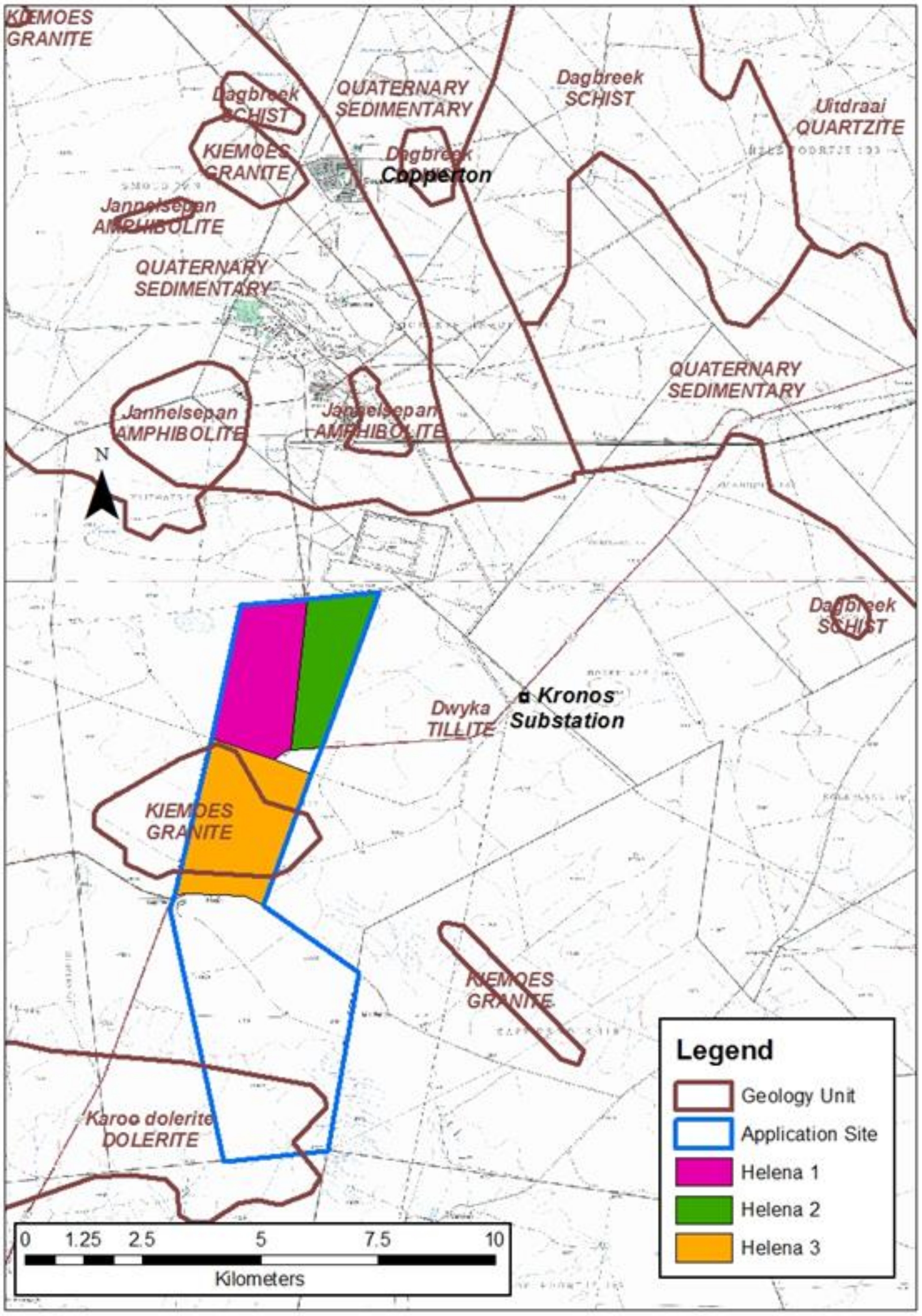

Figure 14: Geology

6.6 Biodiversity (Flora and Fauna)

The Biodiversity Assessment was conducted by David Hoare (Appendix 6A). The environmental baseline from a biodiversity perspective is presented below.

6.6.1 Broad vegetation types of the region

The site falls within the Nama-Karoo Biome (Rutherford & Westfall 1986, Mucina & Rutherford 2006). Typical vegetation structure within the study area is shown below (Figure 15). The most recent and detailed description of the vegetation of this region is part of a national map (Mucina, Rutherford & Powrie, 2005; Mucina et al. 2006). This map shows three vegetation types occurring within the area of interest (Figure 16), of which only two are affected directly by the proposed project alternatives. These vegetation types are described in more detail below.

Figure 15: Typical vegetation structure within the study area

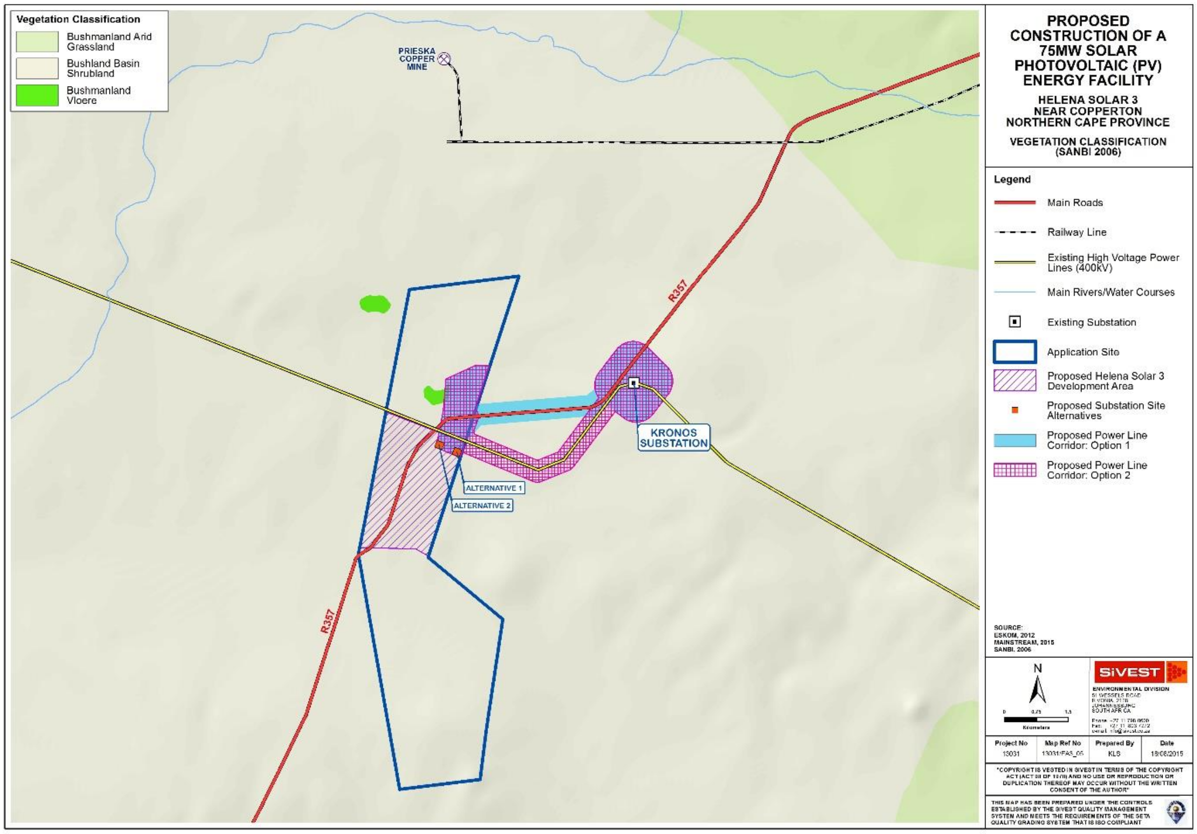

Figure 16: Vegetation of the Study Area.

6.6.2 Bushmanland Basin Shrubland

This vegetation type occurs in the Northern Cape Province in the Large Bushmanland Basin centred on Brandvlei and Vanwyksvlei, from Granaatboskolk in the west to Copperton in the east and Kenhardt in the north to Williston in the south (Mucina et al. 2006). It is found on slightly irregular plains. The vegetation is a dwarf shrubland dominated by a mixture of low sturdy, spiny and sometimes succulent shrubs (*Rhigozum, Salsola, Pentzia* and *Eriocephalus*), white grasses and, in years of high rainfall, abundant annuals, such as *Gazania* and *Leysera*. In comparison to the bordering Bushmanland Arid Grassland, the vegetation of this unit shows increased presence of shrubs and plant indicators of high salt status of soils.

6.6.3 Bushmanland Vloere

This is the vegetation of the salt pans and broad riverbeds of the central Bushmanland basin (Mucina et al. 2006). It occurs in areas of flat and very even surfaces of pans and broad bottoms of intermittent dry rivers. Typically, the central parts are devoid of vegetation. Around this is loosely patterned scrub dominated by *Rhigozum trichotomum* and various species of *Salsola* and *Lycium*, with a mixture of karroid dwarf shrubs. In places loose thickets of *Parkinsonia africana*, *Lebeckia linearifolia* and *Acacia karroo* may be found.

6.6.4 Bushmanland Arid Grassland

This vegetation type occurs on extensive, relatively flat plains and is sparsely vegetated by tussock grasses, including *Stipagrostis ciliata*, *Aristida adscensionis*, *Aristida congesta*, *Enneapogon desvauxii*, *Eragrostis nindensis*, *Schmidtia kalahariensis* and *Stipagrostis obtusa*. In some years after good rains there are abundant displays of annual herbs (Mucina et al. 2006). There are no known endemics in this vegetation type (Mucina *et al*. 2006), but it does contain endemics belonging to the Griqualand West or Gariep Centres of Endemism (van Wyk & Smith 2001), namely *Aizoon asbestinum*, *Maerua gilgii*, *Ruschia muricata* and *Aloe gariepensis*. The vegetation type also contains the protected tree species, *Acacia erioloba* (camel thorn), *Acacia haematoxylon* (grey camel thorn) and *Boscia albitrunca* (shepherd's bush).

6.7 Avifauna

The Avifauna Assessment was conducted by Chris van Rooyen (Appendix 6B). The environmental baseline from an avifaunal perspective is presented below.

The habitat in the broader development area is highly homogenous and consists of extensive sandy and gravel plains with low shrub. The vegetation on the site itself consists mostly of shrubs scattered between bare patches of sand and gravel.

The closest Important Bird Area (IBA), the Platberg Karoo Conservancy, is located approximately 160km to the east (Birdlife 2014) and falls outside the zone of influence of this development.

The South African Bird Atlas Project (SABAP1) recognises six primary vegetation divisions within South Africa, namely (1) Fynbos (2) Succulent Karoo (3) Nama Karoo (4) Grassland (5) Savanna and (6) Forest (Harrison et al. 1997). The criteria used by the authors to amalgamate botanically defined vegetation units, or to keep them separate were (1) the existence of clear differences in vegetation structure, likely to be relevant to birds, and (2) the results of published community studies on bird/vegetation associations. It is important to note that no new vegetation unit boundaries were created, with use being made only of previously published data. Using this classification system, the natural vegetation in the study area is classified as Nama Karoo.

Nama Karoo as dominated by low shrubs and grasses; peak rainfall occurs in summer from December to May. Average daily temperatures range between 35°C in January and 18°C in July (http://www.worldweatheronline.com/Copperton-weather-averages/Northern-Cape/ZA.aspx).

Trees, e.g. *Acacia karroo* are mainly restricted to ephemeral watercourses, but in the proposed development area, due to the extreme aridity (average annual precipitation of only 147mm in 12 years from 2000 – 2012 - http://www.worldweatheronline.com) the ephemeral watercourses are devoid of trees. In comparison with the Succulent Karoo, the Nama Karoo has higher proportions of grass and tree cover. The two Karoo vegetation types support a particularly high diversity of bird species endemic to Southern Africa, particularly in the family *Alaudidae* (Larks). Its avifauna typically comprises ground-dwelling species of open habitats. Because rainfall in the Nama Karoo falls mainly in summer, while peak rainfall in the Succulent Karoo occurs mainly in winter, it provides opportunities for birds to migrate between the Succulent and Nama Karoo, to exploit the enhanced conditions associated with rainfall. Many typical karroid species are nomads, able to use resources that are patchy in time and space (Barnes 1998).

Figure 17 below is a sample of the typical habitat at the Helena Solar 3 site.

Figure 17: Bushmanland Basin Shrubland, the dominant habitat at the proposed Helena Solar 3 site.

The existing Aries-Kronos 400kV transmission line runs in an east-west direction directly north of the development area, which acts as an important perching substrate for raptors (see Figure 18). The site is bisected by the R357 district road, with the solar panel area situated on the portion of the site to the east of the road.

Figure 18: The existing Aries-Kronos 400kV transmission line which runs directly north of the proposed development site.

6.7.1 Proposed Power line Corridor Option 1

The habitat within the proposed transmission line corridor is also Bushmanland Basin Shrubland. The proposed alignment runs in an easterly direction from the PV site along the R357 dirt road to Kronos MTS, for a total length of approximately 4.5km. In general, the corridor does not contain any distinguishing features from an avifaunal perspective, except a two borrow pits that may attract water birds and raptors sporadically when filled with water. The one distinguishing feature of the corridor is a Martial Eagle nest site on the Hydra-Kronos 400 kV line that was initially recorded in the early 2000s in surveys of large raptors nesting on Eskom's transmission network in the Karoo (Jenkins *et al.* 2013). The presence of the nest was re-confirmed in 2013, with a pair of adults in attendance at a nest on tower 519 (30º 01.579 S, 22º 20.675 E) in May 2013, and feeding a small chick in August of the same year. This chick was successfully fledged by November, and at least one adult was present in the area, with the nest showing signs of preparation for the upcoming breeding season, in March 2014 (Jenkins & Du Plessis 2014). The nest was inspected during the site visit in June 2015, but the birds were not observed, which is an indication that the nest may not be active this year. At the time of the site visit, there was extensive activity at the Kronos MTS with continuous movements of trucks and pedestrians, which may account for the absence of the eagles at this specific nest site.

6.7.2 Proposed Power line Corridor Option 2

The habitat within the proposed transmission line corridor is also Bushmanland Basin Shrubland. The proposed alignment runs in an easterly direction to Kronos MTS, adjacent to the existing Aries-Kronos 400kV transmission line (see Figure 18), for approximately 5km. The existing transmission line was inspected for any potential large eagle nesting activity from the development site to the Kronos MTS, but no indications of any nesting activity was recorded. The closest recorded Martial Eagle nest site on the Aries – Kronos 400kV line is situated at tower 392 (Jenkins *et. al* 2013), which is approximately 15km to the west and outside the immediate impact zone of this development footprint. The presence of a Martial Eagle nest site on the Hydra-Kronos 400 kV at Kronos MTS has already been discussed above and is also relevant to this corridor option.

6.8 Surface Water

The Surface Water Assessment was conducted by SiVEST (Appendix 6C) and the environmental findings from a Surface Water perspective are presented below.

According to Dollar *et al*. (2007), regions can be grouped that have similar land areas containing a limited range of recurring landforms that reflect comparable erosion, climatic and tectonic influences, and impose broad constraints on lower levels of organisation, e.g., drainage basins, macro-reaches and channel types. Hence, on this basis, geomorphic provinces (Partridge *et al*. 2010) have been delineated that reflect a relatively common set of climatic, vegetation, geological and topographical characteristics that are akin to one another. Utilising this information, the regional drainage characteristics of the broader study area can be elucidated. Under this context, the study site is located within the Western Transvaal Basin geomorphic province of South Africa.

6.8.1 Northern Cape Pan Veld Geomorphic Province

The main feature of this province, which straddles the uplifted Griqualand-Transvaal axis, is the frequency of pans (some vast in size e.g., Verneukpan and Grootvloer) that are remnants of earlier (Cretaceous) drainage systems (De Wit, 1993). The province is underlain by Karoo rocks (Ecca and Dwyka Groups) in the south and east and by Namaqua gneiss in the west and north. Each pan has its own endorheic drainage net and several are used for the evaporative production of salt. These pans can be regarded as discontinuous groundwater windows, in which the substantial excess of evaporation over precipitation under the prevailing hot, dry climate, leads to rapid concentration of dissolved solids within each discrete basin. These drainage systems were disrupted both by progressive aridification and by uplift along the Griqualand-Transvaal axis, causing the dismembering of several rivers (e.g., the Koa and Vis/Hartbees rivers) (Partridge & Maud, 2000).

Four main drainage systems traverse this province; from east to west of which these are the Boesak, Vis/Hartbees and Brak rivers. Those in the east (Boesak and Vis/Hartbees) display remarkable uniformity, with flat slopes, and wide valley cross-sectional profiles. The rivers in the extreme northwest (e.g., the Brak) are, however, characterised by narrower valley cross-sectional profiles, steeper slopes and convex longitudinal profiles. The Brak River in fact follows the Koa valley, the course of which was disrupted by uplift along the Griqualand-Transvaal axis which crosses it at right angles (Partridge *et al*. 2010).

6.8.2 Overview of Scoping Study Findings

The scoping assessment encompassed identifying and delineating surface water resources within the proposed development site at a database- and desktop-level. For the Helena 3 Solar PV Energy Facility one (1) depression wetland and one (1) non-perennial river was provisionally identified (Figure 19). For the Power Line Option 1 Alternative, one non-perennial river was identified. For the Power Line Option 2 Alternative, one depression wetland was identified. Finally, for the Kronos Substation site, one depression wetland was identified.

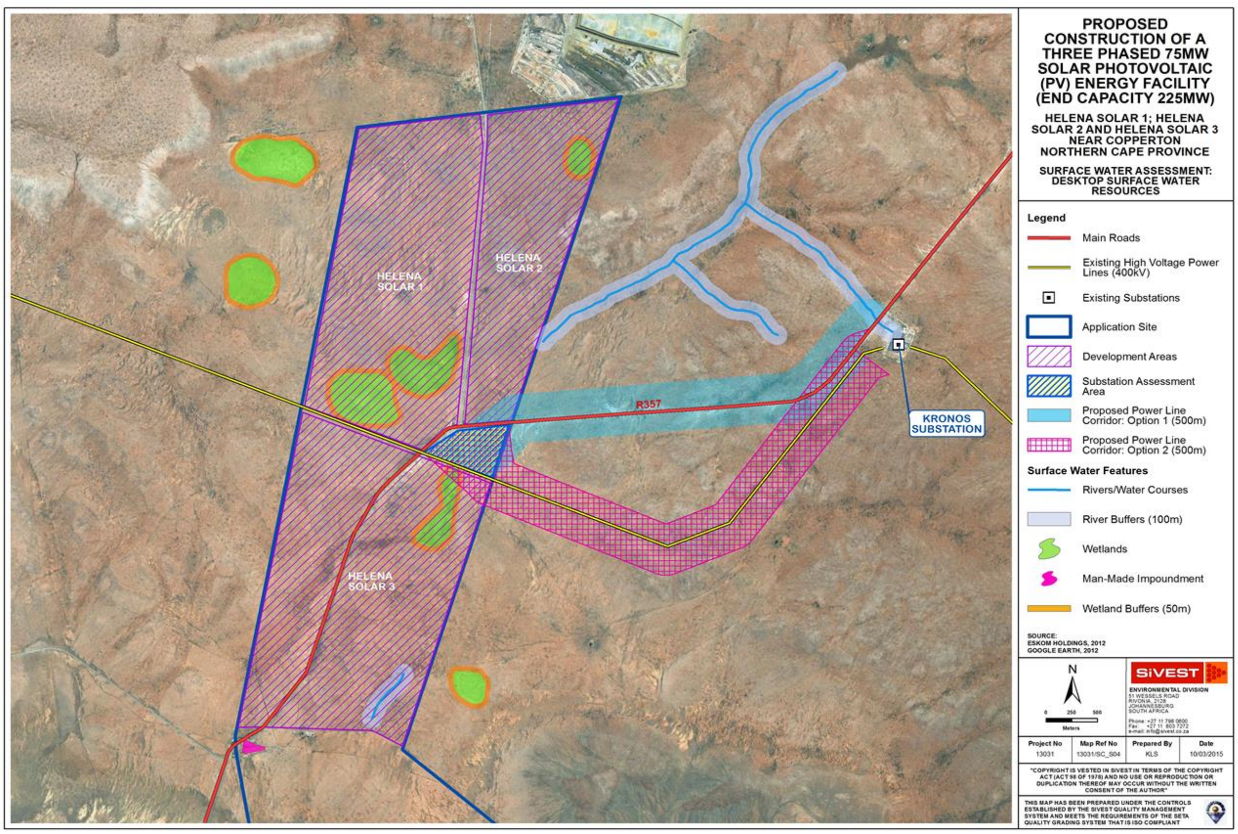

Figure 19: Desktop Surface Water Resources for the project site.

6.9 Agricultural Potential and Soils

The Agricultural Potential Assessment was conducted by Garry Patterson (Appendix 6D) and the environmental findings from an Agricultural Potential perspective are presented below.

Existing soil information was obtained from the map sheets 2922 Prieska and 3022 Britstown (Bruce & Geers, 2005) from the national Land Type Survey, published at 1:250 000 scale. A ***land type*** is defined as an area with a uniform terrain type, macroclimate and broad soil pattern. The soils are classified according to MacVicar *et al* (1977).

The area under investigation for Helena Solar 3 is covered by two land types, as shown in Figure 20, namely:

- **Ah54, Ah93** (Red and yellow, freely-drained soils, high base status)

It should be clearly noted that, since the information contained in the land type survey is of a reconnaissance nature, only the general dominance of the soils in the landscape can be given, and not the actual areas of occurrence within a specific land type. Also, other soils that were not identified due to the scale of the survey may also occur. As it was deemed unnecessary based on the scoping phase findings, the site was not visited during the course of this study, and so the detailed composition of the specific land types has not been ground-truthed.

A summary of the dominant soil characteristics of the land type is given in Table 10 below. The distribution of soils with high, medium and low agricultural potential within each land type is also given, with the dominant class shown in **bold type**.

The soils are virtually all shallow to very shallow (<500 mm), usually sandy and calcareous, overlying either rock or cemented hardpan calcrete. Some rock outcrops occur in places in the landscape.

The occurrence and distribution of the land types is shown in Figure 20.

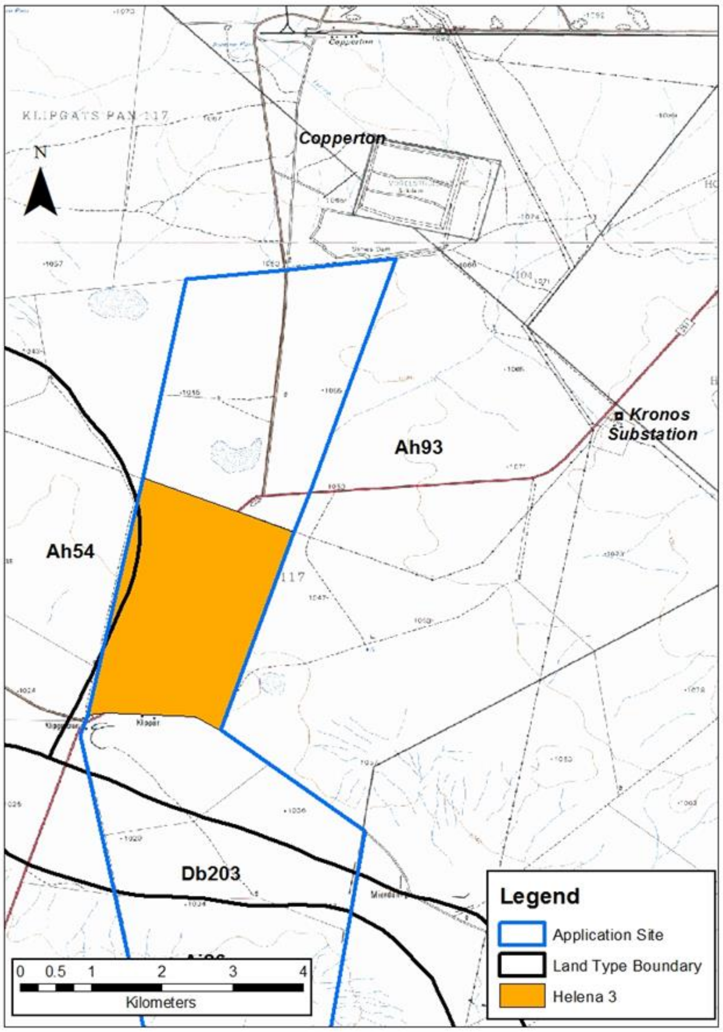

Figure 20: The occurrence and distribution of land types

A summary of the dominant soil characteristics is given in Table 10 below.

Table 10: Land types occurring (with soils in order of dominance)

Land Type	Depth (mm)	Dominant soils	Percent of land type	Characteristics	Agric. Potential* (%)
Ah54	300-1200	Clovelly 43/44/44/45/46	69%	Yellow-brown, sandy/loamy soils on rock or hardpan calcrete	300-1200
	300-1200	Hutton 36/43/44/46	10%	Red, sandy/loamy soils on rock or hardpan calcrete	300-1200
	75-250	Glenrosa 23/24/26/27	9%	Brown, sandy topsoils, on rock or hardpan calcrete	75-250

Ah93	20-100	Mispah 22/ Glenrosa 23	25%	Brown, sandy topsoils, on hardpan calcrete	High:0.0
	100-250	Clovelly 43	24%	Yellow-brown, sandy soils on rock or hardpan calcrete	Mod: 0.0
	100-500	Hutton 33/43	21%	Red, sandy soils on rock or hardpan calcrete	Low: 100.0

*Note: Agricultural Potential refers to soil characteristics only, without potentially restricting climatic factors

6.10 Visual

The Visual Assessment was conducted by SiVEST is included in Appendix 6E. The findings are presented below.

6.10.1 Visual baseline

The flat terrain that occurs within the immediate vicinity of application site results in generally wide-ranging vistas throughout the study area. The only exception to this generally flat topography is the range of mountains located to the north-west of the site and the Doringberge which are both located beyond the visual assessment zone. As such, there would be very little topographical shielding to lessen the impact of the PV energy facility from locally-occurring receptor locations.

The prevailing land use in the wider study area is classified as undeveloped low shrubland, with livestock rearing of sheep occurring at low densities. Built form is limited to isolated farmsteads, gravel access roads, ancillary farm buildings, telephone lines, windmills, fences, the remnants of old workers' dwellings and derelict mining infrastructure including a mine dump and slimes dam.

A high voltage 400kV power line also bisects the application site and the tall steel structures that make up Kronos Substation are visible from the R357 as one approaches the site from the north-east and from the development site when looking in an easterly direction. In addition, the construction works that are currently underway for Mulilo's Prieska solar PV energy facility on the adjacent farm are also visible within study area. Once constructed, this solar PV energy facility and its associated infrastructure, will be highly visible.

The closest built-up areas include the small mining town of Copperton, which is located outside the visual assessment zone approximately 8km north of the site, and the old Prieska Copper Mine which was closed in 1996. Within this part of the study area, a greater human influence is visible in the form of mining infrastructure and electricity transmission infrastructure. Directly north of the application site, the infrastructure associated with the now-defunct mine still exists, with the headgear, as well as an old slimes dams being prominent landmarks. Further north, degraded land and some urban-built up form are located directly adjacent to the old Prieska Copper Mine.

The natural short vegetation cover will offer no visual screening. Tall exotic trees may effectively screen the proposed development from farmhouses, where these trees occur in close proximity to the farmhouse and are located directly in the way of views toward the development. The general lack of human habitation and associated human infrastructure, has an obvious impact on the sense of place and thus giving the area a largely natural, rural feel. Only in areas further north will the landscape character appear more industrial and transformed.

6.10.2 Visual Character

Most of the study area is considered to have a rural or pastoral character as a result of the limited human habitation and associated human infrastructural footprint present within the area. The nature of the predominant land use (sheep farming) has retained the natural vegetation and natural appearance of the landscape. Built infrastructure within the study area is limited to isolated farmhouses, gravel access roads, farm boundary fences, several windmills, a high voltage power line which traverse the application site and the Eskom Kronos Substation. The infrastructure associated with the Copper Mine is unlikely to change the visual character of the study area as the relic mine has been non-functional for a number of years, and the transformation of the area around the mine is extremely localised.

The relatively low density of human transformation throughout the surrounding area is an important component contributing to the largely pastoral visual character of the study area. This is important in the context of potential visual impacts associated with the proposed development of a PV energy facility as introducing this type of development could be considered to be a degrading factor in this context.

It should however be noted that, other than Mulilo's Prieska energy facility, several other solar and wind energy facilities are being proposed within relatively close proximity to the proposed development. These facilities and their associated infrastructure, typically consist of very large structures which are highly visible. As such, these facilities will significantly alter the visual character and baseline in the study area once constructed and make it appear to have a more industrial-type visual character.

6.10.3 Cultural, historical and Scenic Value

The greater area surrounding the proposed development site is an important component when assessing visual character and scenic value. The area can be considered to be typical of a Karoo or "platteland" landscape that would characteristically be encountered across the high-lying dry western and central interior of South Africa. Much of South Africa's dry Karoo interior consists of wide open, uninhabited spaces sparsely punctuated by widely scattered farmsteads and small towns. Although the Karoo may be seen as a dull, lifeless part of the country, in the last couple of decades this has been changing, with the launching of tourism routes within the Karoo, and the promotion of tourism in this little visited, but large part of South Africa. In a context of increasing urbanisation in South Africa's major centres, the Karoo is being marketed as an undisturbed getaway, especially as a stop on a longer journey from the northern parts of South Africa to the Western and Eastern Cape coasts. Examples of this may be found in the relatively recently published "Getaway Guide to Karoo, Namaqualand and Kalahari" (Moseley and Naude-Moseley, 2008). The exposure of the Karoo in the national press during 2011, as part of the debate around the potential for fracking (hydraulic fracturing) mining activities, has brought the natural resources, land use and lifestyle of the Karoo into sharp focus. Many potential objectors stress the need to preserve the environment of the Karoo, as well as preserve the 'Karoo Way of Life', i.e. the stock farming practices which are highly dependent on the use of abstracted ground water (e.g. refer to the Treasure Karoo Action Group website http://treasurethekaroo.co.za/).

Typical Karoo landscape can also be considered a valuable 'cultural landscape' in the South African context. Although the cultural landscape concept is relatively new, it is becoming an increasingly important concept in terms of the preservation and management of rural and urban settings across the world (Breedlove, 2002).

The typical Karoo landscape consisting of wide open plains, and isolated relief, interspersed with isolated farmsteads, windmills and stock holding pens, is an important part of the cultural matrix of the South African environment. The Karoo farmstead is also a representation of how the harsh arid nature of the environment in this part of the country has shaped the predominant land use and economic activity practiced in the area, as well as the patterns of human habitation and interaction. The presence of small Karoo towns, such as Prieska, engulfed by an otherwise rural environment, form an integral part of the wider Karoo landscape. As such, the Karoo landscape as it exists today has value as a cultural landscape in the South African context. In the context of the types of cultural landscape listed above, the Karoo cultural landscape would fall into the second category, that of an organically evolved, "continuing" landscape.

The study area, as visible to the viewer, represents a typical Karoo cultural landscape. This is important in the context of potential visual impacts associated with the proposed development of a PV energy facility as introducing this type of development could be considered to be a degrading factor in the context of the natural Karoo character of the study area.

6.10.4 Sensitive Visual Receptor Locations

Due to the limited human settlement within the immediate vicinity of the site, it was confirmed during the EIA Phase site visit, that very few scattered farmsteads / homesteads which are used to house the local farmers as well as their farm workers were identified within the study area. These dwellings are regarded as potentially sensitive visual receptors as they are located within a mostly rural setting and the proposed development will likely alter natural vistas experienced from these dwellings. The degree of visual impact experienced will vary from one inhabitant to another, as it is largely based on the viewer's perception. Factors influencing the degree of visual impact experienced by the viewer include the following:

- Value placed by the viewer on the natural scenic characteristics of the area.
- The viewer's sentiments toward the proposed structures. These may be positive (a symbol of progression toward a less polluted future) or negative (foreign objects degrading the natural landscape).

- Degree to which the viewer will accept a change in the typical Karoo character of the surrounding area.

Table 11 below provides details of the potentially sensitive visual receptor locations that were identified within the study area.

Table 11: Visual receptor locations potentially sensitive to the proposed PV energy facility

Name	Distance from the proposed PV development area or associated infrastructure	Visual Impact Zone
*Klippan Farmstead	Approximately 50m	Very high
Klipgat pan Farmstead	Approximately 340m	Very high
Mierdam Farmstead	Approximately 3.3km	Low
Uitspan pan Farmstead	Approximately 3.8km	Low

**Klippan Farmstead is located within the proposed application site. It is assumed that the occupants would have a vested interest in the development and would therefore not perceive the proposed PV energy facility in a negative light. During the EIA phase fieldwork it was verified that the owner of Klippan Farm supports the proposed development.*

In many cases, roads, along which people travel, are considered as sensitive receptors. The closest road to the application site is the R357 gravel road that traverses directly through the proposed PV application site and power line corridor alternatives. This road is not considered to be sensitive receptor road. It is used almost exclusively as a local access road, with very little use for any other purposes. As described above the area is not associated with any particular scenic value or any other tourism use. In addition the R357 passes close to the now disused Copperton Mine and associated slimes dam, as well as Kronos Substation. Thus the area around the development site traversed by this road can be considered to be visually 'degraded' by a prevalence of large human infrastructure, and is highly unlikely to be associated with any visual sensitivity.

The potentially sensitive visual receptor locations in relation to the zones of visual impact are indicted in Figure 21 below.

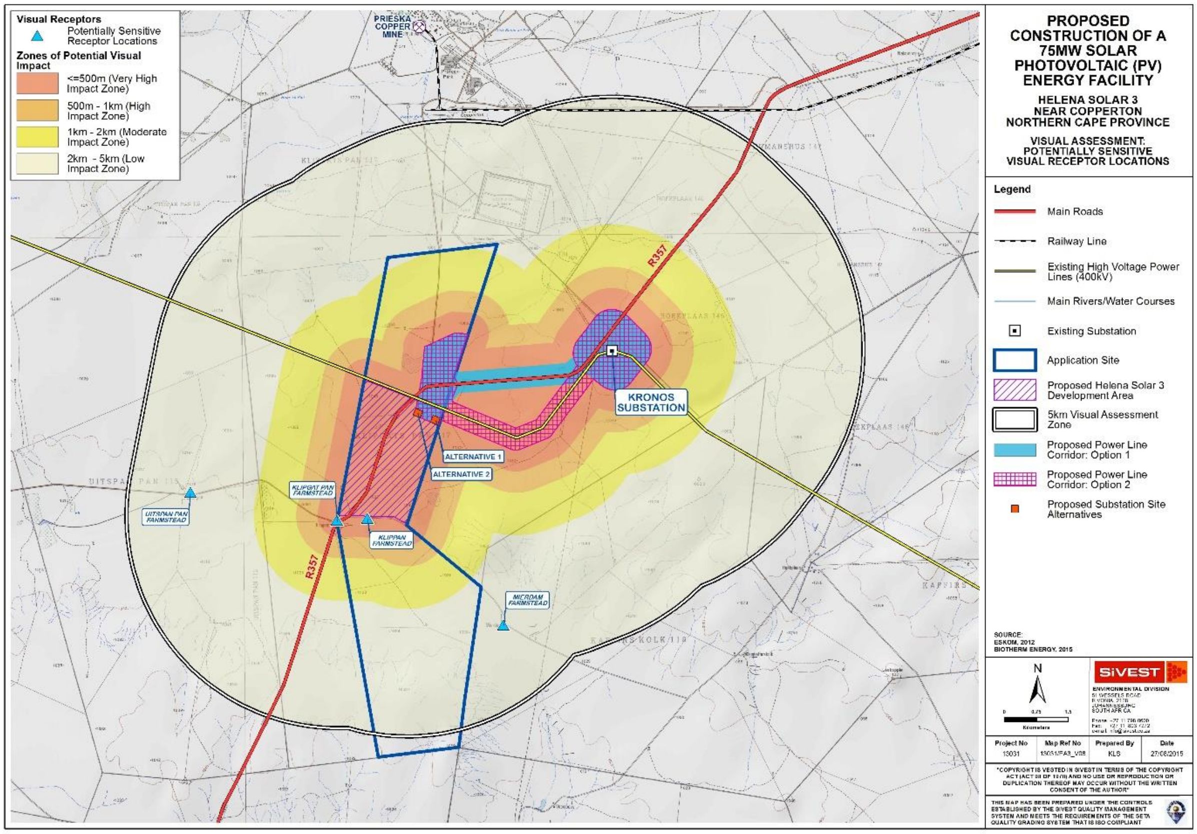

Figure 21: Visually sensitive receptors within the study area

6.11 Heritage

The Heritage Assessment was conducted by Wouter Fourie from PGS and is included in Appendix 6F. As part of the Heritage Assessment a palaeontological desktop study was conducted by Gideon Groenewald of PGS. The environmental baseline from a heritage perspective is presented below.

The examination of heritage databases, historical data and cartographic resources represents a critical additional tool for locating and identifying heritage resources and in determining the historical and cultural context of the study area. Therefore an Internet literature search was conducted and relevant archaeological and historical texts were also consulted. Relevant topographic maps and satellite imagery were studied.

6.11.1 Previous Studies

Researching the SAHRIS online database (http://www.sahra.org.za/sahris), it was determined that a number of other archaeological or historical studies have been performed within the wider vicinity of the study area. Previous studies listed for the area in the APM Report Mapping Project included a number of surveys within the area listed in chronological order below:

VAN RYNEVELD, K. 2006. Phase 1 Archaeological Impact Assessment - Vogelstruisbult 104, Prieska District, Northern Cape, South Africa. National Museum Bloemfontein

KAPLAN, J.M. 2010. Archaeological Scoping Study and Impact assessment of a proposed photovoltaic power generation facility in Copperton Northern Cape. Agency for Cultural Resource Management

KAPLAN, J.M. & WILTSHIRE, N. 2011. Archaeological Impact Assessment of a proposed wind energy facility, power line and landing strip in Copperton, Siyathemba municipality, Northern Cape. Agency for Cultural Resource Management

ATWELL, M. 2011. Heritage Assessment Proposed Wind Energy Facility and Related Infrastructure, Struisbult: (Farm 103, Portions 4 and 7), Copperton, Prieska, Atwell & Associates

ORTON, JAYSON. 2012a. Heritage Impact assessment for a proposed photovoltaic energy plant on the farm Klipgats Pan near Copperton, Northern Cape. Archaeology Contracts Office
Department of Archaeology. University of Cape Town

ORTON, JAYSON. 2012b. Heritage Impact Assessment for a proposed photovoltaic energy plant on the farm Hoekplaas near Copperton, Northern Cape. Archaeology Contracts Office
Department of Archaeology. University of Cape Town

ORTON, J & WEBLEY, L. 2013. Heritage Impact Assessment for Multiple Proposed Solar Energy Facilities on the Remainder of Farm Klipgats Pan 117, Copperton, Northern Cape

ORTON, J. 2014. Archaeological Mitigation of Later Stone Age Sites on the Remainder of Portion 4 of Klipgats Pan 117, Prieska Magisterial District, Northern Cape. ASHA Consulting (Pty) Ltd

Van der Walt, Jaco. 2012. Archaeological Impact Assessment Report for the proposed Garob Wind Energy Facility Project, located close to Copperton in the Northern Cape. Heritage Contracts and Archaeological Consulting CC (HCAC)

FOURIE, W. 2012. Heritage Impact Assessment for the proposed Eskom Cuprum to Kronos Double Circuit 132kv Power line and Associated Infrastructure, Prieska, Northern Cape.

ALMOND, J.E. 2011. Palaeontological Specialist Assessment: Combined Desktop & Field Assessment Study. Proposed Photovoltaic Energy Plant on Farm Klipgats Pan (Portion 4 of Farm 117) near Copperton, Northern Cape Province

6.11.2 Palaeontology

The following map (Figure 22) is an extract from the palaeontological desktop study completed by Almond (2012) for the proposed solar project on the farm Klipgatspan, bordering to the study area. The map indicates the main geological units as:

The main geological units mapped within the PV4 study region are:

1. Precambrian (Mid Proterozoic / Mokolian) basement rocks (igneous / metamorphic):
   Reddish-brown (Mg) = granitic and associated intrusive rocks
2. Late Carboniferous / Early Permian Karoo Supergroup sediments:
   Grey (C-Pd) = Mbizane Formation (Dwyka Group)
3. Early Jurassic dolerite intrusions
   Pink (Jd) = Karoo Dolerite Suite
4. Cretaceous kimberlite intrusions
   Black line (Kk) = kimberlite dykes (not all mapped)
5. Late Caenozoic (Quaternary to Recent) superficial deposits:
   Pale yellow with flying bird symbol = Quaternary to Recent alluvium, pan sediments
   (N.B. calcrete hardpan extensively present in the subsurface and superficial soils gravels are not mapped at this scale)

Almond (2012), indicated that the, "*poorly-exposed upper Dwyka Group bedrocks in the Klipgats Pan study area do not contain rich trace fossil assemblages, petrified wood or other fossil material, and are therefore of low palaeontological sensitivity. The only fossils recorded from the Dwyka succession here are ice-transported erratic boulders of Precambrian limestone or dolomite that contain small stromatolites (microbial mounds or columns). The study area is largely mantled by Pleistocene to Recent superficial sediments (soils, alluvium, calcretes, gravels etc) that are likewise generally of low palaeontological sensitivity*."

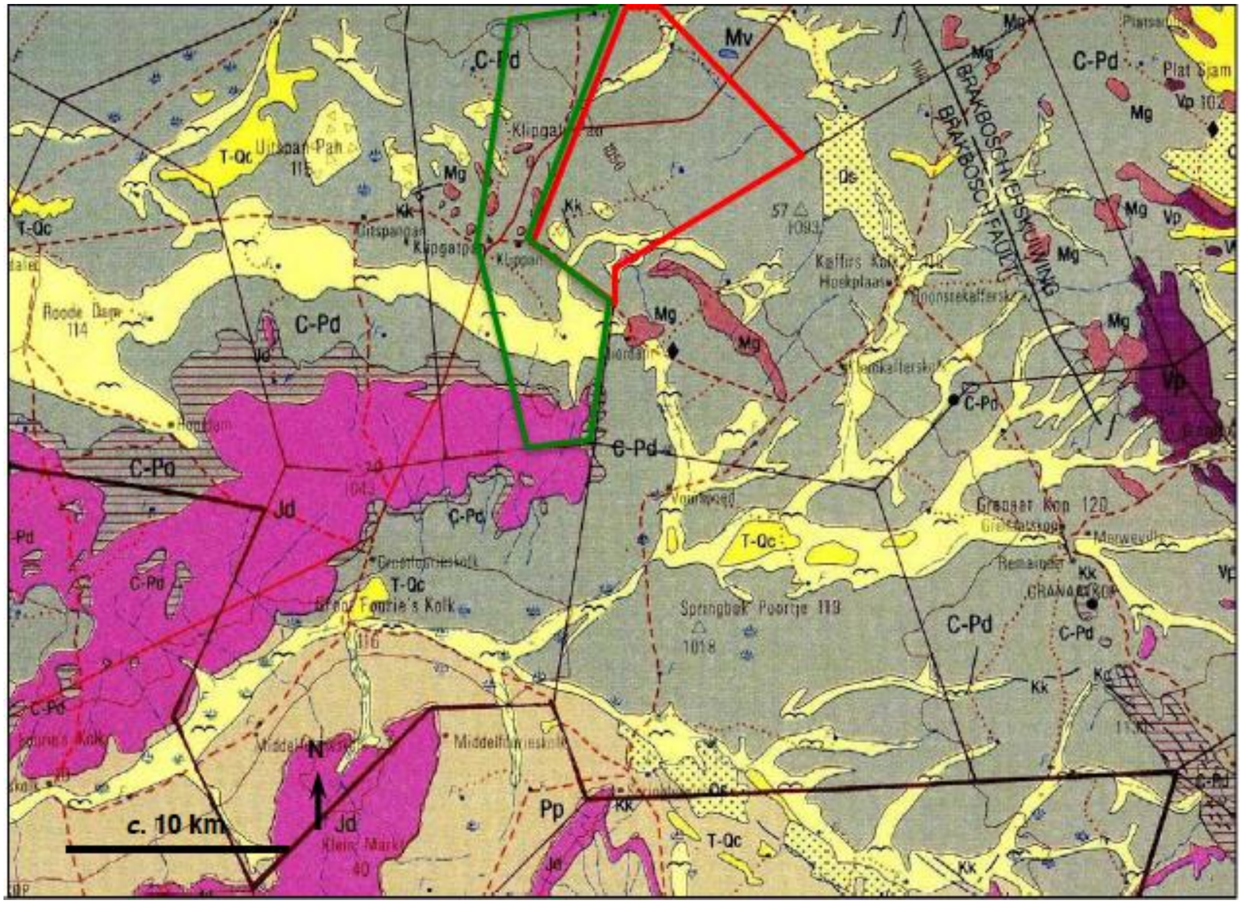

Figure 22: 250 000 geology sheet 3022 Britstown (Council for Geoscience, Pretoria). The Outline of the current study in green

6.11.3 Archaeology

Most archaeological material in the Northern Cape is found near water sources such as rivers, pans and springs, as well as on hills and in rock shelters. Sites usually comprise of open sites where the majority of evidence of human occupation is scatters of stone tools (Parsons 2003). Evaluation of the alignment has identified possible sensitive areas.

The areas marked in blue and red (Figure 25) shows drainage lines and pans in the proposed development areas.

Since Sept 2011 a large number of Heritage and Archaeological Impact Assessments were completed in the vicinity of the proposed development area (Figure 25). Most notably the work of Orton (2011, 2012 and 2013), Kaplan (2010) and Kaplan and Wiltshire (2011) and Van der Walt (2012), has confirmed the statement by Parsons (2003), as noted earlier.

Figure 23: Early Stone Age stone tools found close to Kronos substation, just east of the study area

Orton (2012) notes that literature has shown that the Bushmanland area is littered by low density lithic scatters, with well weathered Early (ESA) and Middle Stone Age (MSA) artefacts dominating the assemblages. Orton's (2012 and 2013) and Fourie's (2012) work on the Klipgats Pan and Hoekplaas, that was done in the closest proximity to the study area has produced numerous find spots as well as clusters of site located on elevated terraces overlooking pan-like areas (identified as the drainage area as indicated in Figure 25**)**, noted by Orton as being of LSA origin.

Figure 24: Close-up view of quartzite flakes and debitage at Kr_Cu/2012/003 (Debitage and lithics indicate by dots) a site situated some 500 meters to the east of the study area (Fourie, 2013)

Kaplan and Wiltshire's (2011) work to the north of the study area has confirmed the presence of Stone Age Sites with a high local significance rating with the sites at Modderpan and Saaipan covering ESA, MAS and LSA finds. A number of knapping occurrences and find spots were also made during the fieldwork.

6.11.4 Historical structures and history

Some structures (green areas in Figure 25) identified during map analysis was investigated during the fieldwork and found to be watering holes for livestock and of no significance.

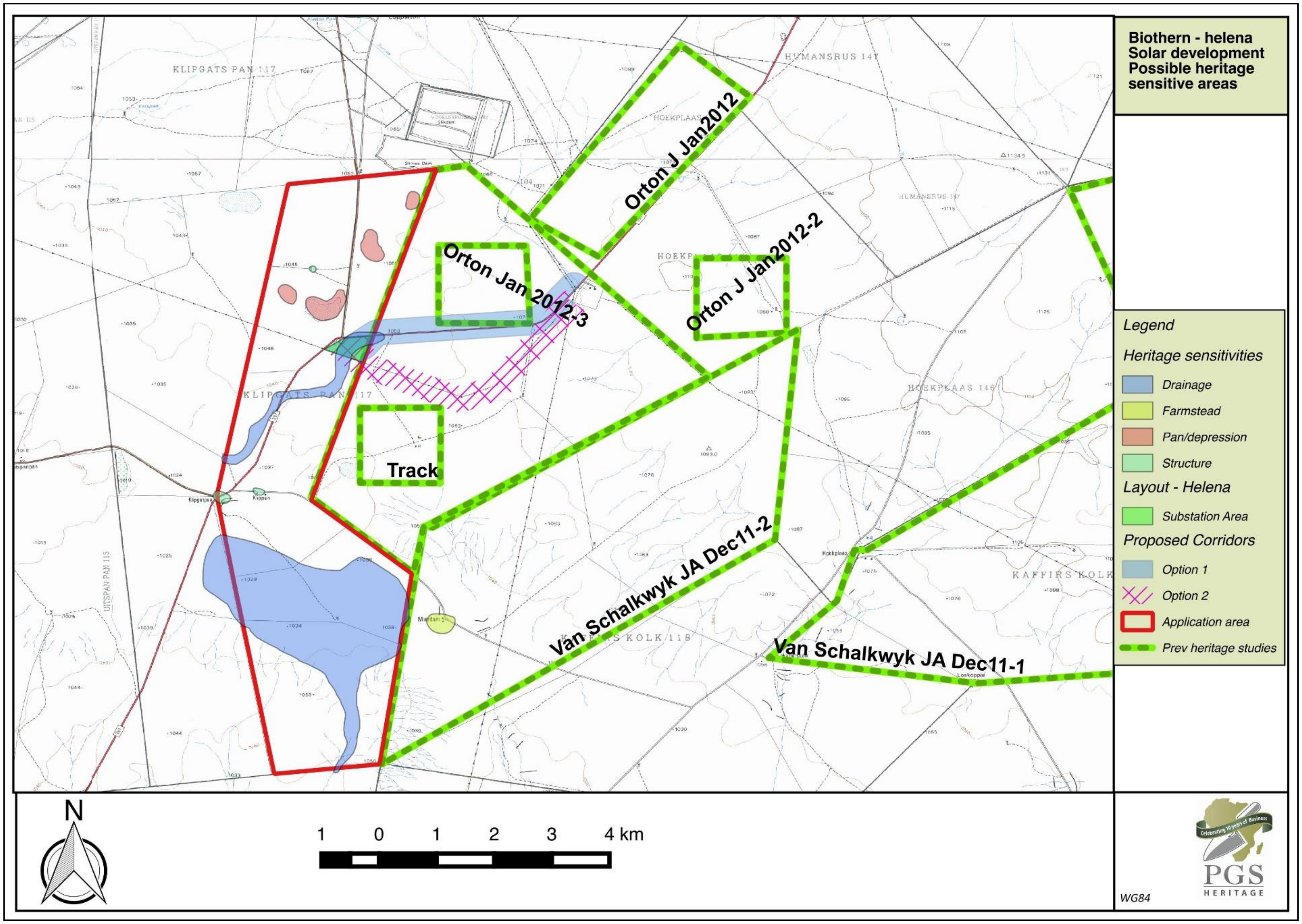

Figure 25 – Possible heritage sensitive areas

6.11.5 Possible Finds

Evaluation of aerial photography has indicated the following area that may be sensitive from an archaeological perspective (Figure 25). The analysis of the studies conducted in the area assisted in the development of the following landform type to heritage find matrix in Table 12.

Table 12: Landform to heritage matrix

LAND FROM TYPE	HERITAGE TYPE
Crest and foot hill	LSA and MSA scatters
Crest of small hills	Small LSA sites – scatters of stone artefacts, ostrich eggshell, pottery and beads
Pans	Dense LSA sites
Dunes	Dense LSA sites
Outcrops	Occupation sites dating to LSA, MSA and ESA
Farmsteads	Historical archaeological material

To be able to compile a heritage management plan to be incorporated into the Environmental Management Plan the following further work will be required for the EIA:

- Archaeological walk through of the areas where the project will be impacting;
- Palaeontological desktop assessment of the area will not be required based on the findings of other palaeontological studies (Almond, 2011) in the same area.

6.12 Socio-economic Environment

The Social Assessment was conducted by Elena Broughton from Urban Econ Development Economists and is included in Appendix 6G. The environmental baseline from a socio-economic perspective is presented below.

6.12.1 Study Area Composition

- Spatial context and regional linkages

The proposed Copperton Solar PV facility is located in the Siyathemba Local Municipality, which is one of the eight local municipalities making up the Pixley ka Seme District Municipality. The other seven local municipalities are Thembelihle Local Municipality, Emthanjeni Local Municipality, Siyancuma Local Municipality, Umsobomvu Local Municipality, Ubuntu Local Municipality, Kareeberg Local Municipality and Renosterberg Local Municipality.

The Northern Cape Province is geographically the largest province in South Africa covering an area of 372 889 km^2, which constitutes approximately 30% of the country's total area. Despite having the largest surface area, the Northern Cape Province is the least populated of all nine provinces. According to Census 2011, the province's population was 1 145 859 or 2.2% of the national population. The province is bordered by Namibia and Botswana in the north, while domestically, the North West Province borders it in the north-east, the Free State Province in the east, the Eastern Cape Province in the south-east and the Western Cape Province to the south and south-west. The Northern Cape consists of five districts, namely Frances Baard, Pixley ka Seme, Namakwa, ZF Mgcawu (previously known as Siyanda) and John Taolo Gaetsewe. Pixley ka Seme DM which lies in the south-east of the Northern Cape Province is geographically the second largest of the five district municipalities and covers a surface area of 103 410 km^2. It is bordered by the Free State in the east, ZF Mgcawu District in the north, the Eastern Cape Province to the south, and Namakwa District in the west. The total population of the district, according to the 2011 Census, was approximately 186 349; making it the municipality with the second lowest population in the Province.

The Siyathemba LM is located within the central eastern parts of the Northern Cape Province and is traversed from the east to west by the Orange River, the country's largest river. The municipality covers a geographic area of 14 725 km^2. Prieska functions as the administrative seat of the local municipality. Other settlements include Marydale, Nierkerkshoop and Copperton.

Spatially, Siyathemba is very distant from South Africa's largest consumer markets. The area is traversed by the R357 which links the site to Prieska. Prieska has easy access to the main railway line to Namibia, good tarred road connections to Upington, Kimberly and De Aar. It is located some 182 km from De Aar (administrative seat of the Pixley ka Seme DM) and 236 km from Kimberley.

- Towns and Settlements

Copperton was once a populated town, providing accommodation for the mine workers and their families. It was then sold to a private owner after the closing of the Copperton Mine and is currently on a long-term lease by the Request Trust. Some of the houses were initially demolished but after the lease agreement was signed with the Request Trust, an agreement was reached that the rest of the houses could be retained (Siyathemba Local Municipality, 2014). According to the Census 2011 results, the population of Copperton was 55 with 33 households. A few of these houses are used by Denel SOC Ltd, which operates a missile testing centre in the area (Wikipedia, 2014).

The site is located in a rural area and as such, the population density is very low, with major towns' located kilometres away. The closest major town to Copperton is Prieska, which is approximately 60 km away in the same local municipality. Prieska is home to 14 248 people LM (Stats SA, 2014). Marydale, situated 60km north-west of Copperton, is also a rural service centre near the site also located in the Siyathemba LM. Nierkerkshoop, another rural service centre, is approximately 80 km north-east.

Figure 26: Settlements and towns near the project site

Siyathemba LM has a population of 21 593 people, comprising of 5 830 households. The most dominant population group is coloured. This group represents 80% of the total population in the municipal area; other groups are black (12%) and white (8%). Education levels in the municipality are low, with approximately 1 500 people out of the adult population having no schooling all, while only 2 200 people have completed high school and 720 people have a higher education qualification.

In 2011, the unemployment rate in Siyathemba LM was 24.7%. The main employment industry is farming, followed by mining. The level of unemployment in the area is low with 7.5% having no income at all, and a further 58.6% earning less than R3 200 per month. The land uses in the area are mainly agriculture, consisting mostly of sheep farming and production of wheat, maize, lucerne, cotton, beans and peanuts.

Prieska is the administrative seat of the Siyathemba Local Municipality and is located on the Southern Bank of the Orange River, approximately 50km northeast of the proposed site. While relatively isolated, Prieska has good access to the main railway line to Namibia, good tarred road connections to Upington, Kimberley and De Aar, and two landing strips for light aircrafts. The Prieska area is also known for its high quality semi-precious stones, specifically tiger's eye.

- Resources and land capability

Generally, the area does not have any significant mineral deposits. To the south of Prieska, on the farm Doornfontein, a medium-sized mineral deposit of Phosphate can be found. Various small mineral deposits can be found near Niekerkshoop. These include Tiger's-eye and Crocidolite (Asbestos). Small deposits of Alluvial Diamonds can be found in the Orange River. Other small mineral deposits within the Municipal boundary include Salt, Gypsum, Iron and Uranium (Siyathemba Local Municipality, 2012). The Orange River runs through the Municipality and provides ideal conditions for irrigation farming in Siyathemba, especially the cultivation of grains and vegetables.

The town of Prieska is located on the south bank of the Orange River at the foot of the Doringberg. It was originally named Prieskap, a Khoisan word meaning, “lace of the lost she-goat”. The following are the main Tourism attractions in the region (Siyathemba Local Municipality, 2014):

- Die Bos Nature Reserve
- British Fort
- Green Valley Nuts
- The Oranjezicht and Keikamspoort Hiking Trails
- Khoisan Rock Art
- Memorial Garden
- Prieska Museum
- Ria Huysamen Aloe Garden Schumann Rock Collection
- Wonderdraai Island
- Land-uses within the affected zone of influence

The surrounding land uses are mainly agriculture, consisting mostly of sheep grazing. The main livestock farming in the region include cattle, sheep and goat farming (Siyathemba Local Municipality, 2014). The interviews with the farm owners within the affected zone of influence corroborates the fact that the area is mainly used for sheep farming. Land-use information for some the farms where various components of the project will be established is discussed in detail in section 8.7 and in the socio-economic specialist report.

6.12.2 Demographic Profile and Income Levels

The population of any geographical area is the cornerstone of the development process, as it affects the economic growth through the provision of labour and entrepreneurial skills, and determines the demand for the production output. Examining population dynamics is essential in gaining an accurate perspective of those who are likely to be affected by any prospective development or project.

The Siyathemba LM is home to approximately 21 593 people, with a total of 5 830 households (Stats SA). The population has increased by 14.9% from 18 376 in 2001. A large portion (87.2%) of the population in the LM resides in urban areas, while the rest (12.8%) lives in on farms. Both urban to urban migration, and rural to urban migration are relevant in the Pixley ka Seme region, including the Siyathemba LM. Rural to urban migration is perceived as the dominant migration type at present (Pixley ka Seme District Municipality, 2011). The large proportion of people living in the urban area can be explained by the ease of access to opportunities and services within the larger urban centres, in this case Prieska. The majority (72.2%) of the people in the municipality are Coloured with 18.5% of the population being Black, followed by White 8.4%), and Indians/Asians (0.5%). Afrikaans is the language most spoken in the LM. The municipality's gender ratios are not very skewed, the female population (50.1%) accounts for slightly more of the LM's population compared to the male population (49.9%).

The youth (age 15-34) make up the majority of the people living in the Siyathemba LM with 31.7%, followed by the group between the ages of 35 and 64 years with 31.4%. Considering the working age group that is between the ages of 15 and 64 years, the municipality has a slightly bigger percentage of working age males than females (refer to **Figure 27**). The population in the area is characterised by a high dependency ratio (58.5%) with a total of 36.8% of the population within the ages of 0 to 14 years (30.6%) and over 65 years old (6.2%). According to the district municipality's IDP, the implications of this population structure are a higher demand on the provision of social and physical facilities, like schools, primary health care centres, etc.

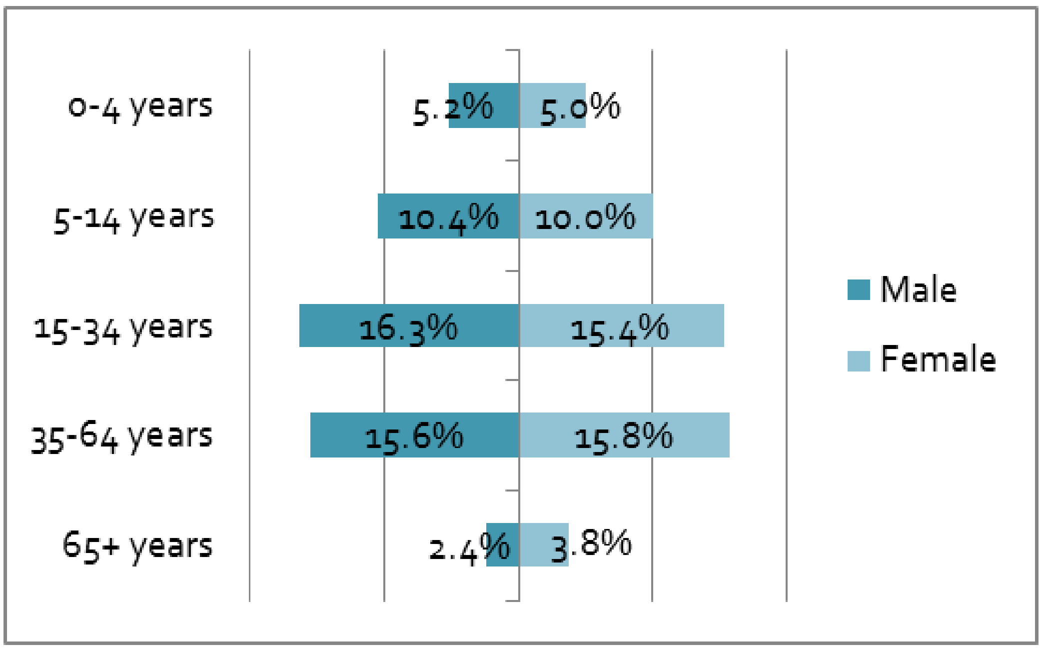

Figure 27: Age and gender profile (Quantec, 2015)

In terms of education levels in the LM, 11.5% of the adult population (over 20 years of age) had no education at all, while 64% have primary or secondary education (Stats SA, 2015).Those with higher educational qualifications accounted for 5.5% of the population. These figures indicate an increase in all categories since 2001, except for the no schooling, some primary, and some secondary categories. In general, there has been an improvement in the educational qualifications of the labour force in the local municipality. The no schooling category decreased by 10%, indicating a higher percentage of people attending school. While the share of people with no schooling at district level is 14.1%, the percentage of people with no schooling is notably lower at provincial (11.1%) and LM (11.5%) level. Additionally, the number of people who have completed matric in Siyathemba is 17.3%, which is lower than the 20% and 22.1% at district and provincial levels, respectively.

The average monthly household income in the Siyathemba LM was R6 858 in 2014 prices. This was less than the national, provincial and district levels which had average household incomes of R9 743, R8 116, and R7 030. Overall, approximately two thirds of the population in the Siyathemba LM earns up to R3 400 a month; this is larger than the same group at district and provincial level. According to the Pixley ka Seme IDP, the cut-off monthly household income for indigence in the Siyathemba LM is R1 500. This means those households who, due to a number of socio-economic factors are unable to afford basic services such as water, basic sanitation, basic energy, health care, housing, food and clothing. From income data obtained in the 2011 Census, approximately 39.4% of the households would qualify as indigent in the local municipality.

6.12.3 Structure of the Economy

The structure of the economy and the composition of its employment provide valuable insight into the dependency of an area on specific sectors and its sensitivity to fluctuations of global and regional markets. Knowledge of the structure and the size of each sector are also important for the economic impact results' interpretation, as it allows the assessment of the extent to which the proposed activity would change the economy, its structure, and trends of specific sectors.

The Northern Cape Province contributes the least percentage (2.3%) to the country's Gross domestic Product (GDP). However, although the Northern Cape Province has the smallest economy of the nine provinces, Gross Domestic Product of the Region (GDPR) per capita is higher than national average which is R59 917 and R58 533, respectively. The Siyathemba LM economy was valued at R 796 million in current prices. The LM contributed 10.9% to the economy of the Pixley ka Seme District and made a contribution of 1.2% to the province's economy. Over a period of ten years (2003-2013), the municipality's economy grew at a Compounded Average Growth Rate (CAGR) of 2.4% per year. This was slightly higher than the district and provincial average growth rates of 1.8% and 2.3%, respectively.

In terms of economic activities, the economy of the Northern Cape Province depends heavily on the primary sectors of the economy (agriculture and mining) which made up 36.5% of GDP-R in 2013. The largest sector is mining, which has been fluctuating between periods of growth and decline in contribution to the GDP-R. Agriculture, on the other hand has declined in contribution from 8.7% in 2002 to 5.4% in 2013. A worrying characteristic of the Northern Cape Province is the limited amount of processing of the primary commodity output in agriculture and mining. This is evident in the fact that the manufacturing sector contributes only 2.4% towards GDP-R. All industries in the secondary sector have shown very little growth if any. The tertiary sector was the largest contributor to the economy of the Northern Cape Province, making up 56.8% of GDP-R. General government services (15.2%) were the second largest industry contributors after mining (31.2%).

Contrary to the province's economy, mining and quarrying continues to be a small contributor to the economy of the LM, making a meagre 3.1% contribution compared to the province's 31.2%. The mining sector historically played a major role in the local economy, with asbestos and copper mining the key activities. Currently, mining activities are mainly related to alluvial diamond mining activities along the Orange River. The closure of the asbestos mines as well as the Copperton mine, has had a major lasting negative impact on the Siyathemba LM economy. On the other hand, the agricultural sector makes a significant contribution of 16.7%, making it the second largest single contributor after finance and business services. The most extensively cultivated crops in the municipality are maize, wheat, peanuts, lucerne and table grapes. Stock farming activities are mainly based on sheep and goats. Overall, the economy of Siyathemba LM is a service economy with the tertiary sector contributing 70% to the municipality's GDP-R.

6.12.4 Labour Force and Employment Structure

Employment is the primary means by which individuals who are of working age may earn an income that will enable them to provide for their basic needs and improve their standard of living. As such, employment and unemployment rates are important indicators of socio-economic well-being.

The Census 2011 data indicates that the Siyathemba LM had about 13 656 people in the working-age population. This amounts to 63% of the total population. Of these, 7 113 people were economically active; while roughly 48% of the working age population were not economically active (NEA), that is, persons aged 15–64 years who are neither employed nor unemployed at the time of the survey, including discouraged job seekers . The employed labour in the LM was estimated at 5 356; while the unemployed population was estimated at 1 757, reflecting an unemployment rate of 24.7%. This was lower than the country's unemployment rate of 29.7% and lower than the provincial unemployment rate that was recorded at 27.4%.

In the town of Prieska, 3 094 of the working age population was employed, with 1 212 of them unemployed. This means that 28.1% of the labour force in Prieska was unemployed. On the other hand, 4 672 of the working age population was not economically active. In the smaller towns, the unemployment situation was worse, with unemployment rates 41% and 33.6% in Marydale and Nierkerkshoop, respectively (Stats SA, 2014). The Copperton community is very small and isolated from employment opportunities and amenities.

More than three quarters of the employed individuals in the Siyathemba LM were employed in the formal sector, and only 10.8% were employed in the informal sector. Private households provided for 11.8% of the employment opportunities in the municipality. In Prieska, 74.4% of the employment opportunities were provided by the formal sector and only 8.6% came from the informal sector. In Marydale, 86.5% of the population is employed in the formal sector while only 52.3% of the Nierkerkshoop employment opportunities come from the formal sector. A significant percentage (43.4%) of Nierkerkshoop's employment opportunities come from the informal sector, while the same sector contributes only 7.7% towards employment in Marydale (Stats SA, 2014).

In terms of the structure of employment, the agricultural sector was the most important economic sector not only in the LM but in the district as well. In the Siyathemba LM, this sector contributed 27.8% of the total employment opportunities, while creating 27.1% of employment opportunities in the Pixley ka Seme District. This was followed by personal services and general government. These figures are almost similar to those of the province, but general government is the largest contributor to employment in the Northern Cape Province. Table 13 below indicates the contribution of economic sectors to employment in the district and the LM.

Table 13: Employment by economic sectors in Ehlanzeni DM and Siyathemba LM

Economic Sector	Pixley ka Seme DM Employment		Siyathemba LM Employment	
	Employment	%	Employment	%
Agriculture	12 587	27.1%	1 637	27.8%
Mining and quarrying	342	0.7%	32	0.6%
Manufacturing	1 354	2.9%	219	3.7%
Electricity, gas and water	358	0.8%	24	0.4%
Construction	2 813	6.1%	596	10.1%
Trade	6 491	14.0%	774	13.1%
Transport and communication	839	1.8%	50	0.8%
Finance and business services	5 357	11.6%	751	12.8%
Personal services	8 489	18.3%	921	15.6%
General government	7 756	16.7%	888	15.1%
TOTAL	**46 387**	**100%**	**22 3232**	**100%**

Source: (Quantec, 2015)

6.12.5 Access to Housing and Basic Services

Access to shelter, water, electricity, sanitation, and other services are indicators that assist to determine the standard of living of the people in the area under investigation. Infrastructure and the state of local infrastructure are other indicators to contemplate when considering living standards. The availability of social and economic infrastructure including roads, educational facilities, and health facilities, further indicates the nature of the study area that is valuable in developing a complete profile of the circumstances in which communities are living. These measurements create a baseline against; which the potential impacts of the proposed project can be assessed.

- **Housing:** Approximately 85% of the households in the Siyathemba LM reside in formal housing in the form of a house or other brick structures on a separate stand or yard. 14.3% of the households live in informal dwellings. Furthermore, 0.7% of the municipality's households live in traditional dwellings. These numbers are similar to those of Prieska with about 85.3% households living in formal dwellings, while 14.5% live in informal structures.
- **Access to water**: In terms of access to piped water, 88.7% of the households in the municipality have access to piped water either inside the dwelling or in the yard. The picture improves in Prieska, where 94.9% of the households have access to piped water inside their dwellings or yard. Only 1.2% of the households in the town do not have access to piped water at all. In terms of the supply, the bulk of the water in the LM is supplied by the municipality or other service providers. In Prieska, close to 97% of the households' water is supplied by the municipality or other water service

providers, while in the non-urban areas of the municipality only 1.1% of water is supplied by bulk water infrastructure connections. Two thirds of the households in non-urban areas used boreholes (Stats SA, 2014). The district's IDP note that water provision and availability is one of the issues that will have to be addressed in order to improve the economic activity in most towns situated within the Pixley ka Seme District Municipal area (Pixley ka Seme District Municipality, 2011).

- **Access to sanitation**: If not properly managed and monitored, sewerage and sanitation are basic needs of communities which can pose serious health and hygiene risks. 71.2% of the households in the Siyathemba LM had access to a flushing toilet while 16.8% of the households used pit latrines. 7.7% of families have no access to toilet facilities and 3.8% is still using the bucket system. According to the Siyathemba LM IDP the municipality has a sanitation backlog of 470 households.
- **Access to electricity:** The indicator "energy for lighting" was used as a proxy for measuring households' access to electricity. The majority of households (86.3%) in the municipality have access to electricity, while 13.7% use alternative forms of energy for lighting; mainly candles (11%).

6.12.6 Social and Recreational Infrastructure

The Siyathemba LM has the following social and recreational infrastructure available:

- Where education facilities are concerned, the municipality has one crèche, 6 primary schools and 3 combined schools, and one secondary school.
- The municipality has five community halls.
- There are four libraries in the municipality.
- Recreational facilities are available in each of the three towns.
- There is a police station in each of the three towns (Marydale, Prieska and Nierkerkshoop)
- There are five health facilities in the municipality; i.e. one hospital, three clinics and a mobile clinic in Prieska. It is indicated that the main challenge is the lack of ambulance services in Nierkerkshoop (Siyathemba Local Municipality, 2014).

7 PUBLIC PARTICIPATION PROCESS

Public participation is the cornerstone of any EIA. The principles of NEMA as well as the EIA Regulations govern the EIA process, including public participation. The Public Participation Process (PPP) for the proposed development has been conducted according to Guideline 4 of the EIA Regulations These include provision of sufficient and transparent information on an ongoing basis to stakeholders to allow them to comment, and ensuring the participation of previously disadvantaged people, women and the youth.

The public participation process is primarily based on two factors; firstly, ongoing interaction with the environmental specialists and the technical teams in order to achieve integration of technical assessment and public participation throughout. Secondly, to obtain the bulk of the issues to be addressed early on in the process, with the latter half of the process designed to provide environmental and technical evaluation of these issues. These findings are presented to stakeholders for verification that their issues have been captured and for further comment.

Input into the public participation process by members of the public and stakeholders can be given at various stages of the EIA process. Registration on the project can take place at any time during the EIA process up until the final EIA report is submitted to DEA. There are however set periods in which comments are required from Interested and / or Affected Parties (I&APs) in order to ensure that these are captured in time for the submission of the various reports. The comment periods during the EIA phase will be implemented according to Guideline 4 of the NEMA (107/1998) and Environmental Impact Assessment Regulations in terms of section 24(5).

The EIA regulations emphasise the importance of public participation. In terms of the EIA regulations, registered interested and/or affected parties –

- may participate in the application process;
- may comment on any written communication submitted to the competent authority by the applicant or environmental consultant;
- must comment within the timeframes as stipulated by the EIA Regulations;
- must send a copy of any comments to the applicant or Environmental Assessment Practitioner (EAP) if the comments were submitted directly to the competent authority; and
- Must disclose any direct business, financial, personal or other interests that the person has in the application being granted or refused.

The following actions were taken upon receiving comments/queries/issues:

- The contact details provided were entered into the project database for use in future notifications.
- Confirmation receipts were sent to those submitting comments.
- Comments were addressed in the Comments & Response Report.

7.1 Overview of the Public Participation Process to date

The public participation process for the EIA phase was initiated on Wednesday the 18th of February 2015 with the issuing of the BID, and by the publication of the EIA process advert in the Gemsbok newspaper on the same day.

Scoping Phase public and focus group meetings were held on the 21st and 22nd of May 2015. The Draft Scoping Report (DSR) was released to the public on Thursday the 28th of May 2015 and the subsequent public comment period ran until Monday the 29th of June 2015. I&APs were notified at the start of the comment period. The Final Scoping Report (FSR) was submitted to the DEA on the 17th of August 2015, and I&APs were notified on the same day. Following the acceptance of the FSR and Plan of Study for EIA, the public was notified of the DEA's decision through the EIA Newsletter which was sent out in November 2015, prior to the DEIAr comment period.

The process that was followed during the Scoping Phase of the project was repeated during the EIA phase. The major difference would be that the public now have an opportunity to comment on the findings of the detailed specialist studies and the final layout of the project.

As part of the letter from the DEA accepting the FSR, it was requested that additional information be included in the DEIAr. Based on this the DEIAr incorporated the requested changes and was submitted to the DEA on the 10 th of December 2015. I&APs were notified that the DEIAr was available for public review on the 9th December 2015. Thereafter, a request for the extension of the EIA timeframes was submitted and received by the DEA on the 10th of June 2016, due to comments received from the SKA during the DEIAr comment period. The DEA accepted the request for extension of the EIA time frames on the 6th of July 2016.

Due to the project, being placed on hold and the extension of the EIA timeframes the FEIAr will be made available for a 21 day comment and review period prior to the submission to the DEA.

On-going consultation with key stakeholders (e.g. provincial, district and local authorities, relevant government departments, local business, affected and adjacent landowners etc.) and identified I&APs will ensure that I&APs are kept informed regarding the EIA phase (the full stakeholder database list is included in Appendix 5F).

7.2 Consultation and Public Involvement

As in the scoping phase, telephonic discussions and focus group meetings will be held with key stakeholders and other relevant I&APs in order to identify key issues, needs and priorities for input into the proposed project. Special attention will be paid to the consultation with possibly affected landowners and communities within the study area to try address their main concerns.

Notifications were sent via email, sms, fax and post on the 9th December 2015 to inform I&APs of the availability of the DEIAr.

Notifications will be sent via email, sms, fax and post to inform I&APs of the availability of the FEIAr as well as the additional 21 day review period.

7.3 Comments Received during the Scoping Phase

All comments and recommendations made by stakeholders and I&APs during the scoping phase and submitted as part of the FSR have been taken into consideration when preparing the DEIAr and FEIAr

Of particular significance are the comments received during the scoping phase from the SKA noting that a based on the distance from the proposed project to the nearest SKA station, the solar energy facility poses a high risk of detrimental impact on the SKA. The SKA project office recommended that further electromagnetic interference (EMI) and radio frequency interference (RFI) detailed studies be conducted as significant mitigation measures would be required to lower the risk of detrimental impact to an acceptable level.

As per the SKA's request an EMI and RFI study were undertaken. The recommended mitigation measures are included in this FEIAr in section 10.1.8, and the both DEIAr and the EMI report were sent to the SKA (Refer to Appendix 11). Further correspondence from the SKA was received on the 17th of December 2015 and is included in this FEIAr. Following these comments, the Applicant engaged with international PV technology suppliers and EMI consultants to identify additional mitigation measures to be implemented.

All other comments received during the scoping phase are addressed and included in Appendix 5E.

7.4 Proof of Notification

Appendix 5 includes all proof of notification to Interested and Affected Parties;

- Proof of process advertisements in the newspapers (Appendix 5C)
- EIA Newsletter (Appendix 5A)
- Correspondence to registered I&APs and key stakeholders (Appendix 5B)

7.5 Focus Group Meetings

Focus Group Meetings (FGMs) are smaller meetings with specific groups or organisations who have similar interests in or concerns about the project.

A FGM took place during the Scoping phase of the proposed project. The Focus Group Meeting (FGM) was held in Copperton with affected landowners on Tuesday the 24th of February 2015. Additional FGMs were also held with the District and Local Municipalities as well as affected landowners on Thursday the 21st of May 2015 and Friday the 22nd of May 2015, respectively.

Table 14: Focus Group Meetings

Venue	Interested Parties	Date	Time
Klipgatspan, Copperton	Affected Landowners	Tuesday 24 February 2015	10h00 - 11h30
SiyaThemba Local Municipality Offices, Prieska	Councillors and Officials – Pixley ka Seme District and SiyaThemba Local Municipalities	Thursday 21 May 2015	12h00 – 13h30
Ietznietz Guest House, Copperton	Affected Landowners	Friday 22 May 2015	09h00 – 11h00

Following all meetings, minutes were compiled and forwarded to all attendees for their review and comment. The primary aim of these meetings was to:

- disseminate information regarding the proposed development to stakeholders
- provide stakeholders with an opportunity to interact with the EIA team and the BioTherm representatives present.
- supply more information regarding the EIA process;
- answer questions regarding the project and the EIA process;
- receive input regarding the public participation process and the proposed development.

These FGMs were deemed acceptable and therefore no FGMs took place during the DEIAr review period.

7.6 Public Meeting

A Public Meeting took place on Thursday evening the 21st of May 2015.

Invitation letters were sent by mail and e-mail to all registered I&APs on the project's database.

The Public Meeting was held in order to provide I&APs with information regarding the proposed development, present the environmental findings (desk-top) and invite I&APs to raise any further comments and/or concerns that they may have.

The Public Meeting was held at the following venue on the following date:

Table 15: Public Meetings/Open Days

Venue	Date	Time
Omega Hall, Alwyn Street, Bonteheuwel, Prieska	Thursday, 21 May 2015	16h30 - 17h30

Draft minutes of this meeting were compiled and forwarded to all attendees and are included in the FEIAr submitted to the Competent Authority.

This public meeting was deemed acceptable and therefore no PMs took place during the DEIAr review period.

7.7 Public review of Environmental Impact Assessment Report

The DEIAr was made available for review at the following venue for a period of 30 calendar days from **Wednesday 9 December 2015 to Wednesday 27 January 2016** (end of business day), excluding public holidays and the December closure period:

Table 16: Venues where the DEIAr will be publically available

Venue	Street Address	Hours	Contact No.
Elizabeth Vermeulen Public Library	Corner of Victoria Street and Steward Street, Prieska	Monday – Fridays 08h45 – 16h45 Saturdays 08h00 – 13h00	053 353 5300/ 053 353 5305

All comments received on this report have been incorporated into the Comments and Response Report, which will be attached to the FEIAr as Appendix 5E.

However, please note due to the project, being placed on hold and the extension of the EIA timeframes the FEIAr will be made available for a 21 day comment and review period prior to the submission to the DEA.

7.8 Authority review of Environmental Impact Assessment Report

Table 17 below includes all the key stakeholders who were e-mailed the DEIAr and FEIAr and sent electronic copies (on CD) of the DEIAr and FEIAr including all appendices. A series of telephone calls will be made during the FEIAr comment period to all stakeholders who did not submit comments, in order to determine if comments would be received from their department, and to provide them with ample opportunity to do so. All feedback and from the stakeholder follow-up will be issued directly to the DEA when the FEIAr is submitted for review.

Table 17: Authorities follow-up consultation

DISTRIBUTION OF THE DEIAr and FEIAr TO ORGANS OF STATE FOR COMMENT					
TITLE	**SURNAME**	**NAME**	**POSITION**	**POSTAL ADDRESS**	**EMAIL ADDRESS**
SIYATHEMBA LOCAL MUNICIPALITY					
Mr	Alexander	JRM	Municipal Manager	PO Box 16 PRIESKA 8940	mm@siyathemba.gov.za
PIXLEY KA SEME DISTRICT MUNICIPALITY					
Mr		Sonwabile	Senior Environmental Officer	Private Bag X1012 DE AAR 7000	
Mr	Madyo	Sindisile	LED Manager	Private Bag X1012 DE AAR 7000	excellentsolutions@live.co.za
DEPARTMENT OF WATER AND SANITATION					
Ms	Makungo	Ester	Environmental Officer	28 Central Road Beaconsfield KIMBERLEY 8301	makungoe@dwa.org.za
NORTHERN CAPE DEPARTMENT OF AGRICULTURE, LAND REFORM & RURAL DEVELOPMENT					
Mr	Steenkamp	Gert		P.O.Box 65 CALVINIA 8190	gsteenkamp@ncpg.gov.za
DEAPARTMENT OF AGRICULTURE, FORESTRY AND FISHERIES					

Northern Cape Department					
Ms	Mans	Jacoline	Chief Forester	Koelenhof 306 Schroder Street UPINGTON, 8800	jacolinema@daff.gov.za
Provincial Department					
Ms	Buthalezi	Thoko	Directorate Land-use & Soil Management	Private Bag X120 PRETORIA 0001	Thokob@nda.agric.za
Ms	Marubini	Mashudu	Assistant Director	Private Bag X120 PRETORIA 0001	mashuduma@daff.gov.za
DEPARTMENT OF MINERAL RESOURCES (DMR)					
Mr	Jasper	Nieuwoudt	Regional Manager	Private bag X14 SPRINGBOK 8240	Jasper.Nieuwoudt@dmr.gov.za
NORTHERN CAPE DEPT OF ENVIRONMENT AND NATURE CONSERVATION					
	Mthombeni	Thulani		Private Bag X86102 KIMBERLEY 8300	tmtho@webmail.co.za
Ms	Ndzumo	Onwabile		90 Long Street, Sasko Building KIMBERLEY 8300	ondyndzumo@gmail.com
DEPT OF SPORT, ARTS & CULTURE: Heritage Resources Unit					
Provincial - Northern Cape Department					
Mr	Timothy	Andrew	Manager: Heritage Resources	PO Box 1930 KIMBERLEY 8300	ratha.timothy@gmail.com
SANRAL - WESTERN REGION					

Mr	Dyers	Shaun	Manager: Statutory Control	Private Bag X19 BELLVILLE 7535	Dyerss@nra.co.za
NORTHERN CAPE DEPARTMENT OF ROADS AND PUBLIC WORKS					
Mr	Steenkamp	Ivan	Deputy Director	PO Box 3132 Kimberley 8300	isteenkamp@ncpg.gov.za ivandrea@mweb.co.za
SAHRA: HEAD OFFICE					
Ms	Lavin	Jenna	Heritage Officer: Northern Cape	PO Box 4637 CAPE TOWN 8000	jlavin@sahra.org.za
ESKOM					
Mr	Geeringh	John	Chief Planner	PO Box 1091 JOHANNESBURG 2000	GeerinJH@eskom.co.za
SQUARE KILOMETRE ARRAY					
Dr	Tiplady	Adriaan	Manager: Site Categorisation	PO Box 522 SAXONWOLD 2132	atiplady@ska.ac.za
SA CIVIL AVIATION AUTHORITY (SA CAA)					
Ms	Stoh	Lizell	Obstacle Specialist	Private Bag X73 HALFWAY HOUSE 1685	strohl@caa.co.za
AIR TRAFFIC AND NAVIGATION SERVICES (ATNS)					
Ms	Morobane	Johanna	Manager: Corporate Sustainability and Environment	Private Bag X15 KEMPTON PARK 1620	JohannaM@atns.co.za

Mr	Masilela	Simphiwe	Obstacle Evaluator		SimphiweM@atns.co.za
TRANSNET FREIGHT RAIL					
Mr	Fiff	Sam	Environmental Manager: Freight Rail	PO Box 255 BLOEMFONTEIN 9300	sam.fiff@transnet.net
SENTECH					
Mr	Koegelenberg	Johan	Renewable Projects	Private Bag X06 Honeydew 2040	koegelenbergj@sentech.co.za
TELKOM					
Mr	Bester	Amanda	Wayleave Officer	Private Bag X20700 BLOEMFONTEIN 9300	WayleaCR@telkom.co.za BesterAD@telkom.co.za
Mr	van den Heever	Heleen	Wayleave Officer	Private Bag X20700 BLOEMFONTEIN 9300	WayleaCR@telkom.co.za
ENDANGERED WILDLIFE TRUST					
Mr	Leeuwner	Lourens	Renewable Energy Project	The Endangered Wildlife Trust, Private Bag X11, Modderfontein, 1609, Johannesburg	lourensl@ewt.org.za
WESSA - NORTHERN CAPE					
Ms	Erasmus	Suzanne	EIA Coordinator, Wildlife and Energy Programme	PO Box 316 KIMBERLEY 8300	info@wessa.co.za wessanc@yahoo.com
BIRDLIFE SOUTH AFRICA					

Mr	Gear	Simon	Policy and Advocacy Manager	PO Box 515 RANDBURG 2125	advocacy@birdlife.org.za

7.9 Comments and response report

Issues, comments and concerns raised during the public participation process to date are captured in the Comments and Response Report (C&RR) – Appendix 5E. This C&RR provides a summary of the issues raised, as well as responses which were provided to I&APs. This information will be used to feed into the evaluation of social impacts.

8 SPECIALIST STUDIES

The following specialist studies were undertaken as per the Plan of Study for EIA:

- Biodiversity (including fauna and flora) Assessment
- Avifauna Assessment
- Surface Water Impact Assessment
- Soils and Agricultural Potential Assessment
- Visual Impact Assessment
- Heritage and Palaeontology Assessment
- Socio-economic Impact Assessment

Each specialist assessed the impact of the solar PV energy facility and associated infrastructure that BioTherm are proposing to develop near Copperton and the results for are presented below.

8.1 Biodiversity

The full Biodiversity Assessment was conducted by David Hoare and is included in Appendix 6A.

8.1.1 Conservation status of broad vegetation types

On the basis of a recently established approach used at national level by SANBI (Driver *et al*. 2005), vegetation types can be categorised according to their conservation status which is, in turn, assessed according to the degree of transformation relative to the expected extent of each vegetation type. The status of a habitat or vegetation type is based on how much of its original area still remains intact relative to various thresholds. The original extent of a vegetation type is as presented in the most recent national vegetation map (Mucina, Rutherford & Powrie 2005) and is the extent of the vegetation type in the absence of any historical human impact. On a national scale the thresholds are as depicted in Table 18, as determined by best available scientific approaches (Driver *et al*. 2005).

The level at which an ecosystem becomes Critically Endangered differs from one ecosystem to another and varies from 16% to 36% (Driver et al. 2005).

All of the vegetation types occurring in the study area (Table 19) are classified as Least Threatened (Driver *et al*. 2005; Mucina *et al*., 2006). None of the vegetation types are flagged therefore as being of conservation concern.

Table 18: Determining ecosystem status (from Driver et al. 2005)

*BT = biodiversity target (the minimum conservation requirement).

Habitat remaining (%)			
	80–100	least threatened	LT
	60–80	vulnerable	VU
	*BT–60	endangered	EN
	0–*BT	critically endangered	CR

Table 19: Conservation status of different vegetation types occurring in the study area, according to Driver et al. 2005 and Mucina et al. 2005.

Vegetation Type	Target (%)	Conserved (%)	Transformed (%)	Conservation status	
				Driver *et al.* 2005; Mucina *et al.*, 2006	**Draft Ecosystem List (NEMBA)**
Bushmanland Basin Shrubland	21	0	1	Least Threatened	Not listed
Bushmanland Vloere	24	0	2	Least Threatened	Not listed
Bushmanland Arid Grassland	21	1	1	Least Threatened	Not listed

8.1.2 Biodiversity Conservation Plans

There are no fine-scale biodiversity conservation plans for the study area (bgis.sanbi.org). According to SANBI, "*Presently BGIS has no Systematic Biodiversity Conservation Plan for the Northern Cape other than the Namakwa District Biodiversity Sector Plan therefore the Biodiversity Summaries Map is used in its place for land use decision support in the province.*" The Biodiversity Summary Map for the Pixley ka Seme District Municipality shows all natural vegetation within the municipal area, except along the Orange River, to be Least Threatened and no areas mapped as of particular biodiversity concern.

8.1.3 Proposed protected areas

According to the National Parks Area Expansion Strategy (NPAES), there is an area 15 km to the east of the project study area that has been identified as priority areas for inclusion in future protected areas. This particular component of the landscape is considered to be of high biodiversity value by National Parks, but the proposed project does not affect this area at all.

8.1.4 Red List plant species of the study area

Lists of plant species of conservation concern previously recorded in the quarter degree grids in which the study area is situated were obtained from the South African National Biodiversity Institute. These are listed in the Biodiversity Specialist Report. Additional species that could occur in similar habitats, as determined from database searches and literature sources, but have not been recorded in these grids, are also listed.

There is one species that may occur in the study area, the succulent, *Hoodia officinalis* subsp. *officinalis*. This species is listed as Near Threatened (see Table 20 for explanation of categories). The species is found in Desert, Nama Karoo and Succulent Karoo and is found inside bushes in flat or gently sloping areas. The species has been recorded in two neighbouring grids and the possibility of it occurring in the study area is therefore considered to be moderate to high.

Table 20: Explanation of IUCN Ver. 3.1 categories (IUCN, 2001), and Orange List categories (Victor & Keith, 2004).

IUCN / Orange List category	**Definition**	**Class**
EX	Extinct	Extinct
CR	Critically Endangered	Red List
EN	Endangered	Red List
VU	Vulnerable	Red List
NT	Near Threatened	Orange List
Declining	Declining taxa	Orange List
Rare	Rare	Orange List
Critically Rare	Rare: only one subpopulation	Orange List
Rare-Sparse	Rare: widely distributed but rare	Orange List
DDD	Data Deficient: well known but not enough information for assessment	Orange List
DDT	Data Deficient: taxonomic problems	Data Deficient
DDX	Data Deficient: unknown species	Data Deficient

8.1.5 Red List animal species of the study area

All Red List vertebrates (mammals, birds, reptiles, amphibians) that could occur in the study area are listed in the Biodiversity Specialist Report.

There are five mammal species of low conservation concern that could occur in available habitats in the study area. These are Geoffroy's Horseshoe Bat, Darling's Horseshoe Bat, Leseuer's Wing-gland Bat, the Honey Badger and Littledale's Whistling Rat. All of these species are classified nationally as near threatened (NT), but globally as Least Concern. They are, therefore, of relatively low conservation concern in comparison to more threatened species found in other parts of the country. The Honey Badger is protected under the National Environmental Management: Biodiversity Act and any impacts on a specimen of this species or that may negatively affect the survival of the species would require a permit. Only the Honey Badger and Littledale's Whistling Rat were considered likely to be found on site.

The Giant Bullfrog is the only amphibian species with a distribution that includes the study area and which could occur on the site. This species is classified as Least Concern globally and Near Threatened in South Africa. It is, however, protected under the National Environmental Management: Biodiversity Act and any impacts on a specimen of this species or that may negatively affect the survival of the species would require a permit.

There are no reptile species of conservation concern that have a distribution that includes the study area.

There are seven bird species of conservation concern that could potentially occur on site, as follows: Kori Bustard, Ludwig's Bustard, Blue Crane, Martial Eagle, Lanner Falcon, Lesser Kestrel and Secretarybird. Four of these species (Kori Bustard, Ludwig's Bustard, Blue Crane and Secretarybird) are potentially vulnerable to impacts from overhead power lines.

8.1.6 Protected plants (National Environmental Management: Biodiversity Act)

Plant species protected under the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) are listed in the Biodiversity Specialist Report. Two plant species that appear on this list that could potentially occur in the general region, although they have not previously been recorded in the grids of the study area, are *Hoodia gordonii* and *Harpagophytum procumbens*.

Hoodia gordonii is found in Namibia, Botswana, Angola and the dry margins of the summer rainfall region of South Africa, including parts of the Western Cape, Northern Cape and Free State Provinces. It occurs in a wide variety of arid habitats from coastal to mountainous, also on gentle to steep shale ridges, found from dry, rocky places to sandy spots in riverbeds. It has not been previously recorded in this grid, but has been recorded in the grid to the north-east. It is considered likely that this species could occur on site due to habitat conditions found there relative to the species requirements.

Harpagophytum procumbens occurs in Angola, Botswana, Mozambique, Namibia, South Africa, Zambia, and Zimbabwe. Within South Africa this species occurs in the Northern Cape, North West, Free State, and Limpopo Provinces and the largest populations are found in the communally owned areas of the North West Province and the north eastern parts of the Northern Cape. The species is found in well-drained sandy habitats in open savanna and woodlands. It has not been previously recorded in this grid, but has been recorded in the grids to the north. It is considered possible, but unlikely that this species could occur on site due to habitat conditions found there relative to the species requirements.

8.1.7 Protected plants (Northern Cape Nature Conservation Act, No. 9 of 2009)

The Act provides lists of protected species for the Province, which is very lengthy and includes a number of common species. According to Northern Cape Nature Conservation officials, a permit is required for the removal of any species on this list. Based on previous experience on projects in the Northern Cape Province, it must be assumed that a permit application will need to be undertaken and that it will include a variety of species found on site.

8.1.8 Protected trees

Tree species protected under the National Forest Act are listed in the Biodiversity Specialist Report. The only one that has a geographical distribution that includes the study sites is *Boscia albitrunca* (Shepherd's Tree / Witgatboom / !Xhi). *Boscia albitrunca* (Shepherd's Tree / Witgatboom / !Xhi) occurs in semi-desert areas and bushveld, often on termitaria, but is common on sandy to loamy soils and calcrete soils. This species could potentially occur on site in areas affected by the proposed project.

8.1.9 Protected animals

There are a number of animal species protected according to the National Environmental Management: Biodiversity Act (Act No. 10 of 2004). According to this Act, "*a person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7*". Such activities include any that are "*of a nature that may negatively impact on the survival of a listed threatened or protected species*". This implies that any negative impacts on habitats in which populations of protected species occur or are dependent upon would be restricted according to this Act.

Those species protected according to the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) that have a geographical distribution that includes the site are listed in the Biodiversity Specialist Report. This includes the following species: White Rhinoceros, Black Wildebeest, Oribi, Cheetah, Cape Clawless Otter, Black-footed Cat, Brown Hyaena, Serval, Spotted-necked Otter, Honey Badger, Leopard, Cape Fox, Southern African Hedgehog, Southern African Python, Giant Bullfrog, Blue Crane, Grey-crowned Crane, Martial Eagle, Cape Vulture, and Lappet-faced Vulture.

Due to habitat and forage requirements and the fact that some species are restricted to game farms and/or conservation areas, only the Black-footed Cat, Honey Badger, Leopard, Cape Fox, Giant Bullfrog and some of the birds (Kori Bustard, Ludwig's Bustard, Blue Crane, Martial Eagle, Lesser Kestrel and Black Stork) have a likelihood of occurring on site. All of these species are mobile animals that are likely to move away in the event of any activities on site disturbing them. They are therefore unlikely to be affected by the proposed development of the solar power facility and associated infrastructure.

8.1.10 Important Bird Areas

The study area is not within an Important Bird Area (IBA). The nearest IBA is the Platberg-Karoo IBA, which is 150 km away to the east / south-east.

8.1.11 Watercourses

The study area contains some drainage areas that are low-lying parts of the landscape. Wetlands, riparian zones and watercourses are defined in the National Water Act as a water resource and any activities that are contemplated that could affect the wetlands requires authorisation (Section 21 of the National Water Act of 1998). It is important that these areas are properly mapped and that impacts on them are kept to a minimum, if possible.

8.1.12 Field Observations

The field survey was undertaken in early winter (7–8 May 2015), which is not ideal for assessing the general characteristics and condition of the study area. In addition, the season has been particularly dry and the vegetation had already been impacted by this factor. This made it particularly difficult to identify plant species, since many plants had lost their leaves and it is likely that cryptic species were not visible. This was not, however, considered to be a serious limitation for evaluating transformed versus natural occurrence of habitat nor for observing habitat differences in the field. It was only a limitation in terms of compiling checklists of species for different habitats.

8.1.12.1 Occurrence of natural habitat

Google imagery and, to a lesser extent, land cover maps, provide a relatively accurate indication of the location of natural habitat on site. The only areas that were found to be transformed or obviously degraded were associated with the roads passing through the study area, the existing Eskom substation and the mining activities some distance towards the north of the site. The majority of the study area is therefore considered to be in a natural state.

8.1.12.2 Condition of natural habitat

Due to the extremely dry condition of the natural vegetation, it was not possible to determine what the condition of the natural habitat was (Figure 28). However, the author has been to this area in the recent past and, at the time of that survey, the vegetation in the area was assessed as being in moderate to good condition. There were no indications to suggest that this condition has altered over the interim period of time. Vegetation structure appeared to be good across the entire study area, with no obvious bare patches or altered structure that could not be explained by habitat conditions.

Figure 28: Dry condition of habitat at time of field survey

8.1.12.3 Natural variation

Vegetation structure varied marginally across the site with an increase in stature and woodiness of plants within the low-lying pan area. Plains areas had relatively uniform vegetation structure that did not vary much from one side of the site to the other. Genera that were possible to identify in the field included *Eriocephalus*, *Salsola*, *Aptosimum* and *Pentzia*, which broadly agrees with the published descriptions for this vegetation type. The lowland pan was dominated by thorny, low, tangled shrubs, including *Rhigozum trichotomum, Asparagus burchellii* and a species of *Lycium* (see Figure 29). This is consistent with the published description for Bushmanland Vloere. The pan area also had deeper soils that had evidence of surface water.

Figure 29: Linear zonation within the drainage area

8.1.12.4 Species occurrence on site

A small number of fauna species were recorded in the field, including Bat-eared Fox, Sociable Weaver, Pied Crow, Gabar Goshawk, Verreaux's Eagle, Southern Pale Chanting Goshawk, Ostrich, Northern Black Korhaan, Karoo Korhaan, Namaqua Sand Lizard, Spotted Sand Lizard and Aardvark (Figure 30).

Figure 30: Namaqua Sand Lizard in the Study Area

8.2 Avifauna

The full Avifauna Assessment was conducted by Chris van Rooyen and is included in Appendix 6B.

An estimated 121 species could potentially occur in the study area. Of these, 10 are South African Red Data species, 18 are southern African endemics and 29 are near-endemics. This means that 8.2% of the species that could potentially occur in the study area are Red Data species, and 38.8% are southern African endemics of near-endemics. Southern Africa contains 13 avifaunal endemic regions, namely Western Arid, Woodland, Evergreen Forest, Grassland, Montane, Rocky slopes and cliffs, Fynbos, Marine and Inland Waters (MacLean 1999). Of these regions, Western Arid, where the study area is located, contains the highest number of endemics. Overall, the study area potentially contains a total of 47 endemics and near-endemics, which is 28% of the 167 southern African endemics and near-endemics (Hockey et al. 2005).

See the avifaunal specialist report for a list of species potentially occurring in the study area. The SABAP2 reporting rate refers to the combined reporting rate in the 9 pentads surrounding and including the development site.

Potential impacts on priority species are listed in Table 21 below.

Table 21: Priority species potentially occurring in the study area

EN = Endangered
VU = Vulnerable
NT = Near-threatened
LC = Least concern
End = Southern African Endemic
N-End = Southern African near endemic

Name	Scientific name	National Red Data Status	Global status	Collisions with associated power line	Collisions with PV panels	Displacement through disturbance	Displacement through habitat transformation*
Ant-eating Chat	*Myrmecocichla formicivora*	End	LC		x	x	x
Ashy Tit	*Parus cinerascens*	N-end	LC		x	x	x
Black-chested Prinia	*Prinia flavicans*	N-end	LC		x	x	x
Black-eared Sparrowlark	*Eremopterix australis*	End	LC		x	x	x
Black-headed Canary	*Serinus alario*	End	LC		x	x	x
Bokmakierie	*Telophorus zeylonus*	N-end	LC		x	x	x
Cape Bunting	*Emberiza capensis*	N-end	LC		x	x	x
Cape Penduline – Tit	*Anthoscopus minutus*	N-end	LC		x	x	x
Cape Sparrow	*Passer melanurus*	N-end	LC		x	x	x
Chat Flycatcher	*Bradornis infuscatus*	N-end	LC		x	x	x
Chertnut-vented Tit-babbler	*Parisoma subcaeruleum*	N-end	LC		x	x	x
Double-banded Courser	*Rhinoptilus africanus*	NT	LC		x	x	x
Dusky Sunbird	*Cinnyris fuscus*	N-end	LC		x	x	x
Eastern Clapper-Lark	*Mirafra fasciolata*	N-end	LC		x	x	x
European Roller	*Coracias garrulus*	NT	NT		x	x	x
Fairy Flyctacher	*Stenostira scita*	End	LC		x	x	x

Name	Scientific name	National Red Data Status	Global status	Collisions with associated power line	Collisions with PV panels	Displacement through disturbance	Displacement through habitat transformation*
Grey-backed Cisticola	*Cisticola subruficapilla*	N-end	LC		x	x	x
Grey-backed Sparrowlark	*Eremopterix verticalis*	N-end	LC		x	x	x
Jackal Buzzard	*Buteo rufofuscus*	End	LC	x		x	x
Kalahari-Scrub-Robin	*Cercotrichas paena*	N-end	LC		x	x	x
Karoo Chat	*Cercomela schlegelii*	N-end	LC		x	x	x
Karoo Eremomela	*Eremomela gregalis*	End	LC		x	x	x
Karoo Korhaan	*Eupodotis vigorsii*	NT, End	LC	x	x	x	x
Karoo Long-billed Lark	*Certhilauda subcoronata*	End	LC		x	x	x
Karoo Prinia	*Prinia maculosa*	End	LC		x	x	x
Karoo Scrub-Robin	*Cercotrichas coryphoeus*	End	LC		x	x	x
Kori Bustard	*Ardeotis kori*	NT	NT	x		x	x
Lanner Falcon	*Falco biarmicus*	VU	LC			x	x
Large-billed Lark	*Galerida magnirostris*	End	LC		x	x	x
Lark-like Bunting	*Emberiza impetuani*	N-end	LC		x	x	x
Layard's Tit-babbler	*Parisoma layardi*	End	LC		x	x	x
Ludwig's Bustard	*Neotos ludwigii*	EN, N-end	EN	x		x	x
Martial Eagle	*Polemaetus bellicosus*	EN	VU	x		x	x
Mountain Wheat-ear	*Oenanthe monticola*	N-end	LC		x	x	x
Namaqua Sandgrouse	*Pterocles namaqua*	N-end	LC	x	x	x	x
Northern Black Korhaan	*Afrotis afraoides*	End	LC	x	x	x	x
Orange River White-eye	*Zosterops pallidus*	End	LC		x	x	x
Pale-winged Starling	*Onychognathus nabouroup*	N-end	LC		x	x	x

Name	Scientific name	National Red Data Status	Global status	Collisions with associated power line	Collisions with PV panels	Displacement through disturbance	Displacement through habitat transformation*
Pririt Batis	*Batis pririt*	N-end	LC		x	x	x
Red-headed Finch	*Amadina erythrocephala*	N-end	LC		x	x	x
Rufous-eared Warbler	*Malcorus pectoralis*	End	LC		x	x	x
Sabota Lark	*Calendulauda sabota*	N-end	LC		x	x	x
Scaly-feathered Finch	*Sporopipes squamifrons*	N-end	LC		x	x	x
Sclater's Lark	*Spizocorys sclateri*	NT, End	NT		x	x	x
Secretarybird	*Sagittarius serpentarius*	VU	VU	x		x	x
Sickle-winged Chat	*Cercomela sinuata*	End	LC		x	x	x
Sociable Weaver	*Philetairus socius*	End	LC		x	x	x
South African Shelduck	*Tadorna cana*	End	LC	x	x	x	x
Southern Pale Chanting Goshawk	*Melierax canorus*	N-end	LC	x	x	x	x
Spike-heeled Lark	*Chersomanes albofasciata*	N-end	LC		x	x	x
Stark's Lark	*Spizocorys starki*	N-end	LC		x	x	x
Tratrac Chat	*Cercomela tractrac*	N-end	LC		x	x	x
Verreaux's Eagle	*Aquila verreauxii*	VU	LC	x		x	x
White-throated Canary	*Crithagra albogularis*	N-end	LC		x	x	x
Yellow Canary	*Crithagra flaviventris*	N-end	LC		x	x	x

With smaller species this impact might result in partial but not total exclusion from the site, depending on the level of vegetation transformation.

8.2.1 Assessment Helena Solar 3 PV and associated infrastructure

- Displacement due to disturbance associated with the construction and de-commissioning of the PV facility and associated infrastructure (construction and de-commissioning)

The construction (and de-commissioning) of the PV facility and associated infrastructure (buildings and access roads) will result in a significant amount of movement and noise, which will lead to temporary displacement of avifauna from the site. It is highly likely that most priority species listed in Table 21 will vacate the area for the duration of these activities. There will be no material difference in the level of displacement due to disturbance associated with the two alternative road lay-outs.

- Displacement due to habitat transformation associated with the PV facility and associated infrastructure (operation)

The construction of the PV facility and associated infrastructure will result in the radical transformation of the existing habitat, i.e. Bushmanland Basin Shrubland. The vegetation will be cleared prior to construction commencing. Once operational, the construction of the PV arrays will prevent sunlight from reaching the vegetation below the solar panels, which is likely to result in stunted vegetation growth and possibly complete eradication of some species below the solar panels. The natural vegetation is likely to persist in the rows between the PV arrays, but it will be a fraction of what was available before the construction of the plant, and it will contain few shrubs as this will most likely have been cleared prior to construction. Table 21 lists the priority species that could potentially be affected by this impact. Small birds are often capable of surviving in small pockets of suitable habitat, and are therefore generally less affected by habitat fragmentation than larger species. It is, therefore, likely that most of the smaller species will continue to use the habitat available within the solar facility albeit at lower densities. This will however differ from species to species and it may not be true for all of the smaller species. Larger species which require contiguous, un-fragmented tracts of suitable habitat (e.g. large raptors, korhaans and bustards) are more likely to be displaced entirely from the area of the proposed plant although in the case of some raptors (e.g. Southern Pale Chanting Goshawk) the potential availability of carcasses or injured birds due to collisions with the PV panels may actually attract them to the area. The significance of the potential displacement impact is difficult to assess at this stage and will only become clear through operational phase surveys. There will be no material difference in the level of displacement due to disturbance associated with the two alternative road lay-outs.

- Collisions with the solar panels of the PV facility (operation)

The 47 priority species that were recorded in the study area which could potentially be exposed to collision risk at the PV1 site is set out in Table 21. The so-called “lake effect” could act as an important attraction to some species and it is expected that flocking species such as Namaqua Sandgrouse, mixed flocks of seed-eaters consisting of inter alia Cape Sparrow, Sociable Weaver, Yellow Canary, Scaly-feathered Finch, Cape Bunting, Lark-like Bunting, Black-eared Sparrow-lark, Sclater's Lark and several species of doves would be most susceptible to this impact as they habitually arrive in flocks at water holes to drink. Multiple mortalities could potentially result from this, which in turn could attract raptors e.g. Southern Pale Chanting Goshawk and Lanner Falcon which will feed on dead and injured birds which could in turn expose them to collision risk, especially when pursuing injured birds. In addition, the "lake effect" produced by the solar panels may draw various water birds to the area, including endemics e.g. the South African Shelduck and possibly even the Greater Flamingo *Phoenicopterus ruber* (Red Data Status – NT), although the species was not recorded by SABAP2, probably due to the absence of major water bodies within the 9 pentad block where the site is situated. Flamingos often fly long distances at night, which may compound the problem in that they might be more inclined to mistake the PV panels for water during full moon conditions. There are a number of pans situated within a 40km radius around the development site which could potentially be utilised by water birds when filled with water, but these are likely to be stochastic events after major rainfall events. It is difficult to assess whether water birds will be affected by the "lake effect" at the PV site and it will only become clear once operational phase monitoring takes place.

- Other impacts

Cape Sparrows and other small birds will very likely attempt to nest underneath the solar panels to take advantage of the shade, but this should not adversely affect the operation of the equipment. The solar panels are probably too low for Sociable Weavers to nest on them, but they might attempt to build their giant nests on other infrastructure. Another impact that could potentially materialise is the pollution of the solar panels by large birds, particularly Pied Crows and raptors, if they get to perch regularly on the solar arrays. It is hoped that the regular cleaning and maintenance activities will prevent this from becoming a problem, but close monitoring will still be required.

8.2.2 Assessment Proposed Power line Corridor Option 1

- Displacement of priority species due to disturbance and habitat transformation during the construction and de-commissioning of the 132kV transmission line (construction and de-commissioning)

The noise and movement associated with the construction of the 132kV transmission line will have a temporary displacement impact on the majority priority species. Larger, sensitive species such as Ludwig's Bustard, Northern Black Korhaan, Karoo Korhaan, Secretarybird and Kori Bustard are most likely to be most affected by this temporary impact, although the proximity of the R357 road probably already act as a deterrent for these species. Many studies have shown that bird abundance, occurrence and species richness are reduced near roads, with the largest reductions where traffic levels are high (Summers et.al 2011). Due to the nature of the vegetation, very little if any vegetation clearing will be required. Loss of habitat is therefore likely to be minimal and should not materially affect any priority species.

The situation with regard to the pair of Martial Eagles that bred in 2013 on tower 519 of the 400kV Hydra-Kronos transmission line is more complex. Based on information gathered in the early 2000s, it seems the pair has three alternative nest platforms, i.e. at towers 519, 516 and 512 (Jenkins *et al.* 2013). Tower 519 is situated approximately 330m away from the Kronos MTS perimeter fence; Tower 516 is 1.2km away and 512 is 2.6km away. During the site visit in June 2015, no breeding activity was recorded at the nest site at tower 519, possibly due to the result of high levels of anthropogenic activity at the Kronos MTS (people and construction vehicles). It may be that the birds were using one of the alternative platforms, but it could not be confirmed. The vehicle and people traffic associated with the construction of the 132kV line and other solar facilities in the vicinity of the Kronos MTS would most likely displace the birds from Tower 519, should they attempt to occupy this nest site again in future.

- Collisions with the earthwire of the 132kV power line (operational)

The most likely priority species candidates for collision mortality on the proposed 132kV power line Option 1 at the Helena Solar 1 PV site are Ludwig's Bustards, South African Shelduck, Northern Back Korhaan, Karoo Korhaan, Kori Bustard and Secretarybird. Namaqua Sandgrouse might also be at risk if the birds descend in flocks to the surface water in the borrow pits next to the R357. The same problem could present itself with water birds. However, the presence of the road will in itself be a mitigating factor in that the vicinity of the road will most likely be avoided by many power line sensitive species, or they will naturally cross the road at a higher altitude. There are a number of pans situated within a 40km radius around the development site which could potentially be utilised by water birds when filled with water, but these are likely to be stochastic events after major rainfall events. Regular occurrence of water birds at the site is therefore not anticipated.

- Other impacts

Sociable Weavers might attempt to nest on the 132kV structures. Whether they are successful in doing so will depend on the type of structure that is used. The steel-monopole structure is generally not very suitable for this purpose. However, if they are successful, this could potentially lead to short circuits when the nests get wet during rainfall events, if the nest straddles two or more phases, or a live and earthed component. Regular removal of nests is the only remedy to prevent this from happening. Pied Crows *Corvus albus* could potentially breed on the structures. Their nests could in turn be utilised by priority species such as Lanner Falcon and Southern Pale Chanting Goshawk.

8.2.3 Assessment Proposed Power line Corridor Option 2

- Displacement of priority species due to disturbance and habitat transformation during the construction and de-commissioning of the 132kV transmission line (construction and de-commissioning)

The noise and movement associated with the construction of the 132kV transmission line will have a temporary displacement impact on the majority priority species. Larger, sensitive species such as Ludwig's Bustard, Northern Black Korhaan, Karoo Korhaan, Secretarybird and Kori Bustard are most likely to be most affected by this temporary impact. The existing Aries-Kronos 400kV line was inspected but no large raptor nests were discovered on any of the structures. If the status quo persists, no displacement of large raptors is likely to happen in the section between the proposed PV facility and the Kronos MTS when the 132kV line is constructed directly next to it. However, this could change in future and should therefore not be taken as a constant.

The issue of the Martial Eagles breeding on structure 519 of the Hydra-Kronos 400kV line is discussed above, and the situation will be identical for this option.

- Collisions with the earthwire of the 132kV power line (operational)

The most likely priority species candidates for collision mortality on the proposed 132kV power line Option 2 at the Helena Solar 3 PV site are Ludwig's Bustards, South African Shelduck, Northern Back Korhaan, Karoo Korhaan, Kori Bustard and Secretarybird. The presence of the Aries- Kronos 400kV line which will be running adjacent to the 132kV line may to some extent act as a shield in that resident birds may have become accustomed to the presence of an obstacle in this location and learnt to avoid the larger 400kV line by flying over it, reducing the risk of collisions with the 132kV line to some extent.

8.2.4 Assessment Proposed Substation Option 1

- Displacement of priority species due to disturbance and habitat transformation during the construction and de-commissioning of the on-site substation (construction and de-commissioning)

The total area of the proposed substation site comprises approximately 2.96 hectares. The habitat is typical Bushmanland Basin Shrubland, consisting of short, hardy shrubs with areas of bare ground, with no features distinguishing it from the rest of the study area. The habitat is ubiquitous and representative of that which occurs across huge areas of Bushmanland. Viewed in isolation, it is not envisaged that the numbers of priority species that will be permanently displaced from the substation site through habitat transformation will materially threaten the local or regional populations of priority species. However, the considerable spatial extent of the PV development as a whole suggests that it may be an important contributor to the potentially significant, cumulative impacts imposed by this and a number of other planned renewable energy projects on the natural environment of the Copperton area.

8.2.5 Assessment Proposed Substation Option 2

- Displacement of priority species due to disturbance and habitat transformation during the construction and de-commissioning of the on-site substation (construction and de-commissioning)

The situation from an avifaunal perspective with Option 2 is similar to Option 1, as the habitat and size of the two proposed substation sites are essentially identical.

8.3 Surface Water

The full Surface Water Assessment was conducted by SiVEST and is included in Appendix 6C.

The in-field surface water delineation assessment took place on the 12th and 13th of August 2015. The fieldwork verification and ground-truthing assessment was undertaken to scrutinise the results of the database and desktop study and to identify any other potentially overlooked surface water resources in the field. The results are presented below.

Ultimately, it was found that the proposed development for the Helena 3 Solar Facility contained only one (1) ephemeral depression wetland but also two (2) drainage pathways (one running centrally through the PV site from the west towards the north and the other in the south eastern corner of the PV site). The depression wetland was found within the greater drainage pathway running from the west into and centrally towards the north of the PV site. The power line component of the proposed development was found to contain one (1) man-made impoundment (Power Line Alternative 1). In addition, an old borrow pit excavation area was identified within both the Power Line Alternative 1 and 2 corridors.

The above findings were found not to be entirely in line with the desktop assessment. Whilst the ephemeral wetland was verified, the non-perennial river to the south east was re-classified as a drainage pathway since no definitive channel was identified in the field. Furthermore, a drainage pathway was verified in the field which was associated with the ephemeral depression wetland. However, the depression wetland identified at the Kronos Substation site from desktop level was not verified, as it appears that the substation may currently occupy the area where the potential feature may have been. However, it may also be possible that there may never have been a feature present and this is an error in the database. Aside from this, the man-made impoundment found within the power line alternative 1 corridor and borrow pit excavation was not identified at a desktop level. Overall, the final results indicate that one additional drainage pathway associated with the ephemeral depression wetland was identified which had not been initially identified, as well as the borrow pit excavation and man-made impoundment. The depression wetland at Kronos Substation was not identified in the field and was accordingly excluded.

A graphic illustration of the findings is presented in Figure 31 and Figure 32. The general characteristics of each surface water feature are elaborated on below.

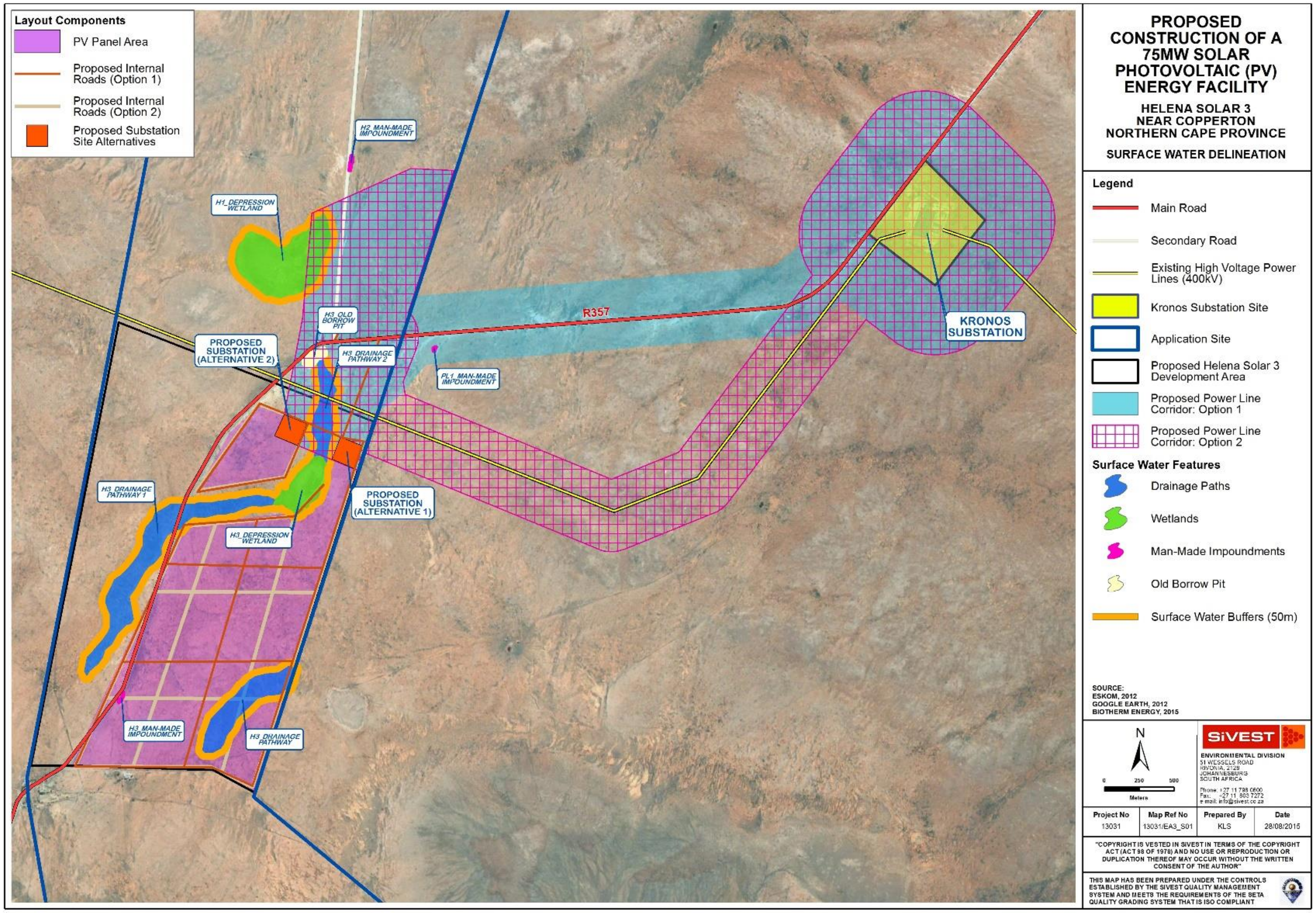

Figure 31. In-field delineated Surface Water Resources within the Helena 3 Proposed Development Site

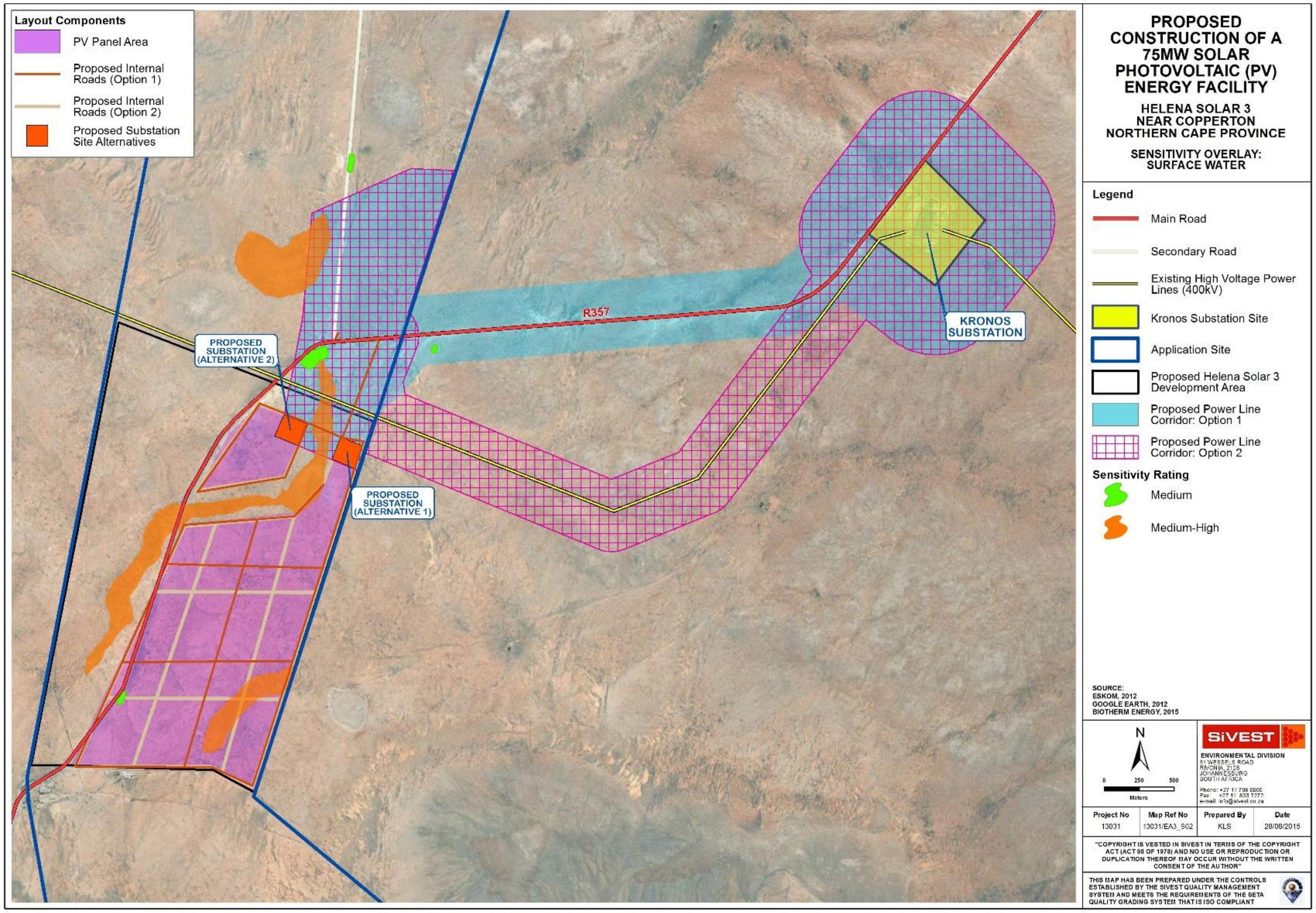

Figure 32. Sensitivity Rating for the Delineated Surface Water Features

8.3.1 Ephemeral Depression Wetlands

- Terrain and Soils

The topography of the site is predominantly flat. However, a slightly lower lying depression area is present which aids in funneling drainage in the localized catchment towards the lowest part of the landscape where the depression wetland can be found. However, the depression wetland central to the PV study site is located within a valley which seems to be associated with a greater drainage pathway which routes in a south west to northern direction. The other depression area is located to the north west of the PV study site in the power line corridor alternative. This wetland is not linked to any other system and is considered to be endorheic (inward draining).

Figure 33. General Topography associated with the Depression Wetland on the PV Study Site

Generally, given the dry climate (relatively high evaporation potential and low annual rainfall), any surface water that accumulates in the pan is not likely to be present for an extended period (few days to several weeks). Examination of the soil samples for the depression wetland on the PV study site shows that the soil profile is relatively shallow (50-60cm deep - Figure 34), although deeper than the surrounding terrestrial areas where rock extrudes at the surface in places. Lime nodules are present in the soil matrix, although the soil profile is generally made up of an Orthic A horizon which overlies a neocarbonate B horizon. The soil form is therefore representative of the Augrabies Soil Form. The soil form that can be said to be associated with the depression wetland in the power line corridor alternatives is the Mispah Soil Form. The soil horizons include an Orthic A horizon overlying hard rock. The two soil forms are not considered wetland soil forms. However, the relatively shallow soil profile for both means that water is generally close to the surface, but will not be present for long due to high temperatures and evaporation. Conditions are therefore presumably not suitable for the formation of hydrogeomorphism to take place. Moreover, the soil particles are predominantly fine (with the exception of a few lime granules and rock fragments found in the soil matrix) but porous. The soils can therefore be considered highly oxidized for the most part throughout the year when not completely inundated for very short periods.

Figure 34. Soil sample drawn from within the Ephemeral Wetland

- Vegetation

The vegetation in the area is mainly made up of dwarf shrubland and scrubs. Within the depression wetlands, vegetation becomes less dense to absent in the central parts of the wetland (Figure 35). Species that were noted included *Eriocephalus*, *Salsola*, *Aptosimum* and *Pentzia* (Hoare, 2015). The depression wetlands were dominated by thorny, low, tangled shrubs, including *Rhigozum trichotomum*, *Asparagus burchellii* and a species of *Lycium* which is consistent with the Mucina and Rutherford (2006) published description for Bushmanland Vloere vegetation type (Hoare, 2015). Small assemblages of *Stipagrostis* species were also noted. The variation in habitat and potential presence of surface water (albeit seldom) makes this surface water feature ecologically significant considering the arid nature of the landscape. However, no notable species of conservation concern were noted. The sensitivity of this surface water feature is considered Medium-High.

Figure 35. Vegetation within the Depression Wetland showing change in Density

8.3.2 Man-made Impoundment

- Terrain and Soils

An area has been excavated to create a man-made impoundment, which serves as a water source for sheep farming that is currently take place on the site. This surface water feature is therefore artificial.

Figure 36. Excavated man-made impoundment

An exposed soil profile on the edge of the man-made impoundment shows that the soils go from what can be described as an Orthic A horizon into a Hard Pan Carbonate B horizon (Figure 37). The combination of these two soil horizons can be attributed to the Prieska Soil Form which is not considered a wetland soil form.

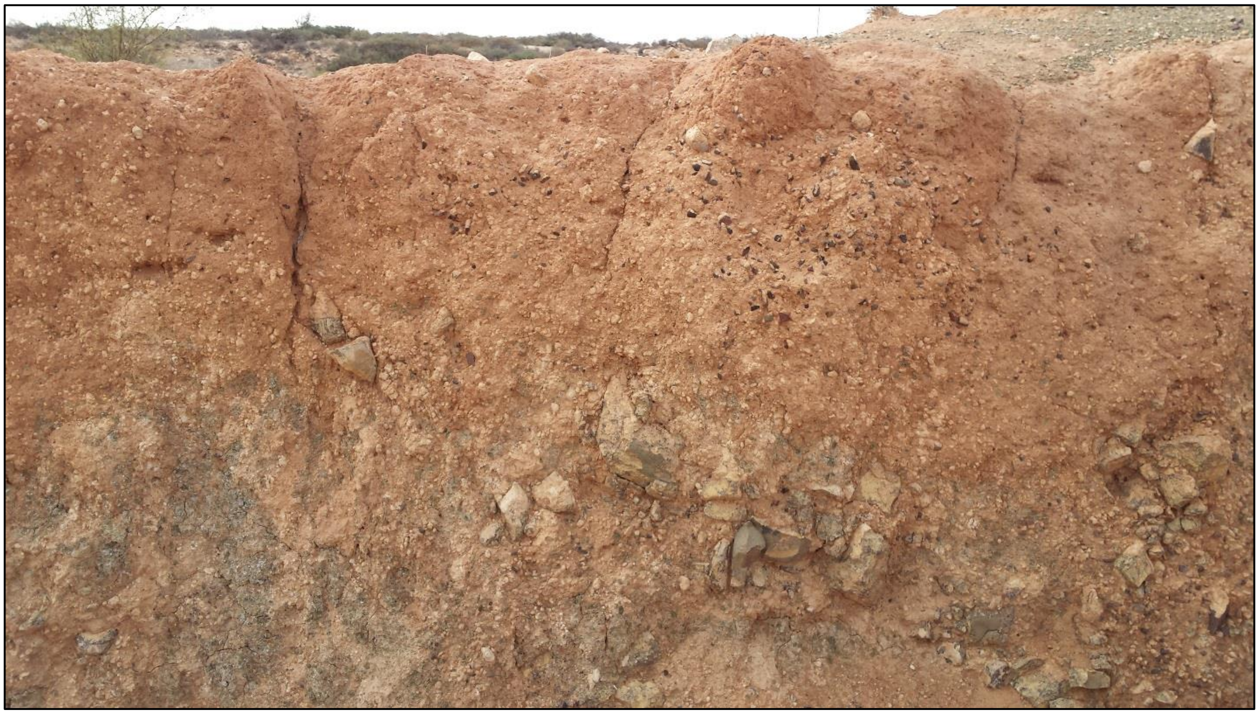

Figure 37. Soil Profile at the edge of the excavated Man-made Impoundment

- Vegetation

Vegetation within the man-made impoundment was limited to a few clumps of graminoid species (*Stipagrostis*, *Centropodia*) in the central part of the surface water feature. *Prosopis glandulosa* var. *torreyana* (Category 2 invader species under the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) as amended in 2001) (Figure 38) was also observed. The composition and state of vegetation decreases the ecological significance of this surface water feature. However, when inundated, it will provide a water source for avifaunal, faunal and amphibian species. The sensitivity of this feature is considered to be Medium.

Figure 38. *Prosopis glandulosa* var. *torreyana* in the Man-made Impoundment

8.3.3 Old Borrow Pit Excavation

- Terrain and Soils

An excavation adjacent to the R357 presumably was created for the purposes of a borrow pit to utilize the soil for construction purposes in the nearby area. The soils are therefore terrestrial in nature. Ponding of water was noted during the site investigation. The presence of bedrock near the surface within the excavation can be taken as a factor preventing further drainage of surface water into the soils.

Figure 39. Old excavated Borrow Pit

- Vegetation

The vegetation was very limited and comprised mainly terrestrial species along with *Stipagrostis* species. The habitat is therefore no more distinct than that of the surrounding landscape with the exception of surface water which may provide aquatic habitat for potential amphibian species. The sensitivity of this surface water feature is considered to be Medium.

8.3.4 Drainage Pathways

- Terrain and Soils

The two drainage pathways are situated in the low lying valleys in the landscape. As with the ephemeral depression wetlands, the soil profile is relatively shallow before reaching bedrock. In some areas, the bedrock was exposed at the surface. However, no distinct channel was identified in each of the drainage pathways. As such, the soil characteristics are very similar to the depression wetland in the power line corridor. The soils are yellow-brown in colour and also finely grained, but porous (Figure 40). No signs of wetness were evident in the soils precluding it as a potential wetland. Nonetheless, drainage flows through this low point in the landscape albeit infrequent.

Figure 40. Example of the Soils drawn near to the surface (20cm) of the Drainage Pathway

- Vegetation

Vegetation structure and composition was similar to that of the depression wetlands. The same increase in robustness and height of the shrub and scrub species was evident. Again, species such as *Eriocephalus*, *Salsola*, *Aptosimum* and *Pentzia* were noted. As such, the variation in habitat and drainage of water (albeit infrequent) through this part of the landscape, makes the surface water feature distinct from the surrounding environment and therefore of higher ecological significance. However, as no species of notable concern or importance were noted, the sensitivity is considered to be Medium-High.

Figure 41. Taller more robust vegetation within the Drainage Pathway. Note the exposed bedrock at the surface

8.3.5 Comment on Wetland Functionality, Sensitivity and Importance

The drainage lines and wetlands within study area were found to be dry and colonised by typically terrestrial species, indicating that these systems are ephemeral in nature, as defined by Rossouw *et al*., 2005 (in terms of drainage lines and watercourses) and SANBI, 2013 (in terms of wetlands). However, it must be noted that a number of vegetation species could not be identified due lack of identifiable plant parts. Nonetheless, presumably surface and sub-surface water occurrence is scarce enough to the extent that herbaceous species are able to colonise the surface water features as opposed to typically hydrophytic vegetation species. Disturbance from cattle grazing is also likely to contribute to the degraded habitat in these systems and prominence of shrub species.

The presence of these ephemeral surface water features in dry lands are however important for the vegetation and biota that they support (Rossouw *et al*., 2005). Ephemeral rivers are characterised by much higher flow variability, extended periods of zero surface flow and the general absence of low flows (Knighton & Nanson, 1997). It may appear that variable flows and intermittency have largely negative effects, adversely affecting water quality during dry periods and limiting the diversity of water fauna and flora (Rossouw *et al*., 2005). Yet, dry periods are part of the natural climatic cycle experienced by the animals, plants and micro-organisms that live in arid regions. Natural low-flow and drought periods are as important for maintaining biodiversity and healthy rivers as natural high flows and floods are in other kinds of rivers

(Hughes, 2005). The abilities of organisms to survive prolonged dry conditions / drought (resistance) and recovery from it (resilience) are “hard-wired” adaptations of healthy aquatic ecosystems from eons of evolution (Jones, 2003). The invertebrate fauna that inhabit these environments have various physiological, behavioural and structural adaptations, enabling their survival in a constantly changing environment. For example, the class *Branchiopoda* (and the order *Anostraca*) is of particular concern as many of the species belonging to this order are in the IUCN listed taxa. Dessication survival is achieved through the production of an egg bank. The egg bank consists of desiccation resistant eggs which lie dormant in the sediment during the dry phase, and only hatch upon the return of favourable conditions when the pan is once again inundated with water.

Additionally, pans (or in this case ephemeral and depression wetlands) act as critical biogeochemical cycling stations, especially in arid landscapes. Typically, these ephemeral wetlands undergo fluctuating conditions often switching from inundated to desiccated stages. As a result, the opposing dry and wet phase conditions, acting out over time and space, markedly influence the biogeochemical processes taking place in the water column and the substrate. In this context, ephemeral wetlands, as those identified within this study, can be regarded as biogeochemical ‘hot spots’ when viewed at the appropriate spatio-temporal scales (McClain *et al*., 2003). Classic biogeochemical processes often associated with wetlands include nitrification and denitrification processes, nitrogen fixation, nitrogen mineralization, nitrogen volatilization, phosphorous precipitation, phosphorous adsorption and absorption, ferrolysis, gleying, sulphur reduction, fermentation of organic carbon and methanogenesis amongst others (Mitsch & Gosselink, 1986).

With the above in mind, any potential impacts to these surface water features that could alter the established natural condition, can disrupt the systems and have far-reaching effects. For example, sedimentation within temporary/ephemeral wetlands could result in limited or no hatching of the invertebrate class *Branchiopoda* after rainfall. Ultimately, given the scarcity of water in the area, systems such as these provide unique habitats and can be considered to play an important role despite the enigmatic nature.

The general attitude of many seems to suggest that ephemeral systems already receive so little water, in such an unpredictable way, that a little less water should not make that much difference, whilst others feel that they already exist in such a marginal way that any further stress would have a massive (and largely unknown) effect on them (Rossouw *et al*., 2005). Ultimately, the safeguarding of ephemeral systems should be upheld in accordance with the pre-cautionary principle and regarded as sensitive until more comprehensive and long term studies can inform otherwise.

8.3.6 Wetland Buffer Zones

The Gauteng Minimum Requirements for Biodiversity Studies (GDACE, 2009) were utilised to implement a suitable buffer zone around the delineated wetlands for the proposed development. In accordance with these guidelines, a buffer zone of 50m was to be applied to the delineated wetland as it is located outside an urban area. The same buffer was applied to the drainage pathways since the vegetation composition was broadly similar and therefore had the same ecological significance. No buffer zones were implemented for the artificial surface water features as these features did not contain the same floristic significance exhibited by the wetland and drainage pathways.

8.4 Agricultural Potential and Soils

The full Agricultural Potential Assessment was conducted by Garry Paterson and is included in Appendix 6D.

8.4.1 Agricultural Potential

Virtually the entire Helena 3 study area comprises shallow, calcareous soils with rock (land type ***Ah93***), as can be seen from the information contained in Table 10 and the Agricultural Potential and Soils specialist report.

Coupled with these shallow soils, the very low rainfall in the area means that the only means of cultivation would be by irrigation and the Google Earth image of the area (Figure 42, orange outlined boundary) shows absolutely no signs of any agricultural infrastructure and certainly none of irrigation.

Figure 42: Google Earth image of study area

The climatic restrictions mean that this part of the Northern Cape is suited at best for grazing and here the grazing capacity is low, around 20-25 ha/large stock unit (ARC-ISCW, 2004).

8.4.2 Land Use

The land use in the area is dominantly “shrubland and low fynbos” with some small areas of “bare rock and soil (natural)” as classified by the National Land Cover (Thompson, 1999). As previously mentioned, there are no areas of cultivation that were identified, only a few small, isolated areas of “Improved grassland”.

8.5 Visual

The full The Visual Assessment was conducted by SiVEST and is included in Appendix 6E.

The study area is rated as having a low visual sensitivity. This is mainly owing to the relatively uninhabited characteristics of the area and the relic mining infrastructure which would likely reduce the scenic quality of the area. An important factor contributing to the visual sensitivity of an area is the presence, or absence of visual receptors that may value the aesthetic quality of the landscape and depend on it to produce revenue and create jobs. As described below, very few potentially sensitive receptors are present in the study area. Although no formal protected areas or leisure / nature-based tourism activities exist within the study area, the area would still be valued as a typical Karoo cultural landscape.

Several solar energy facilities are proposed within relatively close proximity to the proposed project. As such, an assessment of the cumulative impact that will be experience from each potentially sensitive receptor is included in Chapter 11.

8.5.1 Typical visual impact associated with PV energy facilities

The solar power component of the proposed energy generation facility consists of photovoltaic (PV) panels, which grouped together form a ‘solar field’. Each PV panel is a large structure that is typically up to 4m high. The height of these objects will make them visible, especially in the context of a relatively flat landscape (Figure 43).

Figure 43: Photovoltaic Panels being erected near De Aar in the Northern Cape Province

More importantly, the concentration of these panels will make them highly visible, which will depend on the number of panels in each solar field, known as its spatial extent or footprint. Solar fields with a large spatial extent will become a distinctly visible black feature that contrasts with the landscape, especially if the landscape is natural in character or undeveloped (Figure 44). As most solar power energy facilities tend to be located in vacant or uninhabited areas due to space availability, the landscape context is often natural or undeveloped and in this context the solar field could be considered to be a visual intrusion that possibly acts to alter the visual environment.

Figure 44: Photovoltaic Panels being erected near Lime Acres in the Northern Cape Province

In the case of PV energy facilities, taller vegetation such as trees and shrubs will need to be cleared. This practice of clearing vegetation will intensify the visual prominence of the solar energy facility, particularly in natural locations where woody vegetation still exists, but to a lesser degree if the proposed facility is located on land that has already been cleared or where the natural vegetation cover is short.

The infrastructure typically associated with a PV energy facility development will include the following:

- Pole mounted / buried cables to collect the power from the inverter stations; and
- A solar resource measuring station (typically 100m² and 5m high).
- An onsite substation to supply electricity the Eskom grid;
- Overhead power lines to connect the substation to the Eskom grid;
- Buried (where possible) cabling to connect the PV panels to each other;
- Gravel access roads;
- Single story administration buildings;
- Temporary lay down areas required during construction.

The new substation (approximately 150m x 150m) and overhead power lines by their nature are large objects and will typically be visible for great distances. Power lines consist of a series of tall towers thus making them highly visible. Like solar panels, power lines and substations are not features of the natural environment, but are representative of human (anthropogenic) alteration. Thus when placed in largely natural landscapes, they will be perceived to be highly incongruous in this setting. Conversely, the presence of other anthropogenic objects associated with the built environment, especially other power lines or substations, may result in the visual environment being considered to be 'degraded' and thus the introduction of a new power line into this setting may be less of a visual impact than if there was no existing built infrastructure visible.

Other associated infrastructure may also be associated with visual impacts. The solar PV panel arrays are connected to each other in strings, which are likely to be buried, but which also may take the form of above-ground power lines. These cables may become a visual intrusion if placed in areas of the site that are visible to the surrounding areas, especially if located on higher lying areas. A trench dug for the cable (both during construction and post-construction once the trench has become back-filled) may become prominent if it creates a linear feature that contrasts with the surrounding vegetation. A similar principle exists with respect to any access roads constructed in these parts of the site. Roads are likely to be wider than cable trenches and thus could be even more greatly visible than the cable servitude. Cutting a 'terrace' into a slope would increase the visibility and contrast the road against the surrounding vegetation.

Lastly, buildings placed in prominent positions such as on ridge tops may also break the natural skyline, drawing the attention of the viewer.

The visual impact of the other associated infrastructure is however generally not regarded to be a significant factor when compared to the visual impact associated with a PV energy facility. They would however, magnify the visual prominence of the development if located on ridge tops or flat sites in natural settings where there is limited tall wooded vegetation present to conceal the impact.

8.5.2 Sensitive Receptor Impact Rating

In order to assess the impact of the proposed development on the sensitive receptor locations, a matrix that takes into account a number of factors has been developed, and is applied to each receptor location (see Appendix 6E for the specialist visual report).

The matrix has been based on a number of factors as listed below:

- Distance of receptor away from the proposed development (distance banding)
- Primary focus / orientation of the receptor
- Presence of screening factors (topography, vegetation etc.)
- Visual character and sensitivity of the surrounding area
- Visual contrast of the development with the landscape pattern and form

These factors are considered to be the most important factors when assessing the visual impact of a proposed development on a potentially sensitive receptor location in this context. It should be noted that this rating matrix is a relatively simplified way to assign a likely representative visual impact, which allows a number of factors to be considered. Experiencing of visual impacts is however a complex and qualitative phenomenon, and thus difficult to accurately quantify. The matrix should therefore be seen as a representation of the likely visual impact at a receptor location. Part of its limitation lies in the quantitative assessment of what is largely a qualitative or subjective impact.

The tables below present the results of the visual impact matrix.

Table 22: Visual impact of the Helena 3 solar PV energy facility at Klipgat Pan Farmstead

VISUAL FACTOR	RATING
Distance of receptor away from proposed development	**HIGH:** The receptor is located approximately 340m from the proposed Helena 3 development area.
Primary focus / orientation of receptor	**MEDIUM:** The farmhouse is oriented in an easterly direction. The Helena 3 solar PV site will be situated in a north eastern direction from the house. The house is therefore orientated partially towards the PV site. The windows and doors on the southern side of the house are, however, oriented in the opposite direction of the PV development area.
Presence of screening factors	**HIGH:** The very few trees situated at the house will not allow for an adequate amount of screening from the development (Figure 45). The proposed PV facility would therefore be completely visible from large portions of the house and the east facing windows of the farmhouse. No other screening factors are present.
Visual character and sensitivity of the area / surrounding views	**MEDIUM:** Views from the farmhouse are typical of a rural or pastoral environment. Typical pastoral elements include; exotic trees, wire fences, windmills, water tanks and other associated infrastructure such as animal enclosures / kraals. Natural intact Karoo vegetation (low shrub vegetation) is prevalent in the surrounding environment.
Visual Contrast	**MEDIUM:** The surrounding environment is largely natural with a few linear elements present which include a few exotic trees around the house, telephone poles, large Eskom power lines, the Eskom Kronos Substation to the northeast and fence poles. The vegetation is relatively short and appears as a relatively uniform medium shade of grey-green. The PV panels would rise above the natural vegetation, and appear as dark grey mass or 'blanket' contrasting with the relatively uniform flat landscape. It must be noted that a PV facility is currently being built near the Kronos Substation, approximately 4.5km from the house to the north east. In addition, another solar energy facility is proposed to be constructed on an adjacent farm located approximately 4km south east of the house. The presence of these large structures in the area would reduce the visual contrast of the proposed PV energy facility, should they both be constructed.
OVERALL IMPACT RATING	**MEDIUM**

Figure 45: Typical views of the development site from Klipgat Pan Farmstead

Table 23: Visual impact of the Helena 3 solar PV energy facility at Uitspan Pan Farmstead (Frans Eckerd)

VISUAL FACTOR	RATING
Distance of receptor away from proposed development	**LOW:** The receptor is located approximately 3.8km from the proposed Helena 3 development area.
Primary focus / orientation of receptor	**HIGH:** The farmhouse is orientated towards the east. The proposed development will be situated in an eastern direction from the house. The house is therefore orientated directly towards the proposed Helena 3 solar PV development area.
Presence of screening factors	**HIGH:** Very few tress present on the northern and western sides of the house. No screening factors are, however, present on the eastern side of the house which faces the proposed development (Figure 46). Some topographical undulations may however screen views of the development from portions of the farm as is situated reasonably far away.
Visual character and sensitivity of the area / surrounding views	**MEDIUM:** Views from the farmhouse are characteristic of a typical natural or pastoral environment. Rural infrastructure and other anthropogenic elements surrounding the farmhouse include; wire fences, animal enclosures / kraals, windmills, telephone poles, water storage tanks and power lines. The Eskom Kronos Substation can also be found to the north east. Natural intact Karoo vegetation is prevalent in the surrounding environment.
Visual Contrast	**MEDIUM:** The surrounding environment is largely natural with a few linear elements present which include large Eskom power lines, smaller telephone poles and the Eskom Kronos Substation. Where visible the Helena 3 solar PV facility would contrast with the natural earthly tones of

	the prevailing Karoo vegetation by creating a dark grey mass within the relatively uniform flat landscape. It must also be noted that a solar PV facility is currently being constructed near the Kronos Substation to the north east. This PV facility will be located approximately 7km from the farmhouse. In addition, another solar energy facility is proposed to be constructed on an adjacent farm located approximately 7.4km south east of the house. The presence of these large structures in the area would reduce the visual contrast of the proposed PV energy facility, should they both be constructed.
OVERALL IMPACT RATING	**MEDIUM**

Figure 46: Typical view of the development area from the Uitspan Pan Farmstead

Table 24: Visual impact of the Helena 3 solar PV energy facility at Klippan Farmstead (Gerhardus Rudolph)

VISUAL FACTOR	RATING
Distance of receptor away from proposed development	**HIGH:** The receptor is located approximately 50m from the proposed Helena 3 solar PV development area.
Primary focus / orientation of receptor	**HIGH:** The farmhouse is orientated towards the north. The proposed Helena 3 solar PV facility site will be located to the north of the house. This farmstead is therefore orientated directly towards the proposed development. There are some windows and doors that face the southern direction, however the main "stoep" area of the house directly faces the proposed development area.
Presence of screening factors	**HIGH:** No screening factors on the northern side of the house which will successfully block out the views towards the proposed Helena 3 PV facility (Figure 47 and Figure 48). The main "stoep" area of the house directly faces the development and no screening factors are present.

Visual character and sensitivity of the area / surrounding views	**MEDIUM:** Views from the farmhouse are characteristic of a mostly natural environment with typical rural infrastructure present, such as wire fences, a garage building, telephone poles, water storage tanks and a windmill. The natural intact low shrub vegetation characteristic of the Karoo is prevalent in the surrounding environment.
Visual Contrast	**MEDIUM: T**he PV facility would contrast with the natural earthly tones of the prevailing Karoo vegetation by creating a dark grey mass within the relatively uniform flat landscape. The existing Eskom Kronos Substation and associated power lines can be found to the north east. These are relatively large vertical structures within the surrounding landscape. It must also be noted that a solar PV facility is currently being constructed near the Kronos Substation, approximately 4.3km from this farmstead to the northeast. In addition, another solar energy facility is proposed to be constructed on an adjacent farm located approximately 3.5km south east of the house. The presence of these large structures in the area would further reduce the visual contrast of the proposed PV energy facility, should they both be constructed.
OVERALL IMPACT RATING	**HIGH**

Figure 47: Typical view of the development site from Klippan Farmstead

Figure 48: Typical view of the development site from Klippan Farmstead

Table 25Visual impact of the Helena 3 solar PV facility site at Mierdam Farmstead (Coenie Viljoen)

VISUAL FACTOR	RATING
Distance of receptor away from proposed development	**LOW:** The receptor is located approximately 3.3km from the proposed Helena 3 solar PV development area.
Primary focus / orientation of receptor	**LOW:** The farmstead is orientated towards the north east. The proposed PV facility will be located in the north western direction (north north west)

	from the house. This farmhouse is therefore not orientated towards the development. The "stoep" area of the house faces in the south eastern direction, away from the proposed development.
Presence of screening factors	**LOW:** A number of large trees on the western side of the farmhouse will provide a significant amount of screening from the proposed PV facility. The shrubs and trees from the surrounding landscape are also expected to provide a significant amount of screening. In addition, a "koppie" / low-rise to the northwest (on the dirt road which leads to farmstead) will completely block out most views toward the development.
Visual character and sensitivity of the area / surrounding views	**MEDIUM:** The natural intact low shrub vegetation characteristic of the Karoo is prevalent in the surrounding environment. Views from the farmstead are mostly natural with typical rural or farming infrastructure present. Such infrastructure includes wire fences, windmills, telephone poles and existing Eskom power lines. It must be noted that the Eskom Kronos Substation can be found to the north east of the house.
Visual Contrast	**MEDIUM:** There is a high contrast with the pattern and form of the natural landscape elements. The surrounding environment is largely natural with a few linear elements present which include a number of trees around the house, telephone poles, a windmill and fence poles. Large Eskom power lines as well as the Kronos Substation can be found to the north and north east respectively. Where visible the PV panels would rise above the natural vegetation, and appear as dark grey mass or 'blanket' contrasting with the relatively uniform flat landscape. It must also be noted that a PV facility is currently being constructed approximately 5km from the house to the north (near the Eskom Kronos Substation). In addition, another solar energy facility is proposed to be constructed on this farm to the north east of the house. The presence of these large structures in the area would further reduce the visual contrast of the proposed PV energy facility, should they both be constructed.
OVERALL IMPACT RATING	**LOW**

Figure 49: Typical view of the development site from Mierdam Farmstead

Figure 50: Typical view of the development site from Mierdam Farmstead

It should be noted that the landowner of the Klippan Farmstead would benefit financially from the proposed Helena 3 solar PV facility. The impact rating of the development is therefore not regarded as a realistic representation of the actual impact likely to be experienced at the receptor location. The visual impact is likely to be offset by the financial gains.

A summary of the above impact ratings are provided in Table 26below.

Table 26: Visual impact of the proposed Helena 3 solar PV facility on sensitive receptors - summary and results

Receptor Location	**Distance**	**Orientation**	**Screening**	**Character / Sensitivity**	**Contrast**	**OVERALL IMPACT RATING**
Klipgat Pan Farmstead	High (3)	Medium (2)	High (3)	Medium (2)	Medium (2)	**MEDIUM (12)**
Uitspan Pan Farmstead	Low (1)	High (3)	High (3)	Medium (2)	Medium (2)	**MEDIUM (11)**
Klippan Farmstead	High (3)	High (3)	High (3)	Medium (2)	Medium (2)	**HIGH (13)**
Mierdam Farmstead	Low (1)	Low (1)	Low (1)	Medium (2)	Medium (2)	**LOW (7)**

8.5.3 Night-time Impacts

The visual impact of lighting on the nightscape is largely dependent on the existing lighting present in the surrounding area at night. The night scene in areas where there are numerous light sources will be visually degraded by the existing light pollution and therefore additional light sources are unlikely have a significant impact on the nightscape. In contrast, introducing light sources into a relatively dark night sky will impact on the visual quality of the area at night. It is thus important to identify a night-time visual baseline before exploring the potential visual impact of the proposed PV energy facility at night.

The area surrounding the proposed development site is largely uninhabited and as a result, very few light sources are present. The town of Prieska and the small mining town of Copperton are also too far away to have an impact on the night scene. At night, the study area is characterised by a picturesque dark starry sky and the visual character of the night environment is considered to be mostly ‘unpolluted’ and pristine. The most prominent light source within the study area at night is the security lighting at the Eskom Kronos Substation which, according to local farmers, can be seen from at least 7km away. Other sources of light are limited to, isolated lighting from the few surrounding farmsteads.

Security lighting at night will be required for the proposed PV energy facility. The type and intensity of lighting required was unknown at the time of writing this report and therefore the potential impact of the development at night has been discussed based on the general effect that additional light sources will have on the ambiance of the nightscape.

Although the area is not generally renowned as a tourist destination, the natural dark character of the nightscape will be sensitive to the impact of additional lighting at night, particularly from nearby farmhouses. The security lighting required for the proposed project is likely to intrude on the nightscape and create glare, which will contrast with the extremely dark backdrop of the surrounding area.

8.5.4 Visual Impacts of Associated Infrastructure

- Internal roads

A network of gravel access roads will also be constructed to provide access to the PV panels. Roads are typically only associated with a visual impact if they traverse sloping ground on an aspect that is visible to the surrounding area. Considering the flat nature of the terrain on the site, it is likely that the visual impact associated with these roads would be minimal. However, if these roads are not maintained correctly during the construction phase, construction vehicles travelling along the gravel access roads could expose surrounding farmstead to dust plumes.

- Underground cabling

The visual impact of the underground cabling would be very similar to roads in that the ‘scar’ associated with the cable could create a visual contrast with the largely natural vegetation on the site. However, as the PV panels are to be placed on flat terrain and there are no high ridges / high points on the proposed site, the visual impact of the cabling would be minimal. In spite of this it is strongly recommended that all reinstated cable trenches should be re-vegetated with the same vegetation that existed prior to the cable being laid, in order to reduce the potential for creating unnatural linear features in the environment.

- Power Lines

As mentioned above, two (2) alternative route corridors are being assessed to provide grid access from the proposed substation alternatives to the Eskom Kronos Substation (Figure 51). Power line corridor option 1 is aligned to follow the R357 gravel road and power line corridor option 2 is aligned to follow an existing 400kV power line (Figure 52).

Figure 51: View of the existing Eskom Kronos Substation

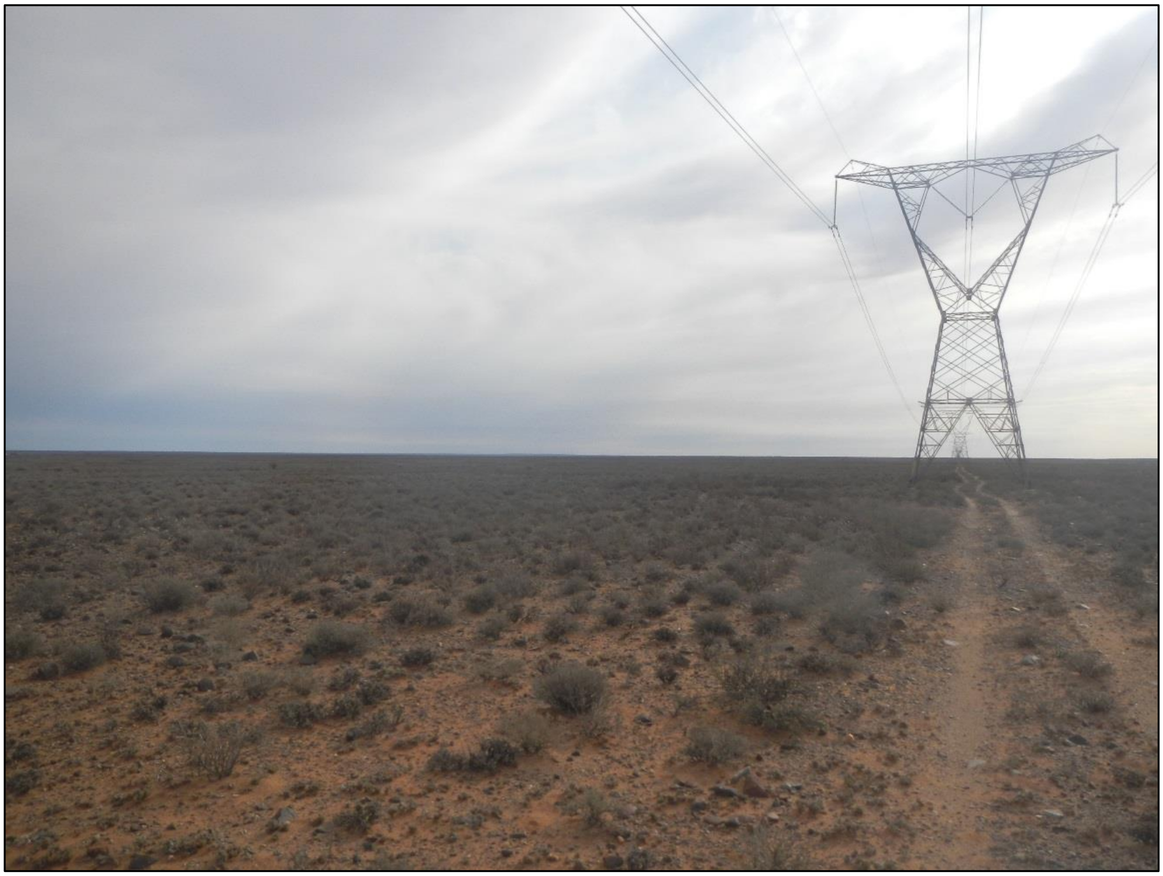

Figure 52: View of the existing power line and servitude which power line corridor option 2 is aligned to follow

Power lines are anthropogenic elements that are typically found in the landscape, both in urban or industrial and in more natural rural settings. The visual impact of a power line would largely be related to the physical characteristics of the area, land use and the spatial distribution of potential receptors. These factors are also important factors used to determine whether a power line would be congruent within an environment as the degree of visual contrast is generally based on the land use, settlement density, visual character and presence of existing power lines. When combining this with the distribution and likely value judgements of visual receptors, the visual impact of the proposed power line can be determined. In areas, where the power line would contrast with the surrounding area it may change the visual character of the landscape and be perceived negatively by visual receptors.

As mentioned above, the presence of other linear structures such as roads, railways and especially other power lines would influence the perception of whether a power line is a visual impact. Where existing power lines are present the visual environment would already be visually 'degraded' and thus the introduction of a new power line in this setting may be considered to be less of a visual impact than if no existing built infrastructure were visible.

The visual impact of the proposed power line alternatives in relation to the physical characteristics, land use, visual character, presence of visual receptors and existing power lines or other infrastructure in the surrounding landscape, are discussed in Table 27 below. These factors have been investigated in order to determine the degree to which the proposed power line alternatives would be visually compatible with the surrounding environment and to determine their overall visual impact.

Table 27: Visual assessment of the proposed power line route corridor alternatives in relation to surrounding environment

Physical and Land Use Characteristics	Visual Character	Visual Contrast	Presence of Visual Receptors	Overall Visual Impact
Topography: The power line would typically be highly visible due to the relatively flat terrain in the area. Localised topographical undulations, would offer minimal visual screening. **Vegetation:** The short nature of the natural shrubland vegetation would offer limited visual screening. **Land use:** The area is mainly used for sheep farming purposes with unimproved natural vegetation prevailing. The power line would contrast within this setting.	The area has a rural or pastoral character visual character. Built infrastructure is limited to isolated farmhouses, gravel access roads, farm boundary fences, several windmills, a high voltage power line which traverse the application site and the Eskom Kronos Substation.	Although the area is largely natural and the prevailing agricultural activities have left the vegetation mostly intact, the presence of the existing 400kV power line within power line corridor option 2 has introduced a distinct linear element into the landscape. As such, the addition of a power line which would either be aligned parallel to this power line (option 2) or be located to the north (option 1) of this power line would contrast moderately with the existing linear elements. The visual contrast would be slightly higher if the power line is constructed within corridor option 1. However the presence of the PV energy facility would lessen the visual contrast.	Potentially sensitive visual receptors within viewing distance (5km) from the power line corridor are limited to approximately four (4) scattered farmsteads. All of these farmsteads are located more than 2km from the power line corridors. From this distance the visibility of the power line would be significantly diminished.	Due to the limited number of visual receptors present within viewing distance from the proposed power line corridors and the fact that the alignments either run parallel to or in close proximity to an existing high voltage power line, the power line would result in a low visual impact.

- Substation

A new substation (approximately 150m x 150m) is being proposed which will supply the generated electricity to the Eskom grid. In isolation, the substations may be considered to be visually intrusive; however, it must be assumed that if the substation would be built to serve the needs of the power generated from the PV energy facility. Thus the substation would only be constructed if the PV energy facility was developed as well. The substations would likely form part of the PV complex, as viewed from the surrounding farmsteads. Views of the substations would therefore be dwarfed by the large number of PV panels that would be visible. As such, the substations are not expected to be associated with a significant visual impact, or even a measurable cumulative impact.

8.6 Heritage

The full Heritage Assessment was conducted by Wouter Fourie from PGS and is included in Appendix 6F.

Fieldwork was conducted from the 22nd to the 24th of July 2015. The methodology focused on a tracked walkthrough of the foot print areas of proposed PV project as well as the two proposed power line corridors from the site to the Kronos substation. An accredited professional archaeologist, Mr Wouter Fourie, completed the fieldwork. All the fieldwork was done on foot and consisted of 60 kilometres of tracked field walking through the proposed development areas.

It must be stressed that the extent of the fieldwork was based on the available field time and was aimed at determining the heritage character of the area.

The fieldwork that covered the Helena 3 Solar site as well as the proposed power line corridors covered approximately 45km in total with an evaluation field of 20 meters for small finds (10 meters either side of the archaeologist) and 100 meters for larger finds such as marked cemeteries and historical structures (50 meters either side of the archaeologist).

A total of a 110 finds were logged of which 13 (9 in proposed power line corridors and 4 in Helena 3 footprint area) can be described as archaeological sites.

The numerous Stone Age artefacts (lithics) occurring over the extent of the area, required a refinement of the methodology and the defining of what constitutes an archaeological site as appose to a find spot.

It was decided to use the density of lithics present on the ground to be the guiding rule towards elaborating on a find spot and defining it as an archaeological site. A find spot was classified as an area containing a density of more than 10 lithics per square meter, while a density of or than 20 lithics per square meter was deemed to be the trigger mechanism for converting a find spot to an archaeological site.

8.6.1 Description of area

The study area and surrounds is characterised by low vegetation growth dispersed over fairly flat terrain. Dominating the surface area are vast exposed pebble layers usually associated with low rises in the landscape. Drainage lines and flat surface are characterised by red sand cover in between the exposed pebble layers.

Figure 53 – General view of southern power line corridor

Figure 54 – General landscape of Helena 3

Figure 55 – Characteristic deflation between pebble scatters

Figure 56 – View of northern corridor alignment with the Kronos substation in background

8.6.2 Find Spots

A total of 97 find spots were marked over the extent of the fieldwork. The find spots were mostly characterised by three types of setting, deflated red sands, and exposed pebble concentrations associated with a calcrete exposure and non-deflated red sand exposures in between low-density vegetation.

The find spots varied from Later Stone Age (LSA) scatters consisting of flakes, chips and some cores manufactured from fine-grained quartzite, chalcedony, and cryptocrystalline (ccs) material; Middle Stones Age (MSA) lithics consisting of cores, chips and flakes with a low occurrence of formal tools. The majority of the material utilised were either lideanite that occur in the form of medium sized boulders or round washed pebbles in the area or coarse-grained quartzite that occur as sporadic outcrops.

Earlier Stone Age (ESA) lithics found at some of these finds spots consisted of hand axes, cleavers and large flakes. Most of the lithics were either rolled or heavily weathered with patination evident on 95% of the lithics.

All these site have a low significance, however the possibility of sub-surface deposits cannot be discounted and was kept in mind with the development of the mitigation recommendations.

Mitigation:

- The final alignment and pylon positions of the power line needs to be walked down and heritage features demarcated;
- Where required the sites identified during the walkdown will then need mitigation measures developed that will need to be completed before construction can commence;
- Such mitigation measures will require a permit from SAHRA before mitigation can be done as well as a final destruction permit on completion of the mitigation work.

Due to the large amount of Stone Age material present on site it is recommended that an archaeologist be appointed to monitor construction activity as part of a watching brief. The aim being the identification and mitigation of any newly discovered sites.

Figure 57 – Heavily weathered ESA material

Figure 58 – MSA lithics (jasper, silcrete and quartzite)

Figure 59 – Backed flake with retouch (jasper)

Figure 60 – Heavily weathered ESA lithics (radial core: top)

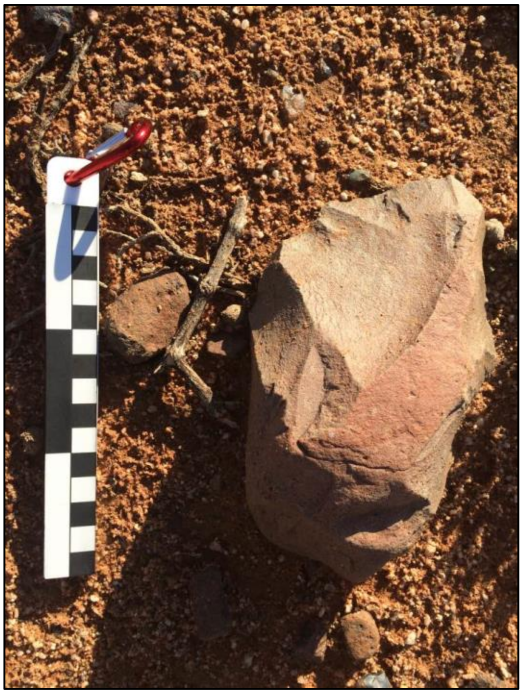

Figure 61 – ESA core with flaking scars (silcrete)

Figure 62 – MSA flakes and cores (silcrete and fine-grained quartzite)

Figure 63 – MSA flakes and cores (silcrete and fine-grained quartzite)

Figure 64 – Late ESA lithic (quartzite)

8.6.3 Sites

During the fieldwork 13 archaeological sites were identified (Table 28 and Table 29). Refer to the heritage specialist report for distribution map

Table 28: Sites – Power line corridor

Site number	Type	Longitude	Latitude	Description	Heritage Significance	Alternative
001-004	MSA site	22.33514	-30.02119	Medium density scatter of ESA and MSA lithics over an area of approximately 20 $m^{2.}$ The site is characterised by a large pebble concentration. The lithics assemblage is characterised by a large number of flakes and chips, while a small percentage of the material on site can be described as cores.	Grade 3C	**Northern Alignment**
014	ESA/MSA site	22.32953	-30.02752	Medium density scatter of heavily weathered (rolled) ESA artefact. The site is characterised by low vegetation growth and a red soil matrix with little or no pebble deposit. Site size is approximately 5 m^2.	Grade 3C	**Northern Alignment**
016	ESA site	22.32890	-30.02798	Medium density scatter of heavily weathered (rolled) ESA artefact. The site is characterised by low vegetation growth and a red soil matrix with little or no pebble deposit. Site size is approximately 10 m^2. Most of the material utilised is coarse-grained quartzite.	Grade 3C	**Northern Alignment**
017	Structure	22.32866	-30.02785	Site is characterised b y a small stone packed pile. No associated artefacts could be seen. The possibility does exist that it could be a Stone Age grave.	Grade 3C	**Northern Alignment**
029	ESA/MSA site	22.30943	-30.02943	The site is situated in a deflated area of approximately $50m^2$. The site consists of a medium density scatter of heavily weathered ESA cores and hand axes. A few	Grade 3C	**Northern Alignment**

Site number	Type	Longitude	Latitude	Description	Heritage Significance	Alternative
				MSA silcrete cores and flakes also occur in the deflation.		
032	MSA site	22.30197	-30.03105	The site is situated in a deflated area of approximately 20m2. The site consists of a medium density scatter of MSA silcrete and quartzite cores with a low density of flakes in the deflation.	Grade 3C	**Northern Alignment**
036	MSA site	22.30114	-30.02586	The site is situated in a deflated area of approximately 40m2. The site consists of a medium density scatter of predominantly MSA flakes. Some of the flakes do show traces of usage and retouch.	Grade 3C	**Northern Alignment**
037a and b	MSA site	22.30147	-30.02546	The site is situated in a deflated area of approximately 40m2. The site consists of a medium density scatter of predominantly MSA flakes. Some of the flakes do show traces of usage and retouch.	Grade 3C	**Northern Alignment**
045	MSA site	22.29749,	-30.02695	Site can be described as knapping site, characterised by a large number of flakes and chips as well as large quartzite cores occurring around the site. The site is however small not more than $5m^2$.	Grade 3	**Northern Alignment**

Mitigation:

- The final alignment and pylon positions of the power line needs to be walked down and heritage features demarcated;
- Where required the sites identified during the walkdown will then need mitigation measures developed that will need to be completed before construction can commence;
- Such mitigation measures will require a permit from SAHRA before mitigation can be done as well as a final destruction permit on completion of the mitigation work.

Figure 65 – MSA flakes and cores (silcrete and fine-grained quartzite)

Figure 66 –Stone structure at site 017

Figure 67 –ESA site 018

Figure 68 – ESA lithics in situ

Figure 69 – Worked material at site 045

Table 29: Sites – Helena 3 Solar footprint

Site number	Type	Longitude	Latitude	Description	Heritage Significance	Alternative
085	MSA site	22.28661	-30.03999	Medium density scatter of MSA and LSA lithics over an area of approximately 20 m2. The lithics assemblage is characterised by a large number of flakes and chips of CCS and quartzite, while a small percentage of the material on site can be described as cores.	Grade 3B	**PV footprint area**
092-093	MSA site	22.29413	-30.04238	Medium density scatter of MSA lithics over an area of approximately 20 m2. The lithics assemblage is characterised by a large number of flakes, blades and some retouch, chips of CCS and quartzite, while a small percentage of the material on site can be described as cores. The rest of the MSA site is characterised by a quartzite outcrop with defined utilisation scaring on it.	Grade 3B	**PV footprint area**
095	Historic	22.28941	-30.04638	Low density scatter of historic artefacts including glass pieces, porcelain, metal objects such as fish cans	Grade 4A	**PV footprint area**
100	Structure	22.28678	-30.04845	A stone cluster occurs in this area. Can possibly be a grave?	Provisional Grade 4 B	**PV footprint area**

Mitigation:

- All sites will require mitigation work before construction can commence;
- The mitigation work will be at a minimum:
  - a controlled surface collection of the material;
  - excavation should be considered at 092-093:
  - analysis of material and final report;
- Such mitigation measures will require a permit from SAHRA before mitigation can be done as well as a final destruction permit on completion of the mitigation work.

Figure 70 – View of pan at site 085 toward the east

Figure 73 – View of pan at site 085 toward the east

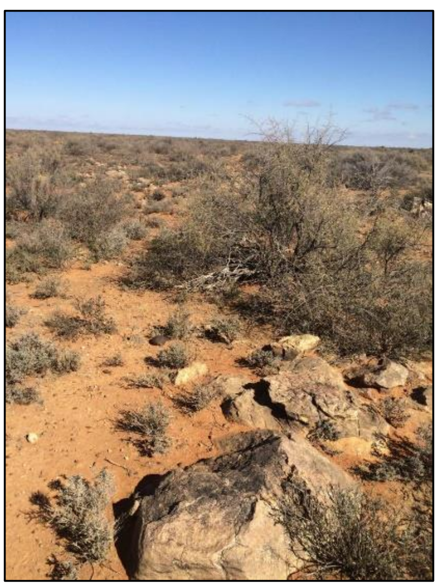

Figure 71 – View of pan at site 093 toward the east

Figure 74 – MSA material associated with the site 085

Figure 72 – Historic artefacts present at site 95

Figure 75 – Stone cluster at site 100

8.7 Socio Economic

The full Social Assessment was conducted by Elena Broughton from Urban Econ Development Economists and is included in Appendix 6G.

The analysis of the expected impacts from the construction and operational phases of the development of the proposed project are presented in the following paragraphs. The assessment covers a number of aspects including the impact on production, GDP, employment, household income, and government revenue of the local and regional economies. It includes the assessment of both positive and potential negative economic impacts.

8.7.1 Construction Phase

- Temporary increase in production

One of the most important objectives of the South African government is to enhance local manufacturing through the REIPP. The programme obliges bidders to meet varying minimum local content requirements depending on the technology with a threshold of 45% set for solar PV projects.

During the construction phase, the demand for necessary goods, services, and materials will induce production amongst the supporting industries and their supply value chains. Total local expenditure during the development phase is estimated to be about R675 million which represents the direct impact of the proposed project on the economy. Therefore, the development of the solar PV facility will have a positive impact on the regional, as well as the national economy. The direct impact will be wholly absorbed by the construction sector through companies that will be directly involved in the construction activities, i.e. construction contractors and engineering firms.

Based on experience and knowledge of other solar PV studies undertaken by Urban-Econ, it is envisaged that a significant portion of new business sales in the economy during construction will be stimulated though indirect effects or production-induced effects, i.e. by companies that will be supplying inputs and services to the contractors and engineering firms operating on site. Aside from the building and construction sector that will benefit from sub-contracting activities, the manufacturing sector will also benefit from the development of the solar PV facility.

In addition to the direct and indirect impacts resulting from the initial capital investment, construction of the solar PV facility will result in significant consumption induced increases in new business sales. Construction activities will lead to the creation of new temporary employment opportunities through both direct and indirect effects which will in turn increase the household income and consequently stimulate sales in a variety of sectors through household consumption. Considering the distribution of consumption induced impacts, the manufacturing industry, real estate, trade, and transport will be the biggest beneficiaries from the temporary increase in household spending. Although the majority of new business sales stimulated through consumption induced effects will be distributed throughout the country, some of it will be captured in the local economy (within the Siyathemba LM) and will most likely benefit businesses within the tertiary sectors such as trade, transport, and personal services.

- Temporary increase in GDP-R

A country's gross domestic product (GDP) is the total value of all "final" goods and services, which were produced within the borders of the country, during a year. Most of the investment activities in the country are associated with a value-adding activity, which has a positive impact on the Gross Domestic Product per Region (GDP-R). The capital investment into the establishment of the proposed solar PV facility will generate some value added. Again, increase in employment will lead to increase in household income and consequently result in an increase of household consumption and expenditure on goods and services. This will result in an increase in GDP-R in the country due to consumption induced effects in addition to the direct and indirect impacts. Sectors that will experience the largest temporary growth in value added as a result of this investment will include the manufacturing industry, as well as the trade, transport, finance, and business services sectors.

- Temporary increase in employment

The establishment of the solar PV facility is expected to create, at minimum, 129 skilled and unskilled jobs over the construction period. It is not possible to state at this stage of the development where the workers will come from; however, it can be expected that a relatively notable share will come from the immediate and surrounding areas, i.e. from within the Northern Cape Province. Besides the employment that will be temporarily created by the construction of the facility directly, an increase in labour demand as a result of production and consumption induced effects is also expected.

According Census 2011 data, the Siyathemba LM had 1 757 unemployed individuals in 2011. It is envisaged that about 80% job opportunities may be made available to individuals from within the municipality. This means that the project could have the potential to reduce unemployment in the municipality by about 6% for a temporary period provided that the local unemployed individuals will be suitable and willing to work on site.

It is expected that the sectors with the largest expected growth in temporary employment during the construction period will be the construction and manufacturing industries.

- Impact on skills development

The construction of the proposed solar PV facility will require general construction experience as well as expert knowledge. It is expected that where specialist training can be provided, candidates from local communities will be trained. People involved in the project will have opportunities to further perfect and develop the skills within their own fields of expertise or acquire new skills. This could particularly be relevant to the unskilled and semi-skilled people engaged in the construction.

The creation of jobs through indirect and induced effects, although for a short-term, will create another opportunity for people to develop and acquire new skills. Given that the impact during construction will affect almost all sectors, although at different levels, it could be argued that the project will stimulate the creation of a comprehensive set of new skills in the country. Most importantly, unlike employment opportunities during construction, skills developed during that period will not expire once the phase is complete. Thus, the impact on skills development is much more sustainable and has a positive impact on the employability of the affected people. This means that although employment will be temporary, people benefiting from skills developed during that employment will have a far greater chance of finding permanent jobs than they had before the project.

- Temporary increase in household income

Given the temporary increase in production levels across the country as well as the increase in temporary employment, a temporary growth in household income is expected. This increase in household income, although temporarily, will result in an increase in the standard of living of the benefitting households. It is essential to keep in mind that this impact is of a temporary nature and it will not be sustained once the facility has been established. Since some of these construction workers will be recruited from outside the area, not all of that spending will be realised in the local community and nearby towns.

In addition to the direct impact on household income, individuals who obtain jobs through indirect and induced effects of the construction activities will also experience growth in their income levels and consequently, more households in the province and other parts of the country will also benefit.

- Increase in government revenue

The construction phase of the proposed project will last for about 18 to 21 months. During this period, the construction company and the workers will earn income and pay government taxes including income taxes and payroll taxes. Although the spending of this money by government is difficult to associate with a specific budget item, any revenue received by government is allocated towards certain budget items, provinces, or local municipalities to support and assist with improvement of their service delivery. Thus, without doubt this revenue would be spent on improving socio-economic conditions of the population in some way.

- Impact on balance of payment

The balance of payments can be described as a summary of all economic transactions between South Africa and all other countries in the world. Two sections make up the balance of payments, namely the current account and the capital account whereby the former refers to trade in the form of export and imports whereas the latter refers to Foreign Direct Investment (FDI), Investment Portfolio, and other investments which reflect on national accounts.

The establishment of the Helena 3 Solar PV facility will require an investment of approximately R1 500 million, of which about 55% or R825 million will be spent on imported goods and services. Expenditure on imported goods can be regarded as a leakage of money from the national economy, which has a negative impact on the trade balance. Any purchase of imported goods and services in South Africa is accounted for in the Current Account as either ‘merchandise imports” or “payments for services”. Thus, the R825 million that is expected to be spent on imported goods will be accounted under “merchandise imports”.

Over the last decade, South Africa’s trade balance has been at a deficit. Between 2007 and 2014, the deficit fluctuated between 1.5% and 5.8% of the GDP (SARB, 2015). It reached the lowest level in 2010 (1.5% of GDP), which could be associated with the increase in demand for South Africa’s goods and services due to the shift in global trade patterns following the global financial crisis in 2009, and increase in travel receipts from South Africa hosting 2010 FIFA World Cup™. Thus the need to import materials, equipment, and services required for the construction of the PV facility would most likely increase the trade deficit in the country. However, the effect will be temporary since the construction period is only about two years. Importantly, though, is that the amount is not significant to have any notable negative effect on macro-economic indicators and government policy.

The negative effect of the balance of payment during the construction period will be negligible. Moreover, a negative balance of payments in a developing economy such as South Africa is generally acceptable as the economy needs to borrow money to allow it to invest in infrastructure, people, and businesses that which will further stimulate economic growth. Care, though, should be taken to ensure that the current account deficit does not grow beyond the means of the country to service its debt.

Mitigations thereof are possible, but only if goods and services required for the establishment of the project can be procured locally at a competitive price.

- Potential loss of agricultural land

Activities such as the establishment of access roads, the movement of heavy vehicles, the establishment of lay-down areas and foundations, as well as the establishment of the substation and permanent administration building would potentially damage topsoil and vegetation. The footprint of the project considering the proposed layout will directly affect two farms. One farm is currently being used for private sheep farming, while there are no agricultural activities currently taking place on the other farm. It is assumed that all agricultural activities currently underway at the proposed site will be halted once construction begins.

Since the farms are not being used for commercial agricultural purposes, there will be no significant or meaningful income and employment losses incurred as a result of the construction of the proposed facility.

- Increased pressure on basic services and social and economic infrastructure

The construction of the solar PV facility will put some pressure on both economic and social infrastructure in the local economy, particularly given the fact that many of the workforce involved in the development would be coming from outside Copperton.

The construction activities will increase the traffic along the R357 road, which could lead to the deterioration of the road infrastructure and require greater expenditure on road maintenance by the municipality. Although the situation regarding access to services in the area appears to be well managed, influx of people to the area and employment of construction workers from outside the local communities will put a strain on the housing and accommodation situation, basic service provision and health facilities during the construction period. Proper mitigation measures need to be put in place to minimise the impact on infrastructure and to ensure that increased pressure does not lead to the deterioration of infrastructure which could reduce the standard of living of the entire community.

- Increase in social pathologies associated with influx of migrant labourers and job seekers to the area (health, crime, prostitution, xenophobia, etc.)

The local area is not sufficiently diversified to provide all skills and workers necessary during construction. The area may thus experience an influx of migrant labourers who may move to the area looking for employment opportunities. The influx of job seekers and migrant construction workers is expected to create social disturbances and conflicts in the local economy, amongst which include crime (stock theft, burglaries, assaults, etc.), and adverse health impacts around the site and elsewhere in the community. The significance of such impacts depends to some extent on the proportion of workers that are recruited from outside the local community.

The findings of this study indicate that the proposed site is located in a sparsely populated rural area with major towns located many kilometres away. There overall numbers of labourers on adjacent farms is small. Given the site lay-out, it appears that no construction camp will be established on the site. The potential for adverse impacts on the relevant rural community is therefore, not rated as significant.

Provided that the stated 80% local recruitment target is met or closely approached, the bulk of construction workers would be from within the Siyathemba LM, particularly Prieska. Given existing skills levels, the majority of the employment opportunities are likely to be filled by semi- and low-skilled workers. Potential social impacts associated with construction workers are usually associated with low-skilled workers, and not the more skilled workers. The fact that the bulk of low skilled workers would potentially be from the local community itself would therefore, serve to neutralise potential impacts as these workers form part of the local social network. It is therefore, unlikely that the remaining fraction of workers recruited from outside the local community will pose a significant risk to the local community.

8.7.2 Operational Phase

- Sustainable increase in production

Based on production assumptions made, once operational the proposed facility is expected to generate an annual turnover of R50 million. In addition to the new business sales created each year directly attributable to the proposed project, new business sales will also be generated as a result of indirect and induced effects. However, due to the fact that operational expenditure for the facility is generally small, multiplier effects are expected to be limited and thus the indirect and induced effects stimulated by spending on operations are not expected to be of a significant amount

Given that the Siyathaemba LM's economy is quite small (R796 million in current prices) and relatively undiversified it is reasonable to assume that a significant portion of the inputs required will be procured from outside, which means that other local economies in the country will benefit from these expenses. With regard to sectoral benefits, it can be expected that the utilities sector will be the biggest beneficiary. It is also envisaged that local businesses involved in sectors such as manufacturing and financial and business services will experience some increase in annual turnover. Nationwide, industries expected to benefit the most from production induced or indirect impacts include the insurance, business activity, and transport industries; while increased consumer spending as a result of increased household income will benefit agriculture, trade, real estate, and health and social services.

- Sustainable increase in GDP-R

New business sales generated through direct and spin-off effects of operations at the facility will generate value added for the national economy. A significant portion of value added will be created directly by the PV facility operations. The rest will be created through production and consumption induced impacts. Similar to the impact on production, the utilities sector will be the sole beneficiary of the direct value added. In addition, it is expected that the biggest overall stimulus will be experienced by the community and government service, business services, transport, and trade and accommodation sectors.

In 2013, the Siyathemba LM's economy was valued at R796 million. Considering the expected revenue, the project's value added would most likely range between R30 million and R40 million per annum. Assuming that the facility's GDP will be accounted in the local municipality, it will increase the local economy by about 5%. Based on the baseline analysis, the Siyathemba LM's economy is dominated by the tertiary sector with the agricultural sector also playing an important role. It can therefore, be argued that the proposed project will assist in diversifying the local municipality's economy.

Some of the production and consumption induced impacts may also be retained in the Siyathemba LM, suggesting that the facility will benefit the local economy not only through direct impact, but also through the multiplier effect. Importantly, the greater the value of goods and services procured by the mine during its operations from the local economy, the greater the overall economic benefit for the local municipality.

- Impact on employment

The facility will create about 43 skilled and unskilled sustainable employment opportunities per annum. The creation of the unskilled and semi-skilled jobs will provide opportunities for the unemployed people in the local communities to acquire a sustainable source of income and potentially develop skills. This means that the proposed facility will be able to reduce the current unemployment level in the Siyathemba LM, albeit by a small percentage. This positive impact though, will be retained for the entire duration of operational activities at the mine.

Besides the employment opportunities created at the facility itself, the project will stimulate the creation of additional jobs throughout the economy through production and consumption induced impacts. The jobs supported by the solar PV facility operation through the multiplier impact will be distributed among various economic sectors particularly agriculture, utilities, financial and business services, manufacturing and community services sectors.

- Impact on skills development

Establishing and operating the plant will result in improved skills amongst the staff if the facility includes a skills development component. On-the-job training is also a key element of the staff development; many of the required skills during the operational phase will be taught to staff through day-to-day operations. It should, however, be noted that most of the jobs required to support operations of the plant are unskilled and semi-skilled jobs that do not present significant opportunities for skills transfer (i.e. panel cleaners and security personnel).

- Increase in household income

The creation of employment opportunities in each year of operation of the Helena 3 facility will positively impact on household income levels and allow these households to improve their standard of living. Furthermore, persons who obtain jobs as an indirect result of the facility's operations will experience growth in their income levels and consequently, more households in the province and other parts of the country will also benefit.

A household in the Siyathemba LM earns on average R6 858 per month with 15% of the households having no income at all. From income data obtained in the 2011 Census approximately 39.4% of the households would qualify as indigent in the local municipality. This means that about four in every ten households are unable to afford basic services such as water, basic sanitation, basic energy, health care, housing, food and clothing. The increase in the local tax base will improve this scenario, leading to the positive effect of the increased employment on living standards of community members being enjoyed by more than just those able to obtain employment at the facility.

- Increase in government revenue

Operations at the facility will contribute to government revenue collection through direct, indirect and payroll taxes during the operational phase. Although the spending of this money by government is difficult to associate with a specific budget item, any revenue received by government is allocated towards certain budget items, provinces or local municipalities to support and assist with improvement of their service delivery. Thus, without doubt, this revenue would be spent on improving socio-economic conditions of the population in some way.

- Investment in the local communities and economic development projects

Any renewable energy project approved by government will need to allocate a certain percentage of its revenue towards socio-economic (SED) and enterprise (ED) development activities in the local communities. The aim is to ensure that the proposed project will contribute to the sustainable development and upliftment of the communities located within a 50 km radius of the proposed site. RE IPPP bidders are required to commit at least 1% of the total revenue earned by each project to be spent on identified socio-economic development initiatives, and at least 0.6% on enterprise development. Given the expected revenue to be generated by the PV facility, the potential benefits of the local communities on an annual basis could amount to R0.8 million on an annual basis for the next 20 years. Proper investigation and planning would allow directing these funds to address the most pertinent challenges faced by the communities, which could substantially improve their livelihoods and standard of living.

- Impact on sense of place

The largest alteration during the operational phase with regard to the sense of place will be through visual impact. However, few people reside in the area and little economic activity is taking place around the development site therefore it is expected that the visual impact will be of little significance.

As mentioned previously, the interviews with the land-owners and residents in the area revealed that they strongly support the proposed solar PV project being built in the area. The land-owners and residents in the area are willing to sacrifice the change in the sense of place that could be brought by the establishment of a PV facility, suggesting that they do not foresee the impact to be of notable significance but rather focus on the benefits of the project for the community. While not a strong concern for the community at present, it is advisable that all efforts be made to address the drivers to the change of the sense of place, such as visual effects, noise, and night illumination to make them less intrusive.

9 ENVIRONMENTAL IMPACT ASSESSMENT

9.1 Methodology for Impact Assessment

The EIA Methodology assists in evaluating the overall effect of a proposed activity on the environment. The determination of the effect of an environmental impact on an environmental parameter is determined through a systematic analysis of the various components of the impact. This is undertaken using information that is available to the environmental practitioner through the process of the environmental impact assessment. The impact evaluation of predicted impacts was undertaken through an assessment of the significance of the impacts.

9.1.1 Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics which include context and intensity of an impact. Context refers to the geographical scale i.e. site, local, national or global whereas Intensity is defined by the severity of the impact e.g. the magnitude of deviation from background conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence. Significance is calculated as shown in Table 31.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

9.1.2 Impact Rating System

Impact assessment must take account of the nature, scale and duration of effects on the environment whether such effects are positive (beneficial) or negative (detrimental). Each issue / impact is also assessed according to the project stages:

- Planning
- Construction
- Operation
- Decommissioning

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance has also been included.

- Rating System Used To Classify Impacts

The rating system is applied to the potential impact on the receiving environment and includes an objective evaluation of the mitigation of the impact. Impacts have been consolidated into one rating. In assessing the significance of each issue the following criteria (including an allocated point system) is used:

Table 30: Description

NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
1	Site	The impact will only affect the site
2	Local/district	Will affect the local area or district

3	Province/region	Will affect the entire province or region
4	International and National	Will affect the entire country
PROBABILITY		
This describes the chance of occurrence of an impact		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
REVERSIBILITY		
This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.
DURATION		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity		

1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts on the environmental parameter. A cumulative effect/impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible Cumulative Impact	The impact would result in negligible to no cumulative effects
2	Low Cumulative Impact	The impact would result in insignificant cumulative effects
3	Medium Cumulative impact	The impact would result in minor cumulative effects
4	High Cumulative Impact	The impact would result in significant cumulative effects
INTENSITY/ MAGNITUDE		
Describes the severity of an impact		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).

3	High	Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.

SIGNIFICANCE

Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula:

(Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.

The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.

Points	**Impact Significance Rating**	**Description**
6 to 28	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive Low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive Medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive High impact	The anticipated impact will have significant positive effects.

74 to 96	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive Very high impact	The anticipated impact will have highly significant positive effects.

Table 31: Rating of impacts

IMPACT TABLE FORMAT		
Environmental Parameter	A brief description of the environmental aspect likely to be affected by the proposed activity e.g. Surface water	
Issue/Impact/Environmental Effect/Nature	A brief description of the nature of the impact that is likely to affect the environmental aspect as a result of the proposed activity e.g. alteration of aquatic biota The environmental impact that is likely to positively or negatively affect the environment as a result of the proposed activity e.g. oil spill in surface water	
Extent	A brief description indicating the chances of the impact occurring	
Probability	A brief description of the ability of the environmental components recovery after a disturbance as a result of the proposed activity	
Reversibility	A brief description of the environmental aspect likely to be affected by the proposed activity e.g. Surface water	
Irreplaceable loss of resources	A brief description of the degree in which irreplaceable resources are likely to be lost	
Duration	A brief description of the amount of time the proposed activity is likely to take to its completion	
Cumulative effect	A brief description of whether the impact will be exacerbated as a result of the proposed activity	
Intensity/magnitude	A brief description of whether the impact has the ability to alter the functionality or quality of a system permanently or temporarily	
Significance Rating	A brief description of the importance of an impact which in turn dictates the level of mitigation required	
	Pre-mitigation impact rating	**Post mitigation impact rating**
	Pre-mitigation impact rating	
Extent	1	4
Probability	1	4
Reversibility	1	4

IMPACT TABLE FORMAT		
Irreplaceable loss	1	4
Duration	1	4
Cumulative effect	1	4
Intensity/magnitude	2	2
Significance rating	-12 (low negative)	-48 (medium negative)
Mitigation measures	*Outline/explain the mitigation measures to be undertaken to ameliorate the impacts that are likely to arise from the proposed activity. Describe how the mitigation measures have reduced/enhanced the impact with relevance to the impact criteria used in analysing the significance. These measures will be detailed in the EMP.*	

The 2010 regulations also specify that alternatives must be compared in terms of impact assessment.

9.2 Environmental Impact Assessment

9.2.1 Biodiversity

- Planning

No impacts are expected during planning.

- Construction

Table 32: Rating of impacts on indigenous natural vegetation for solar array, laydown area, buildings, on-site substation (both options) & internal roads (both options).during construction

IMPACT TABLE	
Environmental parameter	Indigenous natural vegetation
Issue/Impact/Environmental Effect/Nature	Loss, degradation or fragmentation of vegetation.
Extent	The impact will affect natural vegetation on site and possibly in immediately surrounding areas.
Probability	The impact will definitely happen.
Reversibility	Irreversible in human timeframes, since natural successional processes cannot compensate for complete local loss of habitat and diversity. Secondary vegetation will probably never resemble the original vegetation found on site.

Irreplaceable loss of resources	Significant loss of resources will occur.	
Duration	The impact will be permanent (mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient.)	
Cumulative effect	Medium cumulative impact. Added to existing impacts on natural habitat, the current project will cause additional loss of vegetation.	
Intensity/magnitude	Medium. Regional vegetation will continue to function.	
Significance rating	Medium negative impact expected.	
	Pre-mitigation impact rating	**Post-mitigation impact rating**
Extent	1	1
Probability	4	4
Reversibility	4	4
Irreplaceable loss	3	3
Duration	4	4
Cumulative effect	2	2
Intensity/magnitude	2	2
Significance rating	-36 (medium negative)	-36 (medium negative)
Mitigation measures	The following mitigation measures would help to limit impacts: ▪ Compile a rehabilitation programme. ▪ Compile an Alien Plant Management Plan, including monitoring, to ensure minimal impacts on surrounding areas.	

Table 33: Rating of impacts on indigenous natural vegetation for power lines (both options).during construction

IMPACT TABLE	
Environmental parameter	Indigenous natural vegetation
Issue/Impact/Environmental Effect/Nature	Loss, degradation or fragmentation of vegetation.
Extent	The impact will affect natural vegetation on site and possibly in immediately surrounding areas.
Probability	The impact will definitely happen.
Reversibility	Partly reversible, since natural successional processes will compensate for localized loss of habitat.

Irreplaceable loss of resources	Marginal loss of resources will occur.	
Duration	The impact will be medium-term (natural ecological successional processes could restore some vegetation that was lost).	
Cumulative effect	Low cumulative impact. Added to existing impacts on natural habitat, the current project will cause additional loss of vegetation, but not to a significant extent.	
Intensity/magnitude	Medium. Regional vegetation will continue to function.	
Significance rating	Medium negative impact expected.	
	Pre-mitigation impact rating	**Post-mitigation impact rating**
Extent	1	1
Probability	4	4
Reversibility	2	2
Irreplaceable loss	2	2
Duration	2	2
Cumulative effect	2	1
Intensity/magnitude	2	2
Significance rating	-26 (low negative)	-24 (low negative)
Mitigation measures	The following mitigation measures would help to limit impacts: 1. Avoid patches of indigenous vegetation if possible, or place infrastructure as close as possible to boundaries. 2. Compile a rehabilitation programme. 3. Compile an Alien Plant Management Plan.	

Table 34: Rating of impacts on protected plant species for all infrastructural components during construction

IMPACT TABLE	
Environmental parameter	Protected plants, as per NEM:BA and Northern Cape Nature Conservation Act.
Issue/Impact/Environmental Effect/Nature	Loss of individuals.
Extent	The impact will affect local populations or individuals of the affected species.
Probability	The impact may possibly happen.
Reversibility	Partly reversible. Individuals can be rescued or else cultivated to replace lost specimens.

Irreplaceable loss of resources	Marginal loss of resources could occur. The species that are likely to occur on site are likely to be relatively common throughout their range.	
Duration	The impact will be medium-term.	
Cumulative effect	Low cumulative impact. Cumulative effects will not be significant.	
Intensity/magnitude	Low. Loss of some individuals will be insignificant compared to the number that probably occur in surrounding areas.	
Significance rating	Low negative impact expected.	
	Pre-mitigation impact rating	**Post-mitigation impact rating**
Extent	1	1
Probability	2	2
Reversibility	2	2
Irreplaceable loss	2	1
Duration	2	2
Cumulative effect	2	1
Intensity/magnitude	1	1
Significance rating	-11 (low negative)	-9 (low negative)
Mitigation measures	It is a legal requirement to obtain permits for specimens that will be lost. A pre-construction walk-through survey will be required during a more favourable season to locate any protected plants. Plants lost to the development can be rescued and planted in appropriate places in surrounding areas, where possible. This will reduce the irreplaceable loss of resources as well as the cumulative effect.	

Table 35: Rating of impacts on drainage areas for solar array and internal roads (both options).

IMPACT TABLE	
Environmental parameter	Drainage Areas
Issue/Impact/Environmental Effect/Nature	Loss, degradation or fragmentation of vegetation.
Extent	The impact will affect small drainage areas on site.
Probability	The impact will definitely happen
Reversibility	Irreversible in human timeframes, since natural successional processes cannot compensate for complete local loss of

	habitat and diversity. Secondary vegetation will probably never resemble the original vegetation found on site.	
Irreplaceable loss of resources	Marginal loss of resources will occur.	
Duration	The impact will be permanent (mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient.)	
Cumulative effect	Medium cumulative impact. Added to existing impacts on natural habitat, the current project will cause additional loss of habitat.	
Intensity/magnitude	Medium. Wetland systems will probably continue to function, but in a modified way.	
Significance rating	Medium negative impact expected.	
	Pre-mitigation impact rating	**Post-mitigation impact rating**
Extent	1	1
Probability	4	2
Reversibility	4	2
Irreplaceable loss	2	2
Duration	4	2
Cumulative effect	2	1
Intensity/magnitude	2	1
Significance rating	-30 (medium negative)	-10 (low negative)
Mitigation measures	The following mitigation measures would help to limit impacts: 1. Avoid placing infrastructure within drainage area and buffer area of at least 30 m. 2. Prevent erosion impacts on wetland systems. 3. Rehabilitate disturbance as quickly as possible. 4. Prevent invasion by alien plants. 5. Undertake monitoring to evaluate whether further measures would be required to manage impacts.	

- Operation

Table 36: Rating of impacts of mortality of individuals due to collisions with power lines during operation

IMPACT TABLE	
Environmental Parameter	Threatened bird species
Issue/Impact/Environmental Effect/Nature	Loss of individuals.

Extent	The impact will affect individuals on site and possibly in immediately surrounding areas.	
Probability	The impact may possibly happen.	
Reversibility	Partly reversible. Preventative measures could reduce mortality to below replacement levels.	
Irreplaceable loss of resources	Marginal loss of resources will occur.	
Duration	The impact will be long-term.	
Cumulative effect	Medium cumulative impact. Cumulative effects will be minor.	
Intensity/magnitude	Medium. May impact on population processes.	
Significance Rating	Low negative impact expected.	
	Pre-mitigation impact rating	**Post-mitigation impact rating**
Extent	1	1
Probability	2	1
Reversibility	2	2
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	3	2
Intensity/magnitude	2	1
Significance rating	-26 (low negative)	-11 (low negative)
Mitigation measures	Visibility devices could be placed on overhead power lines, if necessary. This will reduce the probability slightly, but not to an extent that it will change the impact rating scores. The mitigation measure is therefore not required unless monitoring identifies this as an issue during operation.	

Table 37: Rating of impacts of establishment and spread of declared weeds and alien invader plants during operation

IMPACT TABLE	
Environmental parameter	Vegetation and habitat
Issue/Impact/Environmental Effect/Nature	Loss of habitat due to invasion by alien plants
Extent	The impact will affect habitat on site and possibly in immediately surrounding areas.
Probability	The impact will probably happen in the absence of control measures.

Reversibility	Partly reversible in the absence of control measures. Completely reversible if mitigation measures applied. Preventative measures will stop the impact from occurring.	
Irreplaceable loss of resources	Marginal to significant loss of resources will occur. Uncontrolled invasion can affect all nearby natural habitats.	
Duration	The impact will be long-term.	
Cumulative effect	Low cumulative impact. Cumulative effects will not be significant.	
Intensity/magnitude	Medium. Severe invasion can alter the functioning of natural ecosystems.	
Significance rating	Low negative impact expected.	
	Pre-mitigation impact rating	**Post-mitigation impact rating**
Extent	1	1
Probability	3	2
Reversibility	2	1
Irreplaceable loss	3	2
Duration	3	3
Cumulative effect	2	2
Intensity/magnitude	2	1
Significance rating	-28 (medium negative)	-11 (low negative)
Mitigation measures	Compile and implement an alien management plan. Undertake regular monitoring to detect alien invasions early so that they can be controlled. Implement control measures.	

- Decommissioning

It is not possible to determine at this stage whether rehabilitation measures will be implemented or not or what the future plans for the site would be nor is it possible at this stage to determine what surrounding land pressures would be. These uncertainties make it impossible to undertake any assessment to determine possible impacts of decommissioning.

9.2.2 Avifauna

- Planning

No impacts are expected during planning.

- Construction

Table 38: Rating of impacts of displacement of priority species due to disturbance and habitat transformation during construction of the PV facility and Associated Infrastructure

CONSTRUCTION: PV FACILITY AND ASSOCIATED INFRASTRUCTURE		
Environmental Parameter	Avifauna	
Issue/Impact/Environmental Effect/Nature	Displacement of priority species due to disturbance and habitat transformation associated with construction of the PV facility and associated infrastructure.	
Extent	The displacement impact will be restricted to the site.	
Probability	The impact will definitely occur.	
Reversibility	The impact is unlikely to be reversed as the habitat transformation after the construction phase will be significant. Many species will not be able to re-colonise the area.	
Irreplaceable loss of resources	The impact on priority species will result in a significant loss of resources at a site level	
Duration	The impact is likely to continue for the duration of the operational phase.	
Cumulative effect	The cumulative impact will be high at a site level	
Intensity/magnitude	At a site level the functioning of the bird population will be severely impacted and for many species it will cease completely.	
Significance Rating	18 x 3 = 54 Negative high impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	4	3
Reversibility	3	3
Irreplaceable loss	3	3
Duration	3	3
Cumulative effect	4	4
Intensity/magnitude	3	3
Significance rating	-54 (High negative)	-51 (High negative)
Mitigation measures	▪ Construction activity should be restricted to the immediate footprint of the infrastructure.	

	▪ Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. ▪ Measures to control noise and dust should be applied according to current best practice in the industry. ▪ Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum.

Table 39: Rating of impacts of displacement of priority species due to disturbance and habitat transformation during construction of power line option 1

CONSTRUCTION: 132KV POWER LINE OPTION 1	
Environmental Parameter	Avifauna
Issue/Impact/Environmental Effect/Nature	Displacement of priority species due to disturbance and habitat transformation associated with construction of the 132kV power line.
Extent	The displacement impact could affect the local population of Martial Eagles if the pair at tower 519 is displaced.
Probability	The impact will likely occur.
Reversibility	Once the construction activity ceases, the source of displacement will be removed and the priority species should be able to utilise the habitat again. However, in the case of the Martial Eagles, construction activities linked to other renewable projects could prevent the birds from returning. This would require relocation of the nest to an area away from the Kronos MTS.
Irreplaceable loss of resources	The impact on the Martial Eagles will result in a significant loss of resources at a local level
Duration	The impact is likely to continue for 2 – 10 years as several renewable projects are developed with grid connection to Kronos MTS.
Cumulative effect	The cumulative impact of the loss of a pair of Martial Eagles will be high at a local level
Intensity/magnitude	At a local level the functioning of the bird population will be moderately affected.
Significance Rating	15 x 3 = 45 Negative medium impact

	Pre-mitigation impact rating	Post-mitigation impact rating
Extent	2	1
Probability	3	2
Reversibility	3	1
Irreplaceable loss	3	2
Duration	2	1
Cumulative effect	4	2
Intensity/magnitude	2	2
Significance rating	-34 (medium negative)	-18 (low negative)
Mitigation measures	• Construction activity should be restricted to the immediate footprint of the infrastructure. • Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. • Measures to control noise and dust should be applied according to current best practice in the industry. • Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum. • Given that the Martial Eagle nest site at tower 519 has been confirmed as having been occupied and active in 2013, the recommendation made in an earlier impact study (Jenkins & du Plessis 2013) that efforts should be made to encourage these eagles to move to an alternative, less disturbed and hazardous nesting site, is supported here. The extent of energy development planned for the immediate vicinity of this probably preclude a short-range relocation, and a dedicated structure, strategically situated off the power line network aggregated around the Kronos MTS, may be the best option.	

Table 40: Rating of impacts of displacement of priority species due to disturbance and habitat transformation during construction of power line option 2

CONSTRUCTION: 132KV POWER LINE OPTION 2	
Environmental Parameter	Avifauna

Issue/Impact/Environmental Effect/Nature	Displacement of priority species due to disturbance and habitat transformation associated with construction of the 132kV power line.	
Extent	The displacement impact could affect the local population of Martial Eagles if the pair at tower 519 is displaced.	
Probability	The impact will likely occur.	
Reversibility	Once the construction activity ceases, the source of displacement will be removed and the priority species should be able to utilise the habitat again. However, in the case of the Martial Eagles, construction activities linked to other renewable projects could prevent the birds from returning.	
Irreplaceable loss of resources	The impact on the Martial Eagles will result in a significant loss of resources at a local level	
Duration	The impact is likely to continue for 2 – 10 years as several renewable projects are developed with grid connection to Kronos MTS.	
Cumulative effect	The cumulative impact of the loss of a pair of Martial Eagles will be high at a local level	
Intensity/magnitude	At a local level the functioning of the bird population will be moderately affected.	
Significance Rating	15 x 3 = 45 Negative medium impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	1
Probability	3	2
Reversibility	3	1
Irreplaceable loss	3	2
Duration	2	1
Cumulative effect	4	2
Intensity/magnitude	2	2
Significance rating	-34 (medium negative)	-18 (low negative)
Mitigation measures	▪ Construction activity should be restricted to the immediate footprint of the infrastructure. ▪ Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species.	

	▪ Measures to control noise and dust should be applied according to current best practice in the industry. ▪ Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum. • Given that the Martial Eagle nest site at tower 519 has been confirmed as having been occupied and active in 2013, the recommendation made in an earlier impact study (Jenkins & du Plessis 2013) that efforts should be made to encourage these eagles to move to an alternative, less disturbed and hazardous nesting site, is supported here. The extent of energy development planned for the immediate vicinity of this probably preclude a short-range relocation, and a dedicated structure, strategically situated off the power line network aggregated around the Kronos substation, may be the best option.

Table 41: Rating of impacts of displacement of priority species due to disturbance and habitat transformation during construction of substation option 1

CONSTRUCTION: SUBSTATION OPTION 1	
Environmental Parameter	Avifauna
Issue/Impact/Environmental Effect/Nature	Displacement of priority species due to disturbance and habitat transformation associated with construction of the substation.
Extent	The displacement impact will be restricted to the site.
Probability	The impact will possibly occur.
Reversibility	The impact will be completely reversible on de-commissioning of the plant provided the substation infrastructure is removed and the habitat rehabilitated.
Irreplaceable loss of resources	The impact on priority species will result in a marginal loss of resources at a site level
Duration	The impact is likely to continue right through the operational life-time of the facility.
Cumulative effect	The cumulative impact will be low at a site level
Intensity/magnitude	At a site level the functioning of the bird population will be slightly impacted.

Significance Rating	12 x 1 = 12 Negative low impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	2
Reversibility	1	1
Irreplaceable loss	2	2
Duration	3	2
Cumulative effect	2	2
Intensity/magnitude	1	1
Significance rating	-12 (low negative)	-11 (low negative)
Mitigation measures	• Construction activity should be restricted to the immediate footprint of the infrastructure. • Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. • Measures to control noise and dust should be applied according to current best practice in the industry. • Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum.	

Table 42: Rating of impacts of displacement of priority species due to disturbance and habitat transformation during construction of substation option 2

CONSTRUCTION: SUBSTATION OPTION 2	
Environmental Parameter	Avifauna
Issue/Impact/Environmental Effect/Nature	Displacement of priority species due to disturbance and habitat transformation associated with construction of the substation.
Extent	The displacement impact will be restricted to the site.
Probability	The impact will possibly occur.
Reversibility	The impact will be completely reversible on de-commissioning of the plant provided the substation infrastructure is removed and the habitat rehabilitated.
Irreplaceable loss of resources	The impact on priority species will result in a marginal loss of resources at a site level

Duration	The impact is likely to continue right through the operational life-time of the facility.	
Cumulative effect	The cumulative impact will be low at a site level	
Intensity/magnitude	At a site level the functioning of the bird population will be slightly impacted.	
Significance Rating	12 x 1 = 12 Negative low impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	2
Reversibility	1	1
Irreplaceable loss	2	2
Duration	3	2
Cumulative effect	2	2
Intensity/magnitude	1	1
Significance rating	-12 (low negative)	-11 (low negative)
Mitigation measures	• Construction activity should be restricted to the immediate footprint of the infrastructure. • Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. • Measures to control noise and dust should be applied according to current best practice in the industry. • Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum.	

- Operation

Table 43: Rating of impacts of displacement of priority species due to habitat transformation in the operational phase

OPERATION: PV FACILITY AND ASSOCIATED INFRASTRUCTURE	
Environmental Parameter	Avifauna

Issue/Impact/Environmental Effect/Nature	Displacement of priority species due to habitat transformation associated with construction of the PV facility and associated infrastructure.	
Extent	The displacement impact will be restricted to the site.	
Probability	The impact will definitely occur.	
Reversibility	The impact will be completely reversible on de-commissioning of the plant provided the solar panels are all removed and the habitat allowed to recover over time.	
Irreplaceable loss of resources	The impact on priority species will result in a significant loss of resources at a site level	
Duration	The impact is likely to continue right through the operational life-time of the facility.	
Cumulative effect	The cumulative impact will be high at a site level	
Intensity/magnitude	At a site level the functioning of the bird population will be severely impacted and for many species it will cease completely.	
Significance Rating	15 x 3 = 45 Negative medium impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	4	3
Reversibility	1	1
Irreplaceable loss	3	3
Duration	3	3
Cumulative effect	4	4
Intensity/magnitude	3	3
Significance rating	-48 (medium negative)	-45 (medium negative)
Mitigation measures	• Construction activity should be restricted to the immediate footprint of the infrastructure. • Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. • Measures to control noise and dust should be applied according to current best practice in the industry. • Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum.	

Table 44: Rating of impacts of mortality of priority species due to collisions with solar panels in the operational phase

OPERATION: PV FACILITY AND ASSOCIATED INFRASTRUCTURE		
Environmental Parameter	Avifauna	
Issue/Impact/Environmental Effect/Nature	Mortality of priority species due to collisions with solar panels	
Extent	The impact should only affect the site	
Probability	Probable	
Reversibility	The impact will be completely reversible on de-commissioning of the plant provided the solar panels are all removed.	
Irreplaceable loss of resources	The impact on priority species is likely to be moderate.	
Duration	The impact is likely to continue right through the operational life-time of the facility.	
Cumulative effect	The cumulative impact on priority species is likely to be moderate.	
Intensity/magnitude	At a local level the functioning of the bird population will be moderately affected.	
Significance Rating	13 x 2 = 26 Negative low impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	2
Reversibility	1	1
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	3	2
Intensity/magnitude	2	2
Significance rating	-26 (low negative)	-22 (low negative)
Mitigation measures	• Monitoring should be implemented to search the ground between arrays of solar panels on a weekly basis (every two weeks at the longest) for at least one year to determine the magnitude of collision fatalities. Searches should be done on foot. Searches should be conducted randomly or at	

	systematically selected arrays of solar panels to the extent that equals 33% or more of the project area. Detection trials should be integrated into the searches. • The EMP should provide for the on-going inputs of an avifaunal specialist to oversee the operational phase monitoring and assist with the on-going management of bird impacts that may emerge as the operational phase monitoring programme progresses. • The exact protocol to be followed for the operational phase monitoring should be compiled by the avifaunal specialist in consultation with the plant operator and Environmental Control Officer before the commencement of operations. The exact scope and nature of the operational phase monitoring will be informed on an ongoing basis by the result of the monitoring and the EMP will be updated accordingly. • Depending on the results of the carcass searches, a range of mitigation measures will have to be considered if mortality levels turn out to be significant, including minor modifications of panel and mirror design to reduce the illusory characteristics of solar panels. What is considered to be significant will have to be established on a species specific basis by the avifaunal specialist.

Table 45: Rating of impacts of collisions of priority species with Option 1 of the proposed 132kV line in the operational phase

OPERATION: 132KV POWER LINE OPTION 1	
Environmental Parameter	Avifauna
Issue/Impact/Environmental Effect/Nature	Collisions of priority species with the proposed 132kV line.
Extent	The collision mortality may affect regional populations of some highly mobile priority species e.g. Ludwig's Bustard.
Probability	The impact will likely occur.
Reversibility	If the power line gets removed after decommissioning, the impact will also be removed.

Irreplaceable loss of resources	Marginal loss of resources	
Duration	The impact is likely to continue for the lifetime of the facility.	
Cumulative effect	Moderate cumulative impact	
Intensity/magnitude	At a local level the functioning of the bird population will be moderately affected.	
Significance Rating	15 x 2 = 30 Negative medium impact	
	Pre-mitigation impact rating	Post-mitigation impact rating
Extent	3	3
Probability	3	2
Reversibility	1	1
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	3	2
Intensity/magnitude	2	2
Significance rating	-30 (medium negative)	-28 (low negative)
Mitigation measures	• The 132kV grid connection should be inspected at least once a quarter for a minimum of two years by the avifaunal specialist to establish if there is any significant collision mortality. Thereafter the frequency of inspections will be informed by the results of the first two years. • The detailed protocol to be followed for the inspections will be compiled by the avifaunal specialist prior to the first inspection. • The line should be marked with Bird Flight Diverters (BFDs) for their entire length on the earth wire of the line, 5m apart, and alternating black and white. See the avifaunal specialist report for the type of BFD which is recommended.	

Table 46: Rating of impacts of collisions of priority species with Option 2 of the proposed 132kV line in the operational phase

OPERATION: 132KV POWER LINE OPTION 2	
Environmental Parameter	Avifauna

Issue/Impact/Environmental Effect/Nature	Collisions of priority species with the proposed 132kV line.	
Extent	The collision mortality may affect regional populations of some highly mobile priority species e.g. Ludwig's Bustard.	
Probability	The impact will likely occur.	
Reversibility	If the power line gets removed after decommissioning, the impact will also be removed.	
Irreplaceable loss of resources	Marginal loss of resources	
Duration	The impact is likely to continue for the lifetime of the facility.	
Cumulative effect	Moderate cumulative impact	
Intensity/magnitude	At a local level the functioning of the bird population will be moderately affected.	
Significance Rating	15 x 2 = 30 Negative medium impact	
	Pre-mitigation impact rating	Post-mitigation impact rating
Extent	3	3
Probability	3	2
Reversibility	1	1
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	3	2
Intensity/magnitude	2	2
Significance rating	-30 (medium negative)	-28 (low negative)
Mitigation measures	• The 132kV grid connection should be inspected at least once a quarter for a minimum of two years by the avifaunal specialist to establish if there is any significant collision mortality. Thereafter the frequency of inspections will be informed by the results of the first two years. • The detailed protocol to be followed for the inspections will be compiled by the avifaunal specialist prior to the first inspection. • The line should be marked with Bird Flight Diverters (BFDs) for their entire length on the earth wire of the line, 5m apart, and alternating black and	

	white. See the avifaunal specialist report for the type of BFD which is recommended.

- Decommissioning

Table 47: Rating of impacts of displacement of priority species due to disturbance during the decommissioning phase

DE-COMMISSIONING: PV FACILITY AND ASSOCIATED INFRASTRUCTURE		
Environmental Parameter	Avifauna	
Issue/Impact/Environmental Effect/Nature	Displacement of priority species due to disturbance associated with de-commissioning of the PV facility and associated infrastructure.	
Extent	The displacement impact will be restricted to the site.	
Probability	The impact will definitely occur.	
Reversibility	The impact will be completely reversible on de-commissioning of the plant provided the solar panels are all removed and the habitat allowed to recover over time.	
Irreplaceable loss of resources	The impact on priority species will result in a minor loss of resources at a site level.	
Duration	The impact is likely to last for a short time (0-2 years).	
Cumulative effect	The cumulative impact will be high at a site level	
Intensity/magnitude	At a site level the functioning of the bird population will be slightly impacted.	
Significance Rating	11 x 1 = 11 Negative low impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	4	3
Reversibility	1	1
Irreplaceable loss	2	2
Duration	1	1
Cumulative effect	2	2
Intensity/magnitude	1	1
Significance rating	-11 (low negative)	-10 (low negative)

Mitigation measures	• De-commissioning activity should be restricted to the immediate footprint of the infrastructure. • Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. • Measures to control noise and dust should be applied according to current best practice in the industry. • Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum.

Table 48: Rating of impacts of displacement of priority species due to disturbance from power line option 1 during the decommissioning phase

DE-COMMISSIONING: 132KV POWER LINE OPTION 1		
Environmental Parameter	Avifauna	
Issue/Impact/Environmental Effect/Nature	Displacement of priority species due to disturbance and habitat transformation associated with de-commissioning of the 132kV power line.	
Extent	Site	
Probability	The impact will likely occur.	
Reversibility	Once the de-commissioning activity ceases, the source of displacement will be removed and the priority species should be able to utilise the habitat again.	
Irreplaceable loss of resources	Marginal loss of resources	
Duration	Short term	
Cumulative effect	Low cumulative impact	
Intensity/magnitude	At a local level the functioning of the bird population will be moderately affected.	
Significance Rating	10 x 2 = 20 Negative low impact	
	Pre-mitigation impact rating	Post-mitigation impact rating
Extent	1	1
Probability	3	2
Reversibility	1	1

Irreplaceable loss	2	2
Duration	1	1
Cumulative effect	2	2
Intensity/magnitude	2	2
Significance rating	-20 (low negative)	-18 (low negative)
Mitigation measures	• De-commissioning activity should be restricted to the immediate footprint of the infrastructure. • Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. • Measures to control noise and dust should be applied according to current best practice in the industry. • Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum.	

Table 49: Rating of impacts of displacement of priority species due to disturbance from power line option 2 during the decommissioning phase

DE-COMMISSIONING: 132KV POWER LINE OPTION 2	
Environmental Parameter	Avifauna
Issue/Impact/Environmental Effect/Nature	Displacement of priority species due to disturbance and habitat transformation associated with de-commissioning of the 132kV power line.
Extent	Site
Probability	The impact will likely occur.
Reversibility	Once the de-commissioning activity ceases, the source of displacement will be removed and the priority species should be able to utilise the habitat again.
Irreplaceable loss of resources	Marginal loss of resources
Duration	Short term
Cumulative effect	Low cumulative impact
Intensity/magnitude	At a local level the functioning of the bird population will be moderately affected.
Significance Rating	10 x 2 = 20 Negative low impact

	Pre-mitigation impact rating	Post-mitigation impact rating
Extent	1	1
Probability	3	2
Reversibility	1	1
Irreplaceable loss	2	2
Duration	1	1
Cumulative effect	2	2
Intensity/magnitude	2	2
Significance rating	-20 (low negative)	-18 (low negative)
Mitigation measures	• De-commissioning activity should be restricted to the immediate footprint of the infrastructure. • Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. • Measures to control noise and dust should be applied according to current best practice in the industry. • Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum.	

Table 50: Rating of impacts of displacement of priority species due to disturbance from substation option 1 during the decommissioning phase

DE-COMMISSIONING: SUBSTATION OPTION 1	
Environmental Parameter	Avifauna
Issue/Impact/Environmental Effect/Nature	Displacement of priority species due to disturbance associated with de-commissioning of the substation.
Extent	The displacement impact will be restricted to the site.
Probability	The impact will possibly occur.
Reversibility	The impact will be completely reversible on de-commissioning of the plant provided the substation infrastructure is removed and the habitat rehabilitated.
Irreplaceable loss of resources	The impact on priority species will result in a marginal loss of resources at a site level
Duration	The impact is likely to continue for 0-2 years
Cumulative effect	The cumulative impact will be low at a site level

Intensity/magnitude	At a site level the functioning of the bird population will be slightly impacted.	
Significance Rating	10 x 1 = 10 Negative low impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	2
Reversibility	1	1
Irreplaceable loss	2	2
Duration	1	1
Cumulative effect	2	2
Intensity/magnitude	1	1
Significance rating	-10 (low negative)	-9 (low negative)
Mitigation measures	• De-commissioning activity should be restricted to the immediate footprint of the infrastructure. • Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. • Measures to control noise and dust should be applied according to current best practice in the industry. • Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum.	

Table 51: Rating of impacts of displacement of priority species due to disturbance from substation option 2 during the decommissioning phase

DE-COMMISSIONING: SUBSTATION OPTION 2	
Environmental Parameter	Avifauna
Issue/Impact/Environmental Effect/Nature	Displacement of priority species due to disturbance associated with de-commissioning of the substation.
Extent	The displacement impact will be restricted to the site.
Probability	The impact will possibly occur.
Reversibility	The impact will be completely reversible on de-commissioning of the plant provided the substation infrastructure is removed and the habitat rehabilitated.

Irreplaceable loss of resources	The impact on priority species will result in a marginal loss of resources at a site level	
Duration	The impact is likely to continue for 0-2 years	
Cumulative effect	The cumulative impact will be low at a site level	
Intensity/magnitude	At a site level the functioning of the bird population will be slightly impacted.	
Significance Rating	12 x 1 = 12 Negative low impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	2
Reversibility	1	1
Irreplaceable loss	2	2
Duration	1	1
Cumulative effect	2	2
Intensity/magnitude	1	1
Significance rating	-10 (low negative)	-9 (low negative)
Mitigation measures	• De-commissioning activity should be restricted to the immediate footprint of the infrastructure. • Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species. • Measures to control noise and dust should be applied according to current best practice in the industry. • Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum.	

9.2.3 Surface Water

- Planning

No impacts are expected during planning.

- Construction

Table 52: Rating of impacts associated with the construction lay-down area in or nearby to surface water resources

IMPACT TABLE		
Environmental Parameter	Surface Water Resources	
Issue/Impact/Environmental Effect/Nature	Impacts associated with the construction lay-down area in or near to surface water resources	
Extent	*Site*	
Probability	*Possible*	
Reversibility	*Partly reversible*	
Irreplaceable loss of resources	*Marginal loss of resources*	
Duration	*Medium term*	
Cumulative effect	*Low cumulative impact*	
Intensity/magnitude	*Medium*	
Significance Rating	*Pre-mitigation significance rating is low and negative. With appropriate mitigation measures, the impact can be further reduced.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	2	1
Irreplaceable loss	2	1
Duration	2	1
Cumulative effect	2	1
Intensity/magnitude	2	1
Significance rating	- 22 (low negative)	- 6 (low negative)
Mitigation measures	**Seasonal Scheduling of the Construction Process** – If possible and practical, construction activities should be scheduled to take place over the dry season when rainfall and flows are low. **Location of the Lay-down Area** – The lay-down area must not be placed within any surface water resources.	

Table 53: Rating of impacts associated with vehicle and machinery degradation to surface water resources

IMPACT TABLE	
Environmental Parameter	Surface Water Resources

Issue/Impact/Environmental Effect/Nature	Vehicle and machinery degradation to surface water resources	
Extent	*Site*	
Probability	*Possible*	
Reversibility	*Partly reversible*	
Irreplaceable loss of resources	*Marginal loss of resources*	
Duration	*Medium term*	
Cumulative effect	*Medium cumulative Impact*	
Intensity/magnitude	*Medium*	
Significance Rating	*Pre-mitigation significance rating is low and negative. With appropriate mitigation measures, the impact can be reduced.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	2	1
Irreplaceable loss	2	1
Duration	2	1
Cumulative effect	3	1
Intensity/magnitude	2	1
Significance rating	- 24 (low negative)	- 6 (low negative)
Mitigation measures	**Preventing Physical Degradation of Surface Water Resources** – Surface water resources and the associated buffer zones are to be designated as "highly sensitive areas". Vehicle access must avoid the highly sensitive areas, as far as possible. Internal access roads must avoid surface water resources, where possible. Construction workers are only allowed in the designated construction areas of the proposed development and not into the surrounding surface water resources, where possible. Highly sensitive areas are to be clearly demarcated prior to the commencement of construction and no access beyond these areas is to be allowed. **Preventing Soil Contamination** – No vehicles are to be allowed in the highly sensitive areas unless authorised. Should vehicles be authorised in highly sensitive areas, all vehicles and machinery are to be checked for oil, fuel	

	or any other fluid leaks before entering the required construction areas. All vehicles and machinery must be regularly serviced and maintained before being allowed to enter the construction areas. No fuelling, re-fuelling, vehicle and machinery servicing or maintenance is to take place in the highly sensitive areas. The study site is to contain sufficient spill contingency measures throughout the construction process. These include, but are not limited to, oil spill kits to be available, fire extinguishers, fuel, oil or hazardous substances storage areas must be bunded to prevent oil or fuel contamination of the ground and/or nearby surface water resources or associated buffer zones.

Table 54: Rating of impacts associated with human degradation to fauna and flora associated with surface water resources

IMPACT TABLE		
Environmental Parameter	Surface Water Resources	
Issue/Impact/Environmental Effect/Nature	Human degradation to fauna and flora associated with surface water resources	
Extent	*Site*	
Probability	*Probable*	
Reversibility	*Completely reversible*	
Irreplaceable loss of resources	*Marginal loss of resources*	
Duration	*Short term*	
Cumulative effect	*Low cumulative impact*	
Intensity/magnitude	*Low*	
Significance Rating	*Pre-mitigation significance rating is low and negative. With appropriate mitigation measures, the impact can be further reduced.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	1
Reversibility	1	1
Irreplaceable loss	2	1
Duration	1	1
Cumulative effect	2	1
Intensity/magnitude	1	1

Significance rating	- 10 (low negative)	- 6 (low negative)
Mitigation measures	**Minimising Human Physical Degradation of Sensitive Areas** - Construction workers are only allowed in designated construction areas and not into the surface water resources designated as highly sensitive. The highly sensitive areas are to be clearly demarcated and no access beyond these areas is to be allowed unless authorised. No animals on the construction site or surrounding areas are to be hunted, captured, trapped, removed, injured, killed or eaten. Should any party be found guilty of such an offence, stringent penalties should be imposed. The appointed ECO is to be contacted should removal of any fauna be required during the construction phase. No "long drop" toilets are allowed on the study site. Suitable temporary chemical sanitation facilities are to be provided. Temporary chemical sanitation facilities must be placed at least 100 meters from any surface water resource where required. Temporary chemical sanitation facilities must be placed over a bunded or a sealed surface area and adequately maintained to prevent pollution impacts. No water is to be extracted unless a water use license is granted for specific quantities for a specific water resource, where applicable. No hazardous or building materials are to be stored or brought into the highly sensitive areas. Should a designated storage area be required, the storage area must be placed at the furthest location from the highly sensitive areas. Appropriate safety measures as stipulated above must be implemented. No cement mixing is to take place in a surface water resource. In general, any cement mixing should take place over a bin lined (impermeable) surface or alternatively in the load bin of a vehicle to prevent the mixing of cement with the ground. Importantly, no mixing	

	of cement directly on the surface is allowed in the highly sensitive areas.

Table 55: Rating of impacts associated with degradation and removal of soils and vegetation associated with surface water resources

IMPACT TABLE		
Environmental Parameter	Surface Water Resources	
Issue/Impact/Environmental Effect/Nature	Degradation and removal of soils and vegetation associated with surface water resources	
Extent	*Site*	
Probability	*Possible*	
Reversibility	*Barely reversible*	
Irreplaceable loss of resources	*Marginal loss of resources*	
Duration	*Long term*	
Cumulative effect	*Medium cumulative Impact*	
Intensity/magnitude	*Medium*	
Significance Rating	*Pre-mitigation significance rating is low and negative. With appropriate mitigation measures, the impact can be further reduced.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	2	1
Reversibility	3	1
Irreplaceable loss	2	1
Duration	3	1
Cumulative effect	3	1
Intensity/magnitude	2	1
Significance rating	- 28 (low negative)	- 6 (low negative)
Mitigation measures	**Obtaining Relevant Authorisations and Licenses** – Before any construction or removal of soils and vegetation in any delineated surface water resources is undertaken, the relevant water use license is to be obtained should development need to take place directly in wetlands. Ideally, all surface water resources are to be avoided as far as possible. **Limiting Damage to Surface Water Resources** – Ideally, to minimise any impact to surface water	

	resources, the proposed development should seek to avoid all surface water resources as far as possible. Where this is not possible a single access route or "Right of Way" (RoW) is to be established to the desired construction area in the surface water resources. The environmentally authorized and license permitted construction area is to be demarcated and made visible. The establishment of the RoW likewise must be demarcated and made visible. The width of the RoW must be limited to the width of the vehicles required to enter the surface water resource (no more than a 3m width). An area around the locations of the proposed development structures, buildings, infrastructure will be required in order for construction vehicles and machinery to operate/manoeuvre. This too must be limited to the smallest possible area (no bigger than $100m^2$) and made visible by means of demarcation. **Limiting Removal of Excavated Soils** – Should the necessary authorisations (water use license, environmental authorisation etc.) be obtained for the solar PV panels, buildings or structures and other associated infrastructure to be placed in surface water resources, excavated topsoils should be stockpiled separately from subsoils so that it can be replaced in the correct order for rehabilitation purposes post-construction. Soils removed from surface water resources must only be removed if absolutely required. Furthermore, any removed soils and vegetation that are not required for rehabilitation should be taken to a registered landfill site that has sufficient capacity to assimilate the spoil. The topsoil is to be used for rehabilitation purposes and should not be removed unless there is surplus that cannot be utilised. It is important that when the soils are reinstated, the subsoils are to be backfilled first followed by the topsoil. Where the soils are excavated from the sensitive areas, it is preferable for them to be stockpiled adjacent to the excavation pit to limit vehicle and any other movement activities around the excavation areas.

	Preventing Pollution Impacts –no mixing of cement directly on the surface is allowed in surface water resources. **Protection of Stockpiled Soils** – Stockpiled soils will need to be protected from wind and water erosion. Stockpiled soils are not to exceed a 3m height and are to be bunded by suitable materials. Stacked bricks surrounding the stockpiled soils can be adopted. Alternatively, wooden planks pegged around the stockpiled soils can be used. **Rehabilitation of RoW areas** – Ideally, the affected RoW zones in the sensitive areas must be re-instated with the soils removed from the surface water resource(s), and the affected areas must be levelled, or appropriately sloped and scarified to loosen the soil and allow seeds contained in the natural seed bank to re-establish. However, given the aridity of the study area, it is likely that vegetation recovery will be slow. Rehabilitation areas will need to be monitored for erosion until vegetation can re-establish where prevalent. If affected areas are dry and no vegetation is present, the soil is to be re-instated and sloped.

Table 56: Rating of impacts associated with increased storm water run-off, erosion and increased sedimentation impacting on surface water resources

IMPACT TABLE	
Environmental Parameter	Surface Water Resources
Issue/Impact/Environmental Effect/Nature	Increased storm water run-off, erosion and increased sedimentation impacting on surface water resources
Extent	*Site*
Probability	*Probable*
Reversibility	*Partly reversible*
Irreplaceable loss of resources	*Marginal loss of resources*
Duration	*Medium term*
Cumulative effect	*Medium cumulative impact*
Intensity/magnitude	*Medium*

Significance Rating	*Pre-mitigation significance rating is low and negative. With appropriate mitigation measures, the impact can be further reduced.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	1
Reversibility	2	1
Irreplaceable loss	2	1
Duration	2	1
Cumulative effect	3	1
Intensity/magnitude	2	1
Significance rating	- 26 (medium negative)	- 6 (low negative)
Mitigation measures	**Preventing Increased Run-off and Sedimentation Impacts** - Vegetation clearing should take place in a phased manner, only clearing areas that will be constructed on immediately. Vegetation clearing must not take place in areas where construction will only take place in the distant future. An appropriate storm water management plan formulated by a suitably qualified professional must accompany the proposed development to deal with increased run-off in the designated construction areas. In general, adequate structures must be put into place (temporary or permanent where necessary in extreme cases) to deal with increased/accelerated run-off and sediment volumes. The use of silt fencing and potentially sandbags or hessian “sausage” nets can be used to prevent erosion in susceptible construction areas. Grass blocks on the perimeter of the building structure footprints can also be used to reduce run-off and onset of erosion. Where required more permanent structures such as attenuation ponds and gabions can be constructed if needs be. All impacted areas are to be adequately sloped to prevent the onset of erosion.	

- Operation

Table 57: Rating of impacts of vehicle damage to surface water resources

IMPACT TABLE		
Environmental Parameter	Surface Water Resources	
Issue/Impact/Environmental Effect/Nature	Vehicle damage to surface water resources	
Extent	*Local*	
Probability	*Possible*	
Reversibility	*Partly reversible*	
Irreplaceable loss of resources	*Marginal loss of resources*	
Duration	*Long term*	
Cumulative effect	*Medium cumulative impact*	
Intensity/magnitude	*High*	
Significance Rating	*Pre-mitigation significance rating is medium and negative. With appropriate mitigation measures, the impact can be reduced to a low negative impact.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	1
Probability	2	1
Reversibility	2	1
Irreplaceable loss	2	1
Duration	3	3
Cumulative effect	3	1
Intensity/magnitude	3	1
Significance rating	- 42 (medium negative)	- 8 (low negative)
Mitigation measures	**Minimising Vehicle Damage to the Surface Water Resources** – Potential impacts can be avoided by the routing of access roads outside of and away from surface water resources, where possible. Additionally there are existing service roads where existing power lines have been established. Should the final alignment follow alongside existing power lines, the existing service roads are to be used and no new roads will be required to be established, if possible. Access roads authorised in sensitive areas will have to be regularly monitored and checked for erosion. Monitoring should be conducted once every two months. Moreover, after short or long periods of heavy rainfall or after long periods of sustained rainfall the roads will need	

	to be checked for erosion. Rehabilitation measures will need to be employed should erosion be identified. Where erosion begins to take place, this must be dealt with immediately to prevent significant erosion damage to the surface water resources. Should large scale erosion occur, a rehabilitation plan will be required.

Table 58: Rating of impacts of impermeable and hardened surfaces creating accelerated run-off and consequent erosion and sedimentation

IMPACT TABLE		
Environmental Parameter	Surface water resources	
Issue/Impact/Environmental Effect/Nature	Impermeable and hardened surfaces creating accelerated run-off and consequent erosion and sedimentation	
Extent	Site	
Probability	Probable	
Reversibility	Partly reversible	
Irreplaceable loss of resources	Marginal loss of resource	
Duration	Long term	
Cumulative effect	Medium cumulative impact	
Intensity/magnitude	Medium	
Significance Rating	*Pre-mitigation significance rating is low and negative. With appropriate mitigation measures, the impact can be reduced.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	2
Reversibility	2	2
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	3	1
Intensity/magnitude	2	1
Significance rating	-28 (low negative)	-11 (low negative)
Mitigation measures	Any hardstand area, building or substation inside or within 50m proximity to a surface water resource must have energy dissipating structures on the perimeter of the structures to prevent increased run-off entering	

	adjacent areas or surface water resources. This can be in the form of hard concrete structures or soft structures such as grass blocks for example. Alternatively, a suitable operational storm water management design or plan can be compiled and implemented that accounts for the use of appropriate alternative structures or devices that will prevent increased run-off entering adjacent areas or surface water resources.

Table 59: Rating of impacts of oil leakage from the substation

IMPACT TABLE		
Environmental Parameter	Surface water resources	
Issue/Impact/Environmental Effect/Nature	Oil leakage from the substation	
Extent	Local	
Probability	Possible	
Reversibility	Partly reversible	
Irreplaceable loss of resources	Marginal loss of resource	
Duration	Long term	
Cumulative effect	High cumulative impact	
Intensity/magnitude	High	
Significance Rating	*Pre-mitigation significance rating is medium and negative. With appropriate mitigation measures, the impact can be reduced to a low negative impact.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	1
Probability	3	2
Reversibility	2	2
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	4	1
Intensity/magnitude	3	1
Significance rating	- 48 (medium negative)	- 11 (low negative)
Mitigation measures	Importantly the substation is to contain adequate bunding structures around any oil containing structure to prevent any oil leakage from leaving the substation site.	

	Oil leak monitoring must take place on a regular basis to ensure that where leaks are identified, these can be dealt with appropriately. Oil spill kits must be available at the substation site to deal with ad hoc oil spills.

- Decommissioning

Should the proposed power lines need to be decommissioned, the same impacts as identified for the construction phase of the proposed development can be anticipated. Hence, the same impacts are expected to occur and the stipulated mitigation measures where relevant must be employed to minimise impacts.

9.2.4 Agricultural Potential and Soils

- Planning

No impacts are expected during planning.

- Construction

Table 60: Rating of impacts of a loss of agriculturally productive soil during construction

IMPACT TABLE	
Environmental Parameter	Soils and agricultural potential
Issue/Impact/Environmental Effect/Nature	Loss of agriculturally productive soil
Extent	Site only
Probability	Unlikely
Reversibility	Reversible
Irreplaceable loss of resources	No loss of resources
Duration	Short term
Cumulative effect	Negligible

Intensity/magnitude	Low	
Significance Rating	**Prior to mitigation measures:** -6 (low negative) **After mitigation measures:** -6 (low negative)	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	1	1
Reversibility	1	1
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	1	1
Intensity/magnitude	1	1
Significance rating	-6 (Low negative)	-6 (low negative)
Mitigation measures	Virtually none applicable, as soils in vicinity are all shallow, with dry climate and little or no potential for agricultural use.	

Table 61: Rating of impacts of increased susceptibility of topsoil to removal by wind due to disturbance caused by construction activities

IMPACT TABLE	
Environmental Parameter	Soils and agricultural potential
Issue/Impact/Environmental Effect/Nature	Increased susceptibility of topsoil to removal by wind due to disturbance caused by construction activities.
Extent	Local/District
Probability	Probable
Reversibility	Partly Reversible
Irreplaceable loss of resources	Significant loss of resources
Duration	Long term
Cumulative effect	Medium cumulative effect (wind-transported topsoil may be deposited many kilometres distant).
Intensity/magnitude	Medium
Significance Rating	**Prior to mitigation measures:**

	-32 (medium negative) **After mitigation measures:** -9 (low negative)	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	1
Probability	3	2
Reversibility	2	1
Irreplaceable loss	3	2
Duration	3	1
Cumulative effect	3	2
Intensity/magnitude	2	1
Significance rating	-32 (Medium negative)	-9 (low negative)
Mitigation measures	▪ Minimise removal of surface vegetation ▪ Re-vegetate with local species as soon as possible ▪ Ensure all access roads/tracks are surfaced/treated to increase cohesion	

- Decommissioning

Agricultural impacts during the decommissioning phase are potentially similar to those during the construction phase.

9.2.5 Visual

- Planning

No impacts are expected during planning.

- Construction

Table 62: Rating of visual impacts of the proposed Helena 3 solar PV energy facility during construction

IMPACT TABLE	
Environmental Parameter	Visual Impact
Issue/Impact/Environmental Effect/Nature	Large construction vehicles and equipment during the construction phase will alter the natural character of the study area and expose visual receptors to visual impacts associated with the construction phase. The construction activities may be

	perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings.	
Extent	Local / District (2)	
Probability	Probable (3)	
Reversibility	Completely reversible (1)	
Irreplaceable loss of resources	No loss (1)	
Duration	Short term (1)	
Cumulative effect	Medium cumulative effects (3)	
Intensity/magnitude	Medium (2)	
Significance Rating	**Prior to mitigation measures:** Low negative impact **After mitigation measures:** Low negative impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	2
Reversibility	1	1
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	3	3
Intensity/magnitude	2	2
Significance rating	-22 (negative low)	-20 (negative low)
Mitigation measures	▪ Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. ▪ Maintain a neat construction site by removing rubble and waste materials regularly. ▪ Make use of existing gravel access roads where possible. ▪ Ensure that dust suppression techniques are implemented on all access roads.	

** Please note in the context of the visual environment 'resources' are defined as scenic / natural views that are almost impossible to replace.*

Table 63: Rating of visual impacts of the infrastructure associated with the Helena 3 PV energy facility during construction

IMPACT TABLE

Environmental Parameter	Visual Impact	
Issue/Impact/Environmental Effect/Nature	Large construction vehicles and equipment during the construction of the proposed power line, substation, access road and building infrastructure could exert a visual impact by altering the visual character of the surrounding area and exposing sensitive visual receptor locations to visual impacts associated with the construction phase. The construction activities may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings.	
Extent	Local/district (2)	
Probability	Probable (3)	
Reversibility	Completely reversible (1)	
Irreplaceable loss of resources	No loss (1)	
Duration	Short term (1)	
Cumulative effect	Medium cumulative effects (3)	
Intensity/magnitude	Medium (2)	
Significance Rating	**Prior to mitigation measures:** Low negative impact **After mitigation measures:** Low negative impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	2
Reversibility	1	1
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	3	3
Intensity/magnitude	2	2
Significance rating	-22 (low negative)	-20 (low negative)
Mitigation measures	▪ All reinstated cable trenches should be re-vegetated with the same vegetation that existed prior to the cable being laid. ▪ Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. ▪ Maintain a neat construction site by removing rubble and waste materials regularly.	

	▪ Make use of existing gravel access roads where possible.

** Please note in the context of the visual environment 'resources' are defined as scenic / natural views that are almost impossible to replace.*

▪ Operation

Table 64: Rating of visual impacts of the proposed Helena 3 PV energy facility during operation

IMPACT TABLE		
Environmental Parameter	Visual Impact	
Issue/Impact/Environmental Effect/Nature	The proposed PV energy facility could exert a visual impact by altering the visual character of the surrounding area and exposing sensitive visual receptor locations to visual impacts. The development may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings.	
Extent	Local/district (2)	
Probability	Definite (4)	
Reversibility	Irreversible (4)	
Irreplaceable loss of resources	Marginal (2)	
Duration	Long term (3)	
Cumulative effect	Medium cumulative effects (3)	
Intensity/magnitude	Medium (2)	
Significance Rating	**Prior to mitigation measures:** Medium negative impact **After mitigation measures:** Medium negative impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	4	4
Reversibility	4	4
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	3	3
Intensity/magnitude	2	2
Significance rating	-36 (medium negative)	-36 (medium negative)

Mitigation measures	▪ Light fittings for security at night should reflect the light toward the ground and prevent light spill.

** Please note in the context of the visual environment ‘resources’ are defined as scenic / natural views that are almost impossible to replace.*

Table 65: Rating of visual impacts of the infrastructure associated with the Helena 3 PV energy facility during operation

IMPACT TABLE		
Environmental Parameter	Visual Impact	
Issue/Impact/Environmental Effect/Nature	The proposed power line, substation, access roads and building infrastructure could exert a visual impact by altering the visual character of the surrounding area and exposing sensitive visual receptors to visual impacts. The development may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings.	
Extent	Local / District (2)	
Probability	Possible (2)	
Reversibility	Irreversible (4)	
Irreplaceable loss of resources	Marginal loss of resources (2)	
Duration	Long term (3)	
Cumulative effect	Low cumulative impact (1)	
Intensity/magnitude	Medium (2)	
Significance Rating	**Prior to mitigation measures:** Medium negative impact **After mitigation measures:** Low negative impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	2	2
Reversibility	4	4
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	1	1
Intensity/magnitude	2	1
Significance rating	-28 (low negative)	-14 (low negative)

Mitigation measures	▪ Light fittings for security at the proposed substation at night should reflect the light toward the ground and prevent light spill. ▪ If the operations and maintenance buildings are unstaffed they should not be illuminated at night. ▪ Bury cables under the ground where possible. ▪ The operation and maintenance building should be painted with natural tones that fit with the surrounding environment. Non-reflective surfaces should be utilised where possible. ▪ Select the alternatives that will have the least impact on visual receptors.

** Please note in the context of the visual environment 'resources' are defined as scenic / natural views that are almost impossible to replace.*

- Decommissioning

Visual impacts during the decommissioning phase are potentially similar to those during the construction phase.

9.2.6 Heritage

The fieldwork findings have shown that the study area is characterised by a background scatter of Stone Age artefact. The methodology utilised in the identification and classification of finds between find spots and sites enable a clear distinction between groupings.

It must be kept in mind that the fieldwork could in no way identify all archaeological sites within the development footprint and as such the fieldwork has shown that the possibility of encountering other Stone Age archaeological site is extremely high.

- Planning

No impacts are expected during planning.

- Construction

Table 66: Rating of impacts – Chance finds

IMPACT TABLE	
Environmental Parameter	Heritage Resources

Issue/Impact/Environmental Effect/Nature	The possibility of encountering previously unidentified heritage resources and specifically Stone Age archaeological sites. As well as the impact on the identified archaeological sites	
Extent	Will impact on the footprint area of the development	
Probability	The fieldwork has shown that such a predicted impact will definitely occur	
Reversibility	Due to the nature of archaeological sites the impact is seen as irreversible, however mitigation could enable the collection of enough information to preserve the data from such a site	
Irreplaceable loss of resources	The development could lead to significant losses in unidentified and unmitigated site	
Duration	The impact on heritage resources such as archaeological sites will be permanent	
Cumulative effect	As the type of development impact on a large area, and other similar development in the area will also impact on archaeological sites the cumulative impact is seen as having a medium negative impact.	
Intensity/magnitude	The large scale impact on archaeological sites and will require mitigation work.	
Significance Rating	The overall significance rating for the impact on heritage resources is seen as high pre-mitigation. This can be attributed to the very definite possibility of encountering more archaeological sites as shown through fieldwork. The implementation of the recommended heritage mitigation measures will address the envisaged impacts and reduce the overall rating to a low impact rating.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	4	4
Reversibility	2	2
Irreplaceable loss	2	2
Duration	4	4
Cumulative effect	3	2
Intensity/magnitude	3	2
Significance rating	-51 (high negative)	-24 (low negative)

Mitigation measures	▪ Mitigation through archaeological excavations and collection prior to construction ▪ Walkdown of final power line route

- Operation

No impacts are expected during operation.

- Decommissioning

Heritage impacts during the decommissioning phase are potentially similar to those during the construction phase.

9.2.7 Socio-economic

- Planning

No impacts are expected during planning.

- Construction

Table 67: Rating of impacts on economic production during construction

Environmental Parameter	Economic production is defined as any activity that uses inputs such as labour and capital to produce outputs in the form of services or goods.
Issue/Impact/Environmental Effect/Nature	The impact takes place due to the investment on the project that will be spent in the country. Besides the direct impact, it involves the indirect and induced effects that are created when either suppliers of goods and services to the project experience an increase in demand or when businesses servicing households experience an increase in demand for their products.
Extent	The national economy will experience an increase in production.
Probability	It is most likely that there will be a temporary increase in production during construction.
Reversibility	The impact is irreversible, as the capital spent on the project cannot be paid back.
Irreplaceable loss of resources	No loss of resource.

Duration	Short term	
Cumulative effect	High, as there are a number of planned renewable energy developments in the area.	
Intensity/magnitude	Considering multiplier effects, the total impact on the national economy's output could be more than three times more than the expenditure of R0.7 billion.	
Significance Rating	This is a positive high impact. Mitigation measures will maximise benefits to the local economy but will not change the significance of the rating.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	3	3
Reversibility	4	4
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	3	3
Intensity/magnitude	4	4
Significance rating	+64(high positive)	+64 (high positive)
Mitigation measures	In order to optimise the stimulation of the local economy through direct, indirect, and induced effects, the following should be applied where possible: ▪ Procure construction materials, goods, and products from local suppliers if feasible. ▪ Employ local contractors where possible. The proposed mitigation measures will possibly increase the positive impact in the local economy; however, this will not affect the rating.	

Table 68: Rating of impacts on Gross Domestic Product during construction

Environmental Parameter	Gross domestic product (GDP) is the total value of all "final" goods and services, which were produced within the borders of the country during a year.
Issue/Impact/Environmental Effect/Nature	The impact is generated through capital expenditure that shocks the economy. It results in growth of sectors that include businesses supplying goods and services required for the establishment of the facility and businesses that benefit from the increased consumer expenditure.

Extent	The national economy will experience an increase in GDP-R.	
Probability	It is most likely that there will be a temporary increase in GDP-R during construction.	
Reversibility	The impact is irreversible, as the capital spent on the project cannot be paid back.	
Irreplaceable loss of resources	No loss of resource.	
Duration	Short term	
Cumulative effect	High, as there are a number of planned renewable energy developments in the area.	
Intensity/magnitude	There will be a significant increase in the country's GDP.	
Significance Rating	This is a positive medium impact. Mitigation measures will maximise benefits to the local economy but will not change the significance of the rating.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	3	3
Reversibility	4	4
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	3	4
Intensity/magnitude	3	3
Significance rating	+48 (medium positive)	+48 (medium positive)
Mitigation measures	▪ Recruit local labour. ▪ Sub-contract to local construction companies. ▪ Use local suppliers where viable and arrange with the local Small and Medium Enterprises to provide transport, catering, and other services for the construction crew. The proposed mitigation measures will possibly increase the positive impact in the local economy; however, this will not affect the rating.	

Table 69: Rating of impacts on employment during construction

Environmental Parameter	Employment impacts are calculated in terms of the Full-Time Equivalent (FTE) employment positions, which is the same as a FTE job or one man-year of work.
Issue/Impact/Environmental Effect/Nature	The impact is generated through capital expenditure that shocks the economy. It involves the creation of direct

	new job opportunities related to the construction of the proposed development and employment opportunities that will be indirectly created through the increased expenditure in sectors supplying goods and services to the construction activity and in sectors benefiting from the increase of consumer expenditure.	
Extent	Increase in employment will affect the entire country depending on the areas where inputs required are sourced.	
Probability	It is most likely that there will be a temporary increase in employment during construction.	
Reversibility	Irreversible as employment created, albeit for a temporary period, cannot be undone.	
Irreplaceable loss of resources	No loss of resource.	
Duration	Short term.	
Cumulative effect	High, as there are a number of planned renewable energy developments in the area.	
Intensity/magnitude	There will be a notable reduction in unemployment within the Siyathemba LM.	
Significance Rating	This is a positive high impact. Mitigation measures will maximise benefits to the local economy but will not change the significance of the rating.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	3	3
Reversibility	4	4
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	3	3
Intensity/magnitude	3	3
Significance rating	+48 (medium positive)	+48 (medium positive)
Mitigation measures	▪ Employ labour-intensive measures in construction. ▪ Employ local residents. ▪ Sub-contract to local construction companies. ▪ Utilise local suppliers. ▪ Set-up a skills desk at the local municipal office and in the nearby communities to identify skills available in the community and assist in recruiting	

	local labour during both construction and operation.

Table 70: Rating of impacts on skills development during construction

Environmental Parameter	Skills development: employment creation gives way to a host of skills transfer and development opportunities in terms of honing an existing skill or acquiring a new skill.	
Issue/Impact/Environmental Effect/Nature	The impact takes place during the creation of new employment opportunities, and unlike the actual employment created is sustainable.	
Extent	People across the country will have the opportunity to develop their skills.	
Probability	Possible – one cannot be certain that people gaining employment during the construction phase will be able to develop or acquire new skills.	
Reversibility	Barely reversible - skills obtained cannot be lost unless they are not being used and/or become outdated	
Irreplaceable loss of resources	No loss of resource.	
Duration	Short term.	
Cumulative effect	High, as there are a number of planned renewable energy developments in the area.	
Intensity/magnitude	High impact on local employees' skills - 11.5% of the adult population in the Siyathemba LM had no education at all, while 64% have primary or secondary education and only 5.5% have higher educational qualifications. In the context of the national economy, though this impact will be of a lower magnitude.	
Significance Rating	This is a medium positive impact.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	2	3
Reversibility	3	3
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	3	3
Intensity/magnitude	3	3
Significance rating	+42 (medium positive)	+45 (medium positive)
Mitigation measures	▪ Contractors should provide learnerships and on-job training, if possible;	

	▪ Where specialist training can be provided, candidates from local communities should be prioritised for training; and ▪ Share knowledge with the sub-contracting companies during the construction period. These mitigation measures could potentially improve the weighting of the impact in terms of its probability.

Table 71: Rating of impacts on household income during construction

Environmental Parameter	Household income: the result of a household's member engaging in economic activity; has a direct link to the standard of living of these households.	
Issue/Impact/Environmental Effect/Nature	The impact takes place during construction as a result of jobs created through direct, indirect and induced impacts.	
Extent	Increase in household income will be nationwide since the temporary increase in employment will affect the entire country.	
Probability	Probable - the impact will most likely take place.	
Reversibility	Irreversible.	
Irreplaceable loss of resources	No loss of resource.	
Duration	Short term.	
Cumulative effect	High, as there are a number of planned renewable energy developments in the area.	
Intensity/magnitude	High – The income earned by households located in the LM as a result of the project will be on average higher than the average income of these households. The impact within the national economy, though will be less significant.	
Significance Rating	This is a medium positive impact. Mitigation measures could increase the impact on the local economy but would not change the total impact. Therefore, the weights assigned for the impact before mitigations will not be affected.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	3	3
Reversibility	4	4
Irreplaceable loss	1	1

Duration	1	1
Cumulative effect	3	3
Intensity/magnitude	3	3
Significance rating	+48 (medium positive)	+48 (medium positive)
Mitigation measures	▪ Recruit local labour as far as feasible to increase the benefits to the local households. ▪ Employ labour-intensive methods in construction. ▪ Sub-contract to local construction companies. ▪ Use local suppliers where viable and arrange with the local Small and Medium Enterprises to provide transport, catering, and other services for the construction crew.	

Table 72: Rating of impacts on government revenue during construction

Environmental Parameter	Government revenue: government obtains its revenue by collecting taxes and rates from the country's residents and business.	
Issue/Impact/Environmental Effect/Nature	The impact will take place as a result of local expenditure on construction and will be acquired by government through indirect and direct taxes on the project's activity.	
Extent	The fiscal gain will be collected by the national government and used in the national budget; it is not possible to pinpoint exact regions benefitting from this increase.	
Probability	Definite - the impact will definitely take place, although one cannot be certain of the exact amount that government will be collecting as a result of this phase of the proposed project.	
Reversibility	Irreversible.	
Irreplaceable loss of resources	No loss of resource.	
Duration	Short term.	
Cumulative effect	High, as there are a number of planned renewable energy developments in the area.	
Intensity/magnitude	Low – the project will make a small contribution to the national revenue.	
Significance Rating	This is a low positive impact.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4

Probability	4	4
Reversibility	4	4
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	3	3
Intensity/magnitude	1	1
Significance rating	+17 (low positive)	+17 (low positive)
Mitigation measures	No mitigations.	

Table 73: Rating of impacts on balance of payments during construction

Environmental Parameter	Balance of payments: a summary of all economic transactions between South Africa and all other countries in the world.	
Issue/Impact/Environmental Effect/Nature	The impact takes place during construction as a result of importing goods and services.	
Extent	Importing will affect the balance of the national and international accounts.	
Probability	Probable - It is likely that machinery and equipment required for the construction of the plant will be imported.	
Reversibility	Completely reversible.	
Irreplaceable loss of resources	No loss of resource.	
Duration	Short-term.	
Cumulative effect	High, as there are a number of planned renewable energy developments in the area.	
Intensity/magnitude	Low – the project will make a small contribution to the national revenue.	
Significance Rating	The impact is low negative - requires development of the local manufacturing capabilities.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	3	2
Reversibility	1	1
Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	3	3
Intensity/magnitude	1	1
Significance rating	-13 (low negative)	-12 (low negative)

Mitigation measures	▪ Goods and services are procured domestically instead of imported, where possible. ▪ Recruit local labour as far as feasible to increase the benefits to the local households.

Table 74: Rating of impacts of land sterilisation during construction

Environmental Parameter	Land sterilisation: loss of land to new development.	
Issue/Impact/Environmental Effect/Nature	The impact will take place as a result of replacement of the low intensity farming activities.	
Extent	Will affect farms on which project will be developed.	
Probability	Definite - without the sale/lease of land the project will not go ahead	
Reversibility	Barely reversible.	
Irreplaceable loss of resources	Marginal loss of resources.	
Duration	Long-term.	
Cumulative effect	High, as there are a number of planned renewable energy developments in the area.	
Intensity/magnitude	Low – the intensity of agricultural activities is low.	
Significance Rating	The impact is low negative. Mitigation may reduce intensity of impact	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	3	2
Reversibility	3	3
Irreplaceable loss	2	2
Duration	3	3
Cumulative effect	3	3
Intensity/magnitude	1	1
Significance rating	-15 (low negative)	-15 (low negative)
Mitigation measures	▪	

Table 75: Rating of impacts on basic services and social and economic infrastructure during construction

Environmental Parameter	Basic services and social and economic infrastructure: this includes housing, water and sanitation, electricity, roads, clinics, recreational facilities

Issue/Impact/Environmental Effect/Nature	The influx of jobseekers to the area and migration of workers will increase the demand for basic services, as well as social and economic infrastructure in the area.	
Extent	The added pressure on infrastructure will be felt by the local municipality.	
Probability	Possible.	
Reversibility	This impact is partly reversible but will require significant investment to provide adequately for the area with a temporary increase in population and straining infrastructure.	
Irreplaceable loss of resources	This impact is not associated with any losses of resources; however, deterioration of man-made infrastructure is probable.	
Duration	Medium-term - impacts may last post the construction phase until mitigated.	
Cumulative effect	High, as there are a number of planned renewable energy developments in the area.	
Intensity/magnitude	Low - considering that there are no existing challenges with regards to basic service delivery.	
Significance Rating	The impact is low negative.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	2	2
Reversibility	2	2
Irreplaceable loss	1	1
Duration	2	2
Cumulative effect	3	3
Intensity/magnitude	1	1
Significance rating	-12 (low negative)	-12 (low negative)
Mitigation measures	▪ Engage with local authorities and inform them of the development as well discuss with them the ability of the municipality to meet the demands for social and basic services created by the migrant construction workers. ▪ Where feasible, assist the municipality in ensuring that the quality of the local social and economic infrastructure does not deteriorate further (especially the local roads).	

Table 76: Rating of impacts on social pathologies during construction

Environmental Parameter	Social pathologies - social factors such as deterioration of health; increase in crime; prostitution; and drugs among others.	
Issue/Impact/Environmental Effect/Nature	Potential impacts on social factors associated with the presence of construction workers and job seekers.	
Extent	The local community.	
Probability	Probable.	
Reversibility	Partly reversible. However, in the case of HIV and AIDS, the impact is irreversible.	
Irreplaceable loss of resources	This impact could be associated with some losses of personal goods and livestock.	
Duration	Short-term.	
Cumulative effect	High, as there are a number of planned renewable energy developments in the area.	
Intensity/magnitude	Low.	
Significance Rating	The impact is low negative - requires development of the local manufacturing capabilities.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	3	2
Reversibility	2	2
Irreplaceable loss	2	2
Duration	1	1
Cumulative effect	3	3
Intensity/magnitude	1	1
Significance rating	-13 (low negative)	-12 (low negative)
Mitigation measures	The developers could implement the following measures to limit the occurrence of an increase in social pathologies: ▪ Employ locals as far as feasible through the creation of the local skills database and recruitment of suitable candidates. ▪ Control the movement of workers between the site and areas of residence to minimise loitering. ▪ The contractors should make the necessary arrangements for allowing workers from outside the area to return home over weekends and/ or on a regular basis. This would reduce the risk	

	posed to local family structures and social networks. ▪ Implementing health awareness campaigns to curb the potential of spreading disease, use of drugs, or alcohol abuse for example.

- Operation

Table 77: Rating of impacts on economic production during operation

Environmental Parameter	Economic production is defined as any activity that uses inputs such as labour and capital to produce outputs in the form of services or goods.	
Issue/Impact/Environmental Effect/Nature	The impact results from sustainable production of the solar PV facility, as well as procurement of goods and services required for its sustainable operations and creation of sustainable employment opportunities through direct and indirect effects.	
Extent	The national economy will experience an increase in production	
Probability	It is most likely that there will be an increase in production.	
Reversibility	The impact is irreversible.	
Irreplaceable loss of resources	No loss of resource.	
Duration	This impact is rated as long-term since it will be experienced over the entire operational life of the project.	
Cumulative effect	High, as there are a number of planned renewable energy developments in the area.	
Intensity/magnitude	Medium.	
Significance Rating	This is a positive medium impact. Mitigation measures will maximise benefits to the local economy but will not change the significance of the rating.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	3	3
Reversibility	4	4
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	3	3

Intensity/magnitude	2	2
Significance rating	+36 (medium positive)	+36 (medium positive)
Mitigation measures	The project should aim to benefit the local economy as far as possible and feasible by opting for procurement of local goods and services. However, this will not affect the rating.	

Table 78: Rating of impacts on gross domestic product during operation

Environmental Parameter	Gross domestic product (GDP) is the total value of all "final" goods and services, which were produced within the borders of the country during a year.	
Issue/Impact/Environmental Effect/Nature	The impact is generated through continuous operation of the solar facility. It stimulates economic activities of directly and indirectly affected businesses, which subsequently leads to the creation of new business sales and generation of value added. Through increased household expenditure, an additional round of value adding is created.	
Extent	The national economy will experience an increase in GDP-R.	
Probability	It is most likely that there will be an increase in GDP-R during operations.	
Reversibility	The impact is irreversible.	
Irreplaceable loss of resources	No loss of resource.	
Duration	This impact is rated as long-term since it will be experienced over the entire operational life of the project.	
Cumulative effect	High, as there are a number of planned renewable energy developments in the area.	
Intensity/magnitude	Medium - The direct impact associated with the project will lead to the change in the local economy's structure but will have a diluted effect on the national economy.	
Significance Rating	This is a positive medium impact. Mitigation measures will maximise benefits to the local economy but will not change the significance of the rating.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	3	3
Reversibility	4	4

Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	3	3
Intensity/magnitude	2	2
Significance rating	+36 (medium positive)	+36 (medium positive)
Mitigation measures	▪ Investigate local procurement opportunities. ▪ Procurement from local suppliers should be encouraged if feasible to the viability of the facility.	

Table 79: Rating of impacts on employment during operation

Environmental Parameter	Employment impacts are calculated in terms of the Full-Time Equivalent (FTE) employment positions, which is the same as a FTE job or one man-year of work.	
Issue/Impact/Environmental Effect/Nature	The project is expected to create over 800 person-years throughout its operational lifespan including 80% from the local communities, and will also create and support additional employment opportunities through multiplier effects.	
Extent	Increase in employment will affect the entire country depending on the areas where inputs required are sourced.	
Probability	It is most likely that there will be an increase in employment during operations.	
Reversibility	The impact is irreversible.	
Irreplaceable loss of resources	No loss of resource.	
Duration	Long-term – the created employment opportunities are expected to last for the duration of the project.	
Cumulative effect	High, as there are a number of planned renewable energy developments in the area.	
Intensity/magnitude	Low – there will be some reduction in unemployment within the Siyathemba LM	
Significance Rating	This is a positive low impact. Mitigation measures will maximise benefits to the local economy but will not change the significance of the rating.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	3	3
Reversibility	4	4

Irreplaceable loss	1	1
Duration	1	1
Cumulative effect	3	3
Intensity/magnitude	1	1
Significance rating	+16 (low positive)	+16 (low positive)
Mitigation measures	▪ Where possible, the employment of local labour should be practiced to increase the benefit to the local community through prevention of leakage of buying power. ▪ Local small businesses should also be approached to investigate the possibility of supplying inputs for maintenance and operations where viable, this should increase local indirect employment creation.	

Table 80: Rating of impacts on skills development during operation

Environmental Parameter	Skills development: employment creation gives way to a host of skills transfer and development opportunities in terms of honing an existing skill or acquiring a new skill.
Issue/Impact/Environmental Effect/Nature	The impact takes place through the creation of employment opportunities during operations, and unlike the actual employment created is sustainable.
Extent	People across the country will have the opportunity to develop their skills.
Probability	Possible – one cannot be certain that people gaining employment during the operational phase will be able to develop or acquire new skills.
Reversibility	Irreversible; skills once gained cannot be lost.
Irreplaceable loss of resources	No loss of resource.
Duration	Permanent – the skills transferred will remain after the life of the project
Cumulative effect	High, as there are a number of planned renewable energy developments in the area.
Intensity/magnitude	Impact is rated as being of low intensity due to the nature of skills required for the operations.
Significance Rating	This impact is given a significance rating of low positive. Enhancement measures exist that can be implemented to ensure that skills development does take place which would improve the probability rating of this impact.

	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	2	3
Reversibility	4	4
Irreplaceable loss	1	1
Duration	4	4
Cumulative effect	3	3
Intensity/magnitude	1	1
Significance rating	+18 (low positive)	+19 (low positive)
Mitigation measures	In order to improve the chances of skills being developed during the operational period it is recommended that vocational skills transfer/training programmes be developed and knowledge sharing among employees encouraged. This mitigation measure could potentially improve the weighting of the impact in terms of its probability and increase its significance slightly.	

Table 81: Rating of impacts on household income during operation

Environmental Parameter	Household income: the result of a household's member engaging in economic activity; has a direct link to the standard of living of these households.
Issue/Impact/Environmental Effect/Nature	The impact takes place during operations as a result of jobs created through direct, indirect and induced impacts
Extent	Increase in household income will be nationwide since the sustainable increase in employment will affect the entire country
Probability	Probable - the impact will most likely take place
Reversibility	Irreversible.
Irreplaceable loss of resources	No loss of resource.
Duration	Long-term – the created employment opportunities are expected to last for the duration of the project.
Cumulative effect	High, as there are a number of planned renewable energy developments in the area.
Intensity/magnitude	Medium intensity
Significance Rating	This is a medium positive impact. Mitigation measures could increase the impact on the local economy but would not change the total impact. Therefore, the weights assigned for the impact before mitigations will not be affected.

	Pre-mitigation impact rating	Post mitigation impact rating
Extent	4	4
Probability	3	3
Reversibility	4	4
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	3	3
Intensity/magnitude	2	2
Significance rating	+36 (medium positive)	+36 (medium positive)
Mitigation measures	Local procurement of labour and required goods and services should be encouraged as far as feasible to increase the benefit to the local households. This, though, will not affect the overall rating.	

Table 82: Rating of impacts on government revenue during operation

Environmental Parameter	Government revenue: government obtains its revenue by collecting taxes and rates from the country's residents and business.	
Issue/Impact/Environmental Effect/Nature	The impact takes place mostly with payment of royalties and corporates taxes, as well as a result of payment of salaries and wages and declaration of dividends.	
Extent	The fiscal gain will be collected by the national government and used in the national budget; it is not possible to pinpoint exact regions benefitting from this increase.	
Probability	Definite - the impact will definitely take place, although one cannot be certain of the exact amount that government will be collecting as a result of this phase of the proposed project.	
Reversibility	Irreversible.	
Irreplaceable loss of resources	No loss of resource.	
Duration	Long-term	
Cumulative effect	High, as there are a number of planned renewable energy developments in the area.	
Intensity/magnitude	Low – the project will make a small contribution to the national revenue.	
Significance Rating	This is a low positive impact.	
	Pre-mitigation impact rating	Post mitigation impact rating

Extent	4	4
Probability	4	4
Reversibility	4	4
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	3	3
Intensity/magnitude	1	1
Significance rating	+19 (low positive)	+19 (low positive)
Mitigation measures	No mitigations.	

Table 83: Rating of impacts of SED and ED initiatives during operation

Environmental Parameter	SED and ED initiatives; as part of the REIPPP programme, project owners are required to spend a portion of their turnover on the upliftment of the community where the project is located.	
Issue/Impact/Environmental Effect/Nature	Currently the economic base of Siyathemba LM is small, and the anticipated injection will have a significant positive impact on the standard of living of its community.	
Extent	The impact will affect the local municipality; it is envisaged to be geared towards Copperton and nearby villages due to their proximity to the site but could potentially be extended in the future.	
Probability	Definite - the impact will definitely take place.	
Reversibility	Irreversible.	
Irreplaceable loss of resources	No loss of resource.	
Duration	Long-term – throughout the operational period	
Cumulative effect	High, as there are a number of planned renewable energy developments in the area.	
Intensity/magnitude	Low – the project will make an average contribution to the local economy.	
Significance Rating	Low positive impact.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	2
Probability	4	4
Reversibility	4	4
Irreplaceable loss	1	1
Duration	3	3

Cumulative effect	3	3
Intensity/magnitude	1	1
Significance rating	+17 (low positive)	+17 (low positive)
Mitigation measures	It is recommended that the project owner develops practical SED and ED programmes throughout the project's lifespan. The plan should be developed in consultation with local authorities and existing strategy documents to identify community projects that would result in the greatest social benefits. With regard to ED initiatives, focus should be on developing plans to support and create sustainable, self-sufficient enterprises. It is important that these plans be reviewed annually and where possible updated.	

Table 84: Rating of impacts on sense of place, living and working conditions during operation

Environmental Parameter	Sense of place, living and working conditions: these conditions are influenced by a variety of factors and can be quite subjective as each factor has a varying degree of influence for each person depending on what each individual's values are.	
Issue/Impact/Environmental Effect/Nature	Operation activities will have a significant visual impact on the areas in close proximity to the development site.	
Extent	The biggest impact will be felt close to the project site.	
Probability	Definite - the impact will definitely take place.	
Reversibility	Completely reversible.	
Irreplaceable loss of resources	No loss of resource.	
Duration	Long-term – throughout the operational period	
Cumulative effect	High, as there are a number of planned renewable energy developments in the area.	
Intensity/magnitude	Low	
Significance Rating	Low negative impact.	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	1	1
Probability	4	4
Reversibility	1	1
Irreplaceable loss	1	1
Duration	3	3
Cumulative effect	3	3
Intensity/magnitude	1	1

Significance rating	-13 (low negative)	-13 (low negative)
Mitigation measures	The mitigation measures proposed by the visual specialist should be adhered to.	

- Decommissioning

Socio-economic impacts stimulated during the closure phase are expected to be similar to those that take place during the construction phase. The impacts though are expected to be of low significance due to the very short duration thereof and lower magnitude. Enhancement and mitigation measures proposed for the construction phase impacts would also apply to the decommissioning phase.

10 SPECIALIST RECOMMENDATIONS AND MITIGATION MEASURES

10.1 Mitigation Measures

10.1.1 Biodiversity

- Avoid patches of indigenous vegetation if possible, or place infrastructure as close as possible to boundaries.
- Avoid wetland systems, where possible, by spanning them completely.
- Visibility devices could be placed on overhead power lines, if necessary. This will reduce the probability of avifaunal collisions slightly. The mitigation measure is not required unless monitoring identifies this as an issue during operation.

- Surface Runoff and Stormwater Management Plan
  This plan must indicate how all surface runoff generated as a result of the project and associated activities (during both the construction and operational phases) will be managed (e.g. artificial wetlands/stormwater and flood retention ponds) prior to entering any natural drainage system or wetland and how surface water runoff will be retained outside of any demarcated buffer/flood zones and subsequently released to simulate natural hydrological conditions.

- Rehabilitation Programme
  Rehabilitation Programme should be established before operation. The programme must address the rehabilitation of the existing habitats as well as rehabilitation after closure. This Rehabilitation Programme must be approved by the relevant government departments.

- Botanical walk-through survey
  A preconstruction walk-through survey should be undertaken to list the identity and location of all listed and protected species. The results of the walk-through survey should provide an indication of the number of individuals of each listed species that are likely to be impacted by the proposed development. This information may be required for a permit application to the Provincial authorities.

- Obtain permits for protected plants
  It is a legal requirement that permits will be required for any species protected according to National or Provincial legislation. The identity of species affected by such permit requirements can only be identified during the walk-through survey (previous mitigation measure). It is common practice for the authorities that issue the permits to require search and rescue of affected plants. Due to the season of the field survey and the extremely dry condition of the vegetation, it was not possible to establish this information at this stage. Plants lost to the development can be rescued and planted

in appropriate places in surrounding areas. This will reduce the irreplaceable loss of resources as well as the cumulative effect.

- Alien plant management plan
  It is recommended that a monitoring programme be implemented to enforce continual eradication of alien and invasive species, especially within the riparian habitat. An Alien Invasive Programme is an essential component to the successful conservation of habitats and species. Alien species, especially invasive species are a major threat to the ecological functioning of natural systems and to the productive use of land. In terms of the amendments of the regulations under the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983), landowners are legally responsible for the control of alien species on their properties. The protection of our natural systems from invasive species is further strengthened within Sections 70-77 of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004). This programme should include monitoring procedures.

- Undertake regular monitoring
  Monitoring should be undertaken to evaluate the success of mitigation measures. Monitoring methods must be in accordance with features that need to be monitored and can form part of a monitoring programme to be compiled.

10.1.2 Avifauna

- *PV facility, substation and associated infrastructure*

- Construction
  - Construction activity should be restricted to the immediate footprint of the infrastructure.
  - Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species.
  - Measures to control noise and dust should be applied according to current best practice in the industry.
  - Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.
  - The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint and rehabilitation of disturbed areas is concerned.

- Operation
  - An avifaunal specialist must be appointed to oversee all aspects of operational phase monitoring (including carcass searches) and assist with the on-going management of bird impacts that may emerge as the monitoring programme progresses. Formal operational phase monitoring should be implemented once the solar arrays have been constructed. The purpose of this would be to establish to what extent displacement of priority species have taken place. The exact time when operational phase monitoring should commence,

will depend on the construction schedule, and will be agreed upon with the site operator once these timelines have been finalised.

- As an absolute minimum, operational phase monitoring should be undertaken for the first two years of operation, and then repeated again in year 5, and again every five years thereafter. This is necessary to account for inter-annual variations in avifaunal activity as the result of varying rainfall patterns which can be highly erratic in this arid habitat. The exact scope and nature of the operational phase monitoring will be informed by the results of the monitoring on an ongoing basis and the EMP will be updated accordingly.
- Carcass searches should be implemented to search the ground between arrays of solar panels on a weekly basis (every two weeks at the longest) for at least one year to determine the magnitude of collision fatalities. Searches should be done on foot. Searches should be conducted randomly or at systematically selected arrays of solar panels to the extent that equals 33% or more of the project area. Detection trials should be integrated into the searches.
- Depending on the results of the carcass searches, a range of mitigation measures will have to be considered if mortality levels turn out to be significant, including minor modifications of panel and mirror design to reduce the illusory characteristics of solar panels. What is considered to be significant will have to be established on a species specific basis by the avifaunal specialist, in consultation with Birdlife South Africa.
- The exact protocol to be followed for the carcass searches and operational phase monitoring must be compiled by the avifaunal specialist in consultation with the plant operator and Environmental Control Officer before the commencement of operations.

- De-commissioning
  - De-commissioning activity should be restricted to the immediate footprint of the infrastructure.
  - Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species.
  - Measures to control noise and dust should be applied according to current best practice in the industry.
  - Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.
  - The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the de-commissioning footprint and rehabilitation of disturbed areas is concerned.

- *The 132kV grid connection*

- Construction
  - Construction activity should be restricted to the immediate footprint of the infrastructure.

- Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum used should be made of existing access roads and the construction of new roads should be kept to a minimum.
- To protect the Martial Eagle nest site located Tower 519 of the Hydra-Kronos 400kV line, it shall be necessary to relocate the nest site to a more distant, less disturbed area (e.g. Jenkins et al. 2007, 2013). The extent and distribution of other renewable energy developments planned for the immediate vicinity probably precludes a short-range relocation, and a dedicated structure, strategically situated off the power line network aggregated around the Kronos substation, may be the best option. The requirements of such an undertaking shall be further investigated if the development is authorised and selected as a preferred site by the DoE.

- Operation
  - The 132kV grid connection should be inspected at least once a quarter for a minimum of two years by the avifaunal specialist to establish if there is any significant collision mortality. Thereafter the frequency of inspections will be informed by the results of the first two years.
  - The detailed protocol to be followed for the inspections will be compiled by the avifaunal specialist prior to the first inspection.
  - The proposed transmission line for evacuation of the electricity generated by the PVs should be marked with Bird Flight Diverters (BFDs) for their entire length on the earth wire of the line, 5m apart, and alternating black and white. See the avifaunal specialist report for the type of BFD which is recommended.

10.1.3 Surface Water

Seasonal scheduling of the Construction Process – If possible, construction activities should be scheduled to take place over the dry season when rainfall and flows are low.

Location of the Lay-down Area – The lay-down area must not be placed within any surface water resources.

Preventing Physical Degradation of Surface Water Resources – Surface water resources and the associated buffer zones are to be designated as "highly sensitive areas". Vehicle access must avoid the highly sensitive areas, as far as possible. Internal access roads must avoid surface water resources, where possible.

Construction workers are only allowed in the designated construction areas of the proposed development and not into the surrounding surface water resources, where possible. Highly sensitive areas are to be clearly demarcated prior to the commencement of construction and no access beyond these areas is to be allowed.

Preventing Soil Contamination – No vehicles are to be allowed in the highly sensitive areas unless authorised. Should vehicles be authorised in highly sensitive areas, all vehicles and machinery are to be checked for oil, fuel or any other fluid leaks before entering the required construction areas. All vehicles and machinery must be regularly serviced and maintained before being allowed to enter the construction areas. No fuelling, re-fuelling, vehicle and machinery servicing or maintenance is to take place in the highly sensitive areas. The study site is to contain sufficient spill contingency measures throughout the construction process. These include, but are not limited to, oil spill kits to be available, fire extinguishers, fuel, oil or hazardous substances storage areas must be bunded to prevent oil or fuel contamination of the ground and/or nearby surface water resources or associated buffer zones.

Minimising Human Physical Degradation of Sensitive Areas - Construction workers are only allowed in designated construction areas and not into the surface water resources designated as highly sensitive. The highly sensitive areas are to be clearly demarcated and no access beyond these areas is to be allowed unless authorised.

No animals on the construction site or surrounding areas are to be hunted, captured, trapped, removed, injured, killed or eaten. Should any party be found guilty of such an offence, stringent penalties should be imposed. The appointed ECO is to be contacted should removal of any fauna be required during the construction phase.

No “long drop” toilets are allowed on the study site. Suitable temporary chemical sanitation facilities are to be provided. Temporary chemical sanitation facilities must be placed at least 100 meters from any surface water resource where required. Temporary chemical sanitation facilities must be placed over a bunded or a sealed surface area and adequately maintained to prevent pollution impacts.

No water is to be extracted unless a water use license is granted for specific quantities for a specific water resource, where applicable.

No hazardous or building materials are to be stored or brought into the highly sensitive areas. Should a designated storage area be required, the storage area must be placed at the furthest location from the highly sensitive areas. Appropriate safety measures as stipulated above must be implemented.

No cement mixing is to take place in a surface water resource. In general, any cement mixing should take place over a bin lined (impermeable) surface or alternatively in the load bin of a vehicle to prevent the mixing of cement with the ground. Importantly, no mixing of cement directly on the surface is allowed in the highly sensitive areas.

Obtaining Relevant Authorisations and Licenses – Before any construction or removal of soils and vegetation in any delineated surface water resources is undertaken, the relevant water use license is to be obtained should development need to take place directly in wetlands. Ideally, all surface water resources are to be avoided as far as possible.

Limiting Damage to Surface Water Resources – Ideally, to minimise any impact to surface water resources, the proposed development should seek to avoid all surface water resources as far as possible. Where this is not possible a single access route or "Right of Way" (RoW) is to be established to the desired construction area in the surface water resources. The environmentally authorized and license permitted construction area is to be demarcated and made visible. The establishment of the RoW likewise must be demarcated and made visible. The width of the RoW must be limited to the width of the vehicles required to enter the surface water resource (no more than a 3m width). An area around the locations of the proposed development structures, buildings, infrastructure will be required in order for construction vehicles and machinery to operate/manoeuvre. This too must be limited to the smallest possible area (no bigger than $100m^2$) and made visible by means of demarcation.

Limiting Removal of Excavated Soils – Should the necessary authorisations (water use license, environmental authorisation etc.) be obtained for the solar PV panels, buildings or structures and other associated infrastructure to be placed in surface water resources, excavated topsoils should be stockpiled separately from subsoils so that it can be replaced in the correct order for rehabilitation purposes post-construction. Soils removed from surface water resources must only be removed if absolutely required. Furthermore, any removed soils and vegetation that are not required for rehabilitation should be taken to a registered landfill site that has sufficient capacity to assimilate the spoil. The topsoil is to be used for rehabilitation purposes and should not be removed unless there is surplus that cannot be utilised. It is important that when the soils are reinstated, the subsoils are to be backfilled first followed by the topsoil.

Where the soils are excavated from the sensitive areas, it is preferable for them to be stockpiled adjacent to the excavation pit to limit vehicle and any other movement activities around the excavation areas.

Preventing Pollution Impacts –No mixing of cement directly on the surface is allowed in surface water resources.

Protection of Stockpiled Soils – Stockpiled soils will need to be protected from wind and water erosion. Stockpiled soils are not to exceed a 3m height and are to be bunded by suitable materials. Stacked bricks surrounding the stockpiled soils can be adopted. Alternatively, wooden planks pegged around the stockpiled soils can be used.

Rehabilitation of RoW areas – Ideally, the affected RoW zones in the sensitive areas must be re-instated with the soils removed from the surface water resource(s), and the affected areas must be levelled, or appropriately sloped and scarified to loosen the soil and allow seeds contained in the natural seed bank to re-establish. However, given the aridity of the study area, it is likely that vegetation recovery will be slow.

Rehabilitation areas will need to be monitored for erosion until vegetation can re-establish where prevalent. If affected areas are dry and no vegetation is present, the soil is to be re-instated and sloped.

Preventing Increased Run-off and Sedimentation Impacts - Vegetation clearing should take place in a phased manner, only clearing areas that will be constructed on immediately. Vegetation clearing must not take place in areas where construction will only take place in the distant future.

An appropriate storm water management plan formulated by a suitably qualified professional must accompany the proposed development to deal with increased run-off in the designated construction areas.

In general, adequate structures must be put into place (temporary or permanent where necessary in extreme cases) to deal with increased/accelerated run-off and sediment volumes. The use of silt fencing and potentially sandbags or hessian “sausage” nets can be used to prevent erosion in susceptible construction areas. Grass blocks on the perimeter of the building structure footprints can also be used to reduce run-off and onset of erosion. Where required more permanent structures such as attenuation ponds and gabions can be constructed if needs be. All impacted areas are to be adequately sloped to prevent the onset of erosion.

Any hardstand area, building or substation inside or within 50m proximity to a surface water resource must have energy dissipating structures on the perimeter of the structures to prevent increased run-off entering adjacent areas or surface water resources. This can be in the form of hard concrete structures or soft structures such as grass blocks for example.

Alternatively, a suitable operational storm water management design or plan can be compiled and implemented that accounts for the use of appropriate alternative structures or devices that will prevent increased run-off entering adjacent areas or surface water resources.

Minimising Vehicle Damage to the Surface Water Resources – Potential impacts can be avoided by the routing of access roads outside of and away from surface water resources, where possible. Additionally there are existing service roads where existing power lines have been established. Should the final alignment follow alongside existing power lines, the existing service roads are to be used and no new roads will be required to be established, if possible.

Access roads authorised in sensitive areas will have to be regularly monitored and checked for erosion. Monitoring should be conducted once every two months. Moreover, after short or long periods of heavy rainfall or after long periods of sustained rainfall the roads will need to be checked for erosion. Rehabilitation measures will need to be employed should erosion be identified.

Where erosion begins to take place, this must be dealt with immediately to prevent significant erosion damage to the surface water resources. Should large scale erosion occur, a rehabilitation plan will be required. Input, reporting and recommendations from a suitably qualified wetland/surface water specialist must be obtained in this respect.

Preventing Oil Leakages from the Substation - Importantly the substation is to contain adequate bunding structures around any oil containing structure to prevent any oil leakage from leaving the substation site.

Oil leak monitoring must take place on a regular basis to ensure that where leaks are identified, these can be dealt with appropriately.

Oil spill kits must be available at the substation site to deal with ad hoc oil spills.

10.1.4 Agricultural Potential and Soils

- Minimize removal of surface vegetation
- Re-vegetate with local species as soon as possible
- Ensure all access roads/tracks are surfaced/treated to increase cohesion

10.1.5 Visual

- Minimise vegetation clearing and rehabilitate cleared areas as soon as possible.
- Maintain a neat construction site by removing rubble and waste materials regularly.
- Make use of existing gravel access roads where possible.
- Ensure that dust suppression techniques are implemented on all access roads.
- All reinstated cable trenches should be re-vegetated with the same vegetation that existed prior to the cable being laid.
- Light fittings for security at night should reflect the light toward the ground and prevent light spill.
- If the operations and maintenance buildings are unstaffed they should not be illuminated at night.
- Bury cables under the ground where possible.
- The operation and maintenance building should be painted with natural tones that fit with the surrounding environment. Non-reflective surfaces should be utilised where possible.
- Select the alternatives that will have the least impact on visual receptors

10.1.6 Heritage

The National Heritage Resources Act (Act 25 of 1999) states that, any person who intends to undertake a development categorised as-

(a) the construction of a road, wall, transmission line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;

(b) the construction of a bridge or similar structure exceeding 50m in length;

(c) any development or other activity which will change the character of a site-

(i) exceeding 5 000 m^2 in extent; or

(ii) involving three or more existing erven or subdivisions thereof; or

(iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or

(iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;

(d) the re-zoning of a site exceeding 10 000 m^2 in extent; or

(e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority,

must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

In the event that an area previously not included in an archaeological or cultural resources survey is to be disturbed, the SAHRA needs to be contacted. An enquiry must be lodged with them into the necessity for a Heritage Impact Assessment.

2. In the event that a further heritage assessment is required it is advisable to utilise a qualified heritage practitioner, preferably registered with the Cultural Resources Management Section (CRM) of the Association of Southern African Professional Archaeologists (ASAPA).

   This survey and evaluation must include:

   (a) The identification and mapping of all heritage resources in the area affected;
   (b) An assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6 (2) or prescribed under section 7 of the National Heritage Resources Act;
   (c) An assessment of the impact of the development on such heritage resources;
   (d) An evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;
   (e) The results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;
   (f) If heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and
   (g) Plans for mitigation of any adverse effects during and after the completion of the proposed development.

3. It is advisable that an information section on cultural resources be included in the SHEQ training given to contractors involved in surface earthmoving activities. These sections must include basic information on:

   a. Heritage;
   b. Graves;
   c. Archaeological finds; and
   d. Historical Structures.

   This module must be tailor made to include all possible finds that could be expected in that area of construction.

Possible finds include:

a. Open air Stone Age scatters, disturbed during vegetation clearing. This will include stone tools.
b. Palaeontological deposits such as bone, and teeth in fluvial riverbank deposits.

4. In the event that a possible find is discovered during construction, all activities must be halted in the area of the discovery and a qualified archaeologist contacted.
5. The archaeologist needs to evaluate the finds on site and make recommendations towards possible mitigation measures.
6. If mitigation is necessary, an application for a rescue permit must be lodged with SAHRA.
7. After mitigation, an application must be lodged with SAHRA for a destruction permit. This application must be supported by the mitigation report generated during the rescue excavation. Only after the permit is issued may such a site be destroyed.
8. If during the initial survey sites of cultural significance are discovered, it will be necessary to develop a management plan for the preservation, documentation or destruction of such a site. Such a program must include an archaeological/palaeontological monitoring programme, timeframe and agreed upon schedule of actions between the company and the archaeologist.
9. In the event that human remains are uncovered, or previously unknown graves are discovered, a qualified archaeologist needs to be contacted and an evaluation of the finds made.
10. If the remains are to be exhumed and relocated, the relocation procedures as accepted by SAHRA need to be followed. This includes an extensive social consultation process.

Archaeology

The project will encompass a range of activities during the construction phase, including ground clearance, establishment of construction camps area.

It is possible that cultural material will be exposed during operations and may be recoverable, but this is the high-cost front of the operation, and so any delays should be minimised. Development surrounding infrastructure and construction of facilities results in significant disturbance, but construction trenches do offer a window into the past and it thus may be possible to rescue some of the data and materials. It is also possible that substantial alterations will be implemented during this phase of the project and these must be catered for. Temporary infrastructure is often changed or added to during the subsequent history of the project. In general these are low impact developments as they are superficial, resulting in little alteration of the land surface, but still need to be catered for.

During the pre-construction phase, it is important to recognise any significant material being unearthed, and to make the correct judgment on which actions should be taken. In the event that possible heritage resources are identified a qualified archaeologist/palaeontologist must be contacted to evaluate the finds and make recommendations on the mitigation required.

In addition, feedback reports can be submitted by the archaeologist to the client and SAHRA to ensure effective monitoring. This archaeological monitoring and feedback strategy should be incorporated into the Environmental Management Programme (EMPr) of the project. Should an archaeological/palaeontological site or cultural material be discovered during construction (or operation), such as burials or grave sites, the project needs to be able to call on a qualified expert to make a decision on what is required and if it is necessary to carry out emergency recovery. SAHRA would need to be informed and may give advice on procedure. The developers therefore should have some sort of contingency plan so that operations could move elsewhere temporarily while the material and data are recovered. The project thus needs to have an archaeologist/palaeontologist available to do such work. This provision can be made in an archaeological monitoring programme.

In the case where archaeological material is identified during construction the following measures must be taken:

- Upon the accidental discovery of archaeological material, a buffer of at least 20 meters should be implemented.
- If archaeological material is accidentally discovered during construction, activities must cease in the area and a qualified archaeologist be contacted to evaluate the find. To remove the material permit must be applied for from SAHRA under Section 35 of the NHRA.

Graves

In the case where a grave is identified during construction the following measures must be taken:

- Upon the accidental discovery of graves, a buffer of at least 50 meters should be implemented.
- If graves are accidentally discovered during construction, activities must cease in the area and a qualified archaeologist be contacted to evaluate the find. To remove the remains a permit must be applied for from SAHRA (Section 36 of the NHRA) and other relevant authorities (National Health Act and its regulations). The local South African Police Services must immediately be notified of the find.
- Where it is recommended that the graves be relocated, a full grave relocation process that includes comprehensive social consultation must be followed.

The grave relocation process must include:

i. A detailed social consultation process, that will trace the next-of-kin and obtain their consent for the relocation of the graves, that will be at least 60 days in length;
ii. Site notices indicating the intent of the relocation;
iii. Newspaper notices indicating the intent of the relocation;
iv. A permit from the local authority;
v. A permit from the Provincial Department of Health;

vi. A permit from the South African Heritage Resources Agency, if the graves are older than 60 years or unidentified and thus presumed older than 60 years;

vii. An exhumation process that keeps the dignity of the remains intact;

viii. The whole process must be done by a reputable company that is well versed in relocations;

ix. The exhumation process must be conducted in such a manner as to safeguard the legal rights of the families as well as that of the developing company.

10.1.7 Socio-economic

In order to optimise the stimulation of the local economy through direct, indirect, and induced effects, the following should be applied where possible:

- Procure construction materials, goods, and products from local suppliers if feasible and possible.
- Employ local contractors where possible.
- Recruit local labour.
- Sub-contract to local construction companies.
- Use local suppliers where viable and arrange with the local Small and Medium Enterprises to provide transport, catering, and other services for the construction crew.
- Employ labour-intensive measures in construction
- Set-up a skills desk at the local municipal office and in the nearby communities to identify skills available in the community and assist in recruiting local labour during both construction and operation.
- Contractors should provide learnerships and on-job training, if possible;
- Where specialist training can be provided, candidates from local communities should be prioritised for training; and
- Share knowledge with the sub-contracting companies during the construction period.
- Goods and services are procured domestically instead of imported, where possible.
- Engage with local authorities and inform them of the development as well discuss with them the ability of the municipality to meet the demands for social and basic services created by the migrant construction workers.
- Where feasible, assist the municipality in ensuring that the quality of the local social and economic infrastructure does not deteriorate further (especially the local roads).
- Control the movement of workers between the site and areas of residence to minimise loitering.
- The contractors should make the necessary arrangements for allowing workers from outside the area to return home over weekends and/ or on a regular basis. This would reduce the risk posed to local family structures and social networks.

- Implementing health awareness campaigns to curb the potential of spreading disease, use of drugs, or alcohol abuse for example.
- Local small businesses should also be approached to investigate the possibility of supplying inputs for maintenance and operations where viable, this should increase local indirect employment creation.
- In order to improve the chances of skills being developed during the operational period it is recommended that vocational skills transfer/training programmes be developed and knowledge sharing among employees encouraged.
- It is recommended that the project owner develops practical SED and ED programmes throughout the project's lifespan. The plan should be developed in consultation with local authorities and existing strategy documents to identify community projects that would result in the greatest social benefits. With regard to ED initiatives, focus should be on developing plans to support and create sustainable, self-sufficient enterprises. It is important that these plans be reviewed annually and where possible updated.

10.1.1 Electromagnetic and radio frequency interference

The recommended mitigation measures are provided in the table below. Recommendations are based on the levels by which limits are exceeded, and are worst case values. The highest levels of exceedance are in all cases in comparison to closest telescope limits. However, the general improvement of shielding obtained by replacing existing enclosures containing any electronic hardware, should be sufficient to reduce emission levels to below required limits for the closest telescopes. By implication this will provide compliance with core-site limits as well.

The correct installation and use of shielded enclosures are crucial to their successful operation. This includes a well-defined cable entry policy where all galvanic cabling should go through bulk-head connectors that ensure galvanic connection of cable armouring or outer/over braiding to the enclosure. This will help to reduce radiated interference associated with resonant galvanic loops. Also, it requires the enclosures to be connected to a well-defined earthing network with a low impedance connection to ground. No additional apertures should exist on the enclosure, and any ventilation openings should be fitted with an adequately specified honeycomb ventilation filter.

Finally, the use of bare copper in soil, ensures that earthing reference potentials throughout the distributed system are equal and constant. It provides a well-defined earthing system for the entire plant layout, which simplifies installation of any additional connections should they be required.

Table 85: Identified interference, comparison to relevant SKA limits and mitigation recommendations

Areas of Interference and Associated Mitigation		
Description	Impact on SKA	Recommendations
Inverter Switching Noise	Detrimental to operation of closest telescope; Negative impact on operation of core site	Improved Shielding: RFI gasketting on all seams and doors. RFI honeycomb filtering on ventilation openings, improved cable entry interfaces.
String and Tracking cabinets	Detrimental to operation of closest telescope; Negative impact on operation of core site	Replace existing fibreglass enclosures with metallic versions specified for purposes of RFI reduction. Improved cable entry interfaces.
Weather Station	Detrimental to operation of closest telescope; Negative impact on operation of core site	Replace existing fibreglass enclosures with metallic versions specified for purposes of RFI reduction. Improved cable entry interfaces. Improve earthing of weather station.
Tracking Hardware	Detrimental to operation of closest telescope; Negative impact on operation of core site	Interference associated mostly with the motor control hardware. Replace conventional mechanical relays with solid state versions. Improved String cabinet shielding help aid reduction of radiated levels. Review of control hardware required.
Wireless Communication	Detrimental to operation of closest telescope; Negative impact on operation of core site	Replace all wireless communication in particular any WiFi network with fixed line communication.

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11 CUMULATIVE IMPACTS

11.1 Cumulative Impacts

The area has seen a notable interest from developers of various renewable energy projects, which could be associated with the wind and solar energy resource potential found in the region, proximity to the existing sub-station and its evacuation capacity, as well as other factors. Such developments, whether already approved or only proposed, need to be considered as they have the potential to create numerous cumulative impacts, whether positive or negative, if implemented. Table 86 lists the projects that will need to be considered when examining the cumulative impacts; their location relative to the project under review is illustrated in Figure 76.

Table 86: Proposed renewable energy projects in the area

Proposed Development	DEA Reference Number	Current Status of EIA	Proponent	Proposed Capacity	Farm Details
Helena Solar 1	14/12/16/3/3/2/765	EIA Underway	BioTherm Energy (Pty) Ltd	75MW	Portion 3 of the farm Klipgats Pan No 117
Helena Solar 2	14/12/16/3/3/2/766	EIA Underway	BioTherm Energy (Pty) Ltd	75MW	Portion 3 of the farm Klipgats Pan No 117
Bosjesmansberg Solar Energy Facility	14/12/16/3/3/2/579	Unknown	Networx Renewables (Pty) Ltd	up to 300MW	Ptn 1 of Farm Bosjesmansberg 67
Aletta Wind Energy Facility	N/A	Application to be submitted	BioTherm Energy (Pty) Ltd	140MW	Re of Farm Uitzigt 69 Portions 1, 2, 3 and Re of Farm Drielings Pan 101
Eureka Wind Energy Facility	N/A	Application to be submitted	BioTherm Energy (Pty) Ltd	140MW	Re of Farm Witfontein 54 Ptn 2, 3 and Re of Farm Blaaubosch Poortje 66 Ptn 8 and 9 of Farm Nelspoortje 103
Garob Wind Energy Facility	14/12/16/3/3/2/279	EA Amendment Application underway	Garob Wind Farm (Pty) Ltd	140MW	Ptn 5 of Farm Nelspoorttje 103
Mulilo Renewable Energy Solar PV Prieska	14/12/16/3/3/1/454	EA Issued, Fully operational	Mulilo Renewable Energy (Pty) Ltd	19.9MW	Vogelstruisbult farm
Mulilo Prieska PV	14/12/16/3/3/1/453	EA Issued	Mulilo Renewable Energy (Pty) Ltd	75MW	Ptn 4 of Farm Klipgats Pan 117
Mulilo Sonnedix Prieska PV		EA Issued	Mulilo Sonnedix Prieska PV (PTY) LTD	75MW	Remainder of Farm Hoekplaas 146
Mierdam Solar Photovoltaic (PV) Facility	12/12/20/2320/2	EA Issued	South Africa Mainstream Renewable Power Mierdam (Pty) Ltd	75MW	Portion 1 of Farm Kaffirs Kolk 118
Platsjambok West PV Facility	12/12/20/2320/5	EA Issued	South Africa Mainstream Platsjambok West (Pty) Ltd	75MW	Remainder of Farm Platsjambok 102
Platsjambok East PV Facility	12/12/20/2320/4	EA Issued	South Africa Mainstream Platsjambok East (Pty) Ltd	75MW	Remainder of Farm Platsjambok 102
Hedley Plains PV Facility	14/12/16/3/3/2/608	Unknown	NK Energie (Pty) Ltd	Unknown	Ptn 3 of Farm Hedley Plains A 64

Proposed Development	DEA Reference Number	Current Status of EIA	Proponent	Proposed Capacity	Farm Details
Helena Solar 1	14/12/16/3/3/2/765	EIA Underway	BioTherm Energy (Pty) Ltd	75MW	Portion 3 of the farm Klipgats Pan No 117
Helena Solar 2	14/12/16/3/3/2/766	EIA Underway	BioTherm Energy (Pty) Ltd	75MW	Portion 3 of the farm Klipgats Pan No 117
Doonies Pan PV Facility	14/12/16/3/3/2/609	Unknown	NK Energie (Pty) Ltd	Unknown	Ptn 5 of Farm Doonies Pan 106
Hoekplaas PV Facility	PV2: 14/12/16/3/3/2/493; PV3: 14/12/16/3/3/2/494 PV4: 14/12/16/3/3/2/495; PV5: 14/12/16/3/3/2/496; PV6: 14/12/16/3/3/2/497; PV7: 14/12/16/3/3/2/498; PV8: 14/12/16/3/3/2/499; PV9: 14/12/16/3/3/2/500; PV10: 14/12/16/3/3/2/501; PV11: 14/12/16/3/3/2/502;	Unknown	Mulilo Renewable Energy (Pty) Ltd	75MW x 10 projects	Remainder of Farm Hoekplaas 146
Struisbult 1 & 2 PV Facility	12/12/20/2502	Unknown	Mulilo Renewable Energy (Pty) Ltd	100-300MW	Ptn 1 of Farm Struisbult Pan 104 (Vogelstruisbult)

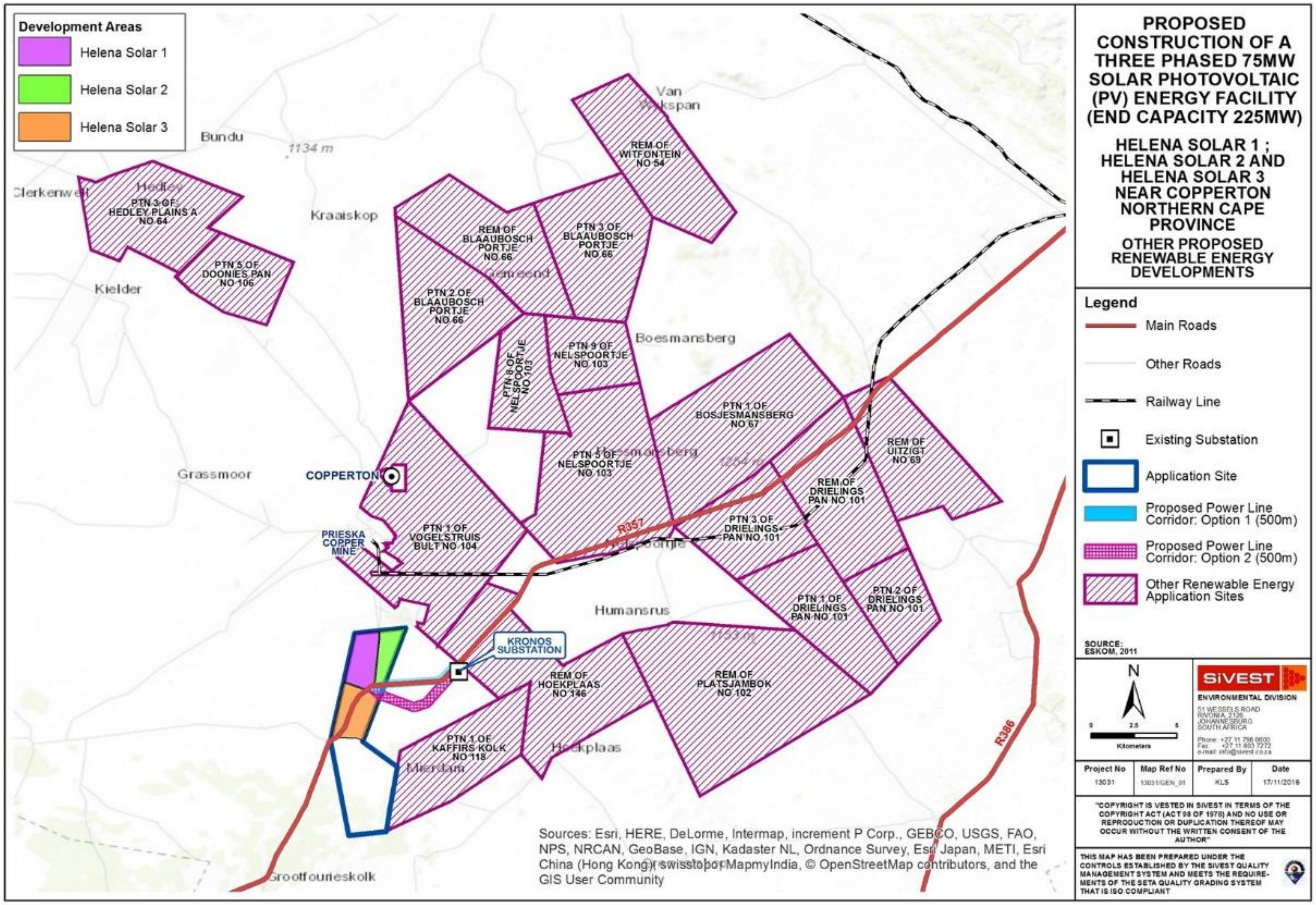

Figure 76: Location of other renewable energy projects (proposed and approved) in the area

In addition to the cumulative impacts that each specialist rated within the impact tables above (refer to section 9.2), the specialists have also identified specific cumulative impacts and these are outlined below.

11.2 Biodiversity impacts

Existing impacts on site and in the surrounding areas are mostly related to rural land-use, such as grazing, roads and homesteads. These have resulted in some direct impacts on natural habitat as well as grazing effects on natural habitat. In the area around the site are also impacts evident from historical mining activities.

The main impact due to the proposed project will be loss of habitat, along with associated secondary impacts, as listed and discussed in the sections above (loss of faunal habitat, displacement of fauna and invasion by alien plants). There are a number of other solar projects that have been proposed or have already been approved in the general area around the site and towards Prieska. Together, these projects will lead to significant loss of natural habitat in the general area. Cumulative impacts associated with the project are therefore potentially significant and are assessed as moderate for all impacts associated with habitat loss. A summary of cumulative impacts associated with each impact are as follows:

Table 87: Summary of cumulative impacts on biodiversity

Impacts on indigenous natural vegetation	High cumulative impact. Added to existing impacts on natural habitat, the current project will cause additional loss of vegetation that could be significant.
Loss of individuals of protected plants	Low cumulative impact. Some individuals will possibly be affected, but not to a significant extent compared to numbers within natural populations nearby.
Damage to drainage areas and pans	Low cumulative impact. Added to existing impacts on drainage areas and pans, the current project may cause additional impacts, but not to a significant extent, if management measures are employed to control impacts. The region is very arid and, although there are drainage areas and pans in the area, not a large number will likely be affected by the combination of all the projects.
Displacement of mobile fauna	Moderate to high cumulative impact. Added to existing impacts on natural habitat, the current project will cause additional displacement. The projects all taken together could potentially cause regional displacement of some species.
Bird mortality due to power line collisions	Moderate to high cumulative impact. Cumulative effects are expected to be significant for some vulnerable species (those that are affected by collisions with overhead power lines), since

	there is little current impact in the region, but this will be expanded significantly if all projects proceed.
Establishment and spread of declared alien plants	Moderate cumulative impact. Cumulative effects will not be significant for any single project due to the existing presence of populations of alien plants in the study area, but taken in combination, the degree of disturbance to the landscape will increase conditions favourable for invasive species quite significantly.

11.3 Avifauna impacts

11.3.1 Cumulative impacts at a local level (within a 20km radius)

The Kronos MTS forms the hub of a renewable energy node which is planned for the future (See Figure 76). The total potentially transformed area is within a 20km radius around the Kronos MTS amounts to 593km^2 , which amounts to 47% of the available land within the 20km radius, or the equivalent of 2.1 Martial Eagle territories in Nama Karoo habitat (Hockey et al. 2005).

- Potential mortality due to collisions with the proposed PV arrays

In the current instance, not all the criteria can be met in assessing the cumulative impact of potential mortality due to collisions with the proposed PV arrays at a local level. The main reason is that no scientifically verified information exists with regard to actual avifaunal mortality levels with the status quo as it currently exists, in other words there are no existing studies to review as far as existing impacts on the avifauna is concerned. In the absence of any scientifically verified data, general knowledge and experience will have to suffice. Given the extensive farming practices which are currently used in the study area, it can be surmised that the existing anthropogenic impacts on avifauna in the study area is relatively low. Although it cannot be confirmed, interviews with the landowner indicate that active persecution of large raptors for alleged stock killing is not commonly practised. Hunting of avifauna is also not a major impact. Overall, the very low human population is definitely advantageous to avifauna in general. All of these assertions would ideally need to be tested empirically in order to make comparisons possible, but a study of that proportion falls outside the scope of this project.

The one existing impact that can be taken as confirmed is the mortality of Ludwig's Bustard due to collisions with the existing high voltage network in the 20km radius around the proposed development. Due to the presence of the Kronos MTS, there is an extensive network of existing HV lines feeding into the substation. The extent of this mortality factor is unknown, but it can be assumed that it is a regular occurrence (Shaw 2013). The key question therefore is to what extent potential collisions with the PV arrays will contribute to this existing and potentially significant mortality factor, taking into account not only the status quo as it currently stands, but also the future situation should all the proposed renewable energy projects materialise. It is not envisaged that collisions of Ludwig's Bustard with the PV arrays will be a major impact, as the species is not likely to be attracted by the “lake effect”. The cumulative impact of mortality of Ludwig’s Bustard at the proposed Helena 3 PV site, due to collisions with the PV arrays, is therefore likely to be negligible.

As far as the other priority species are concerned, the cumulative impact may be more significant, assuming that all the proposed renewable energy plants will be built. Overall, the cumulative impact of collisions with renewable energy infrastructure (solar panels and wind turbines) consisting of a total surface area of approximately 593km², or 47% of the area within a 20km radius, could be Moderate at a local level for priority species. With mitigation, this could probably be reduced to Minor, but it must be borne in mind that mitigation for this type of impact still in an experimental phase.

- Displacement of priority species due to habitat transformation and disturbance

The difficulties associated with the quantification of cumulative impacts of the renewable energy facilities at a local level have already been explained above. The current land use, namely extensive sheep farming, is not displacing any priority species although it may be that periodic overgrazing might have an impact on the habitat and therefore the densities of some species. However, that cannot be categorically confirmed without more research. As far as potential future impacts are concerned, the cumulative impact of habitat transformation due to renewable energy infrastructure consisting of a total surface area of approximately 593km², or 47% of the area within a 20km radius, is likely to be significant for many species, especially large terrestrial species such as Ludwig’s Bustard, Northern Black Korhaan, Karoo Korhaan, Secretarybird, large raptors (particularly Martial Eagle) and range restricted species such as Sclater’s Lark. Apart from the direct habitat loss due to solar panels and wind turbines, the habitat fragmentation caused by the proposed road networks might indirectly have a significant impact on large terrestrial species, particularly Ludwig’s Bustard, as it is known that the species avoids the vicinity of roads (Shaw 2013). Overall, the significance of this impact is rated at Major at a local level (i.e. within a 20km radius), and will remain so irrespective of mitigation. It should however not be viewed as a fatal flaw, as the regional impact is not as severe

- Bird collisions, particularly priority species, with the proposed 132kV grid connection

The difficulties associated with the quantification of cumulative impacts at a local level have already been explained above. The risks that power lines pose to avifauna, and specifically to Ludwig’s Bustards, is well researched (Shaw 2013). These transmission lines will increase the already high collision risk to the species that power lines pose throughout its range. No quantification of Ludwig’s Bustard collision mortality has been undertaken for the local area, but it can be assumed that it is a regular occurrence (Shaw 2013). The key question therefore is to what extent transmission line collisions will contribute to this existing and potentially significant mortality factor. All in all, it is envisaged that collisions of priority species, particularly Ludwig’s Bustard, with the new Helena 132kV grid connection will have a Moderate cumulative impact at a local scale. If the recommendations in this report are implemented, it is envisaged that the cumulative impact of this mortality factor could be reduced to a Minor level for the local area. In this respect it should be mentioned that the extensive habitat transformation that is envisaged should all the projects materialise, will definitely reduce the occurrence of the species at a local level and therefore also the collision risk.

11.3.2 Cumulative impacts at a regional level (within a 40km radius)

The total amount of land that could potentially be transformed within a 40km radius through renewable energy projects is 926km², which is 18% of the surface area within this 40km radius (see Figure 10 below), or the equivalent of 3.3 Martial Eagle territories in the Nama Karoo (Hockey et al. 2005).

The difficulty associated with the quantification of cumulative impacts of the renewable energy facilities at a local level have already been explained above, and is equally valid on a regional scale.

- Potential mortality due to collisions with the proposed PV arrays

Given the extensive farming practices which are currently used in the region, it can be surmised that the existing anthropogenic impacts on avifauna is relatively low. Although it cannot be confirmed, interviews with the landowner at Nelspoortjie indicate that active persecution of large raptors for alleged stock killing is not commonly practised. Hunting of avifauna is also not a major impact. Overall, the very low human population is definitely advantageous to avifauna in general. All of these assertions would ideally need to be tested empirically in order to make comparisons possible, but a study of that extent falls outside the scope of this project.

The one existing impact that can be taken as confirmed is the mortality of Ludwig's Bustard due to collisions with the existing power line network in the 40km radius around the proposed development. Due to the presence of the Kronos MTS, there is an extensive network of existing HV and MV lines feeding into the substation. The extent of this mortality factor is unknown, but it can be assumed that it is a regular occurrence (Shaw 2013). The key question therefore is to what extent collisions with the PV arrays will contribute to this existing and potentially significant mortality factor, taking into account not only the status quo as it currently stands, but also the future situation should all the proposed renewable energy projects materialise. It is not envisaged that collisions of Ludwig's Bustard with the PV arrays will be a major impact, as the species is not likely to be attracted by the "lake effect". The cumulative impact of mortality of Ludwig's Bustard at the proposed Helena PV site, due to collisions with the PV arrays, is therefore likely to be Insignificant at a regional scale.

As far as the other priority species are concerned, the cumulative impact at a regional scale may be more significant, assuming that all the proposed renewable energy plants will be built. The cumulative impact of collisions with solar panels and wind turbines consisting of a total surface of approximately 926km², or 18% of the area within a 40km radius, may be more significant, but still relatively minor on a regional scale. The overall cumulative impact is therefore rated as Minor on a regional scale.

- Displacement of priority species due to habitat transformation and disturbance

The difficulties associated with the quantification of cumulative impacts of the renewable energy facilities at a regional level have already been explained above. The current land use, namely extensive sheep farming, is not displacing any priority species although it may be that periodic overgrazing might have an impact on the habitat and therefore the densities of some species. However, that cannot be categorically confirmed without more research. As far as potential future impacts are concerned, the cumulative impact of habitat transformation due to renewable energy infrastructure consisting of a total surface area of approximately 926km², or 18% of the area within a 40km radius, is not likely to be catastrophic for any of the priority species, as they all have large distribution ranges with healthy populations in the Nama Karoo, with the exception of Sclater's Lark. For the latter species the impact may be more significant, but still within acceptable levels. The overall impact is therefore rated as Minor on a regional scale.

- Bird collisions, particularly priority species, with the proposed 132kV grid connection

The difficulties associated with the quantification of cumulative impacts at a local level have already been explained above and the same is applicable as far as regional impacts are concerned. The risks that power lines pose to avifauna, and specifically to Ludwig's Bustards, is well researched (Shaw 2013). These transmission lines will increase the already high collision risk to the species that power lines pose throughout its range. No quantification of Ludwig's Bustard collision mortality has been undertaken for the regional area, but it can be assumed that it is a regular occurrence (Shaw 2013). The key question therefore is to what extent transmission line collisions will contribute to this existing and potentially significant mortality factor. All in all, it is envisaged that collisions of priority species particularly Ludwig's Bustard, with the new Helena 132kV grid connections will have a low cumulative impact at a regional scale. If the recommendations in this report are implemented, it is envisaged that the cumulative impact of this mortality factor could be reduced, but will remain at a low level for the regional area. In this respect it should be mentioned that the extensive habitat transformation that is envisaged should all the solar projects materialise, will definitely reduce the occurrence of the species at a local level and therefore also the collision risk. Furthermore, from a regional perspective, the proposed 132kV grid connections are relatively short compared to the existing high voltage network and therefore of moderate/low significance. The overall significance of this impact is therefore rated as Minor on a regional scale.

11.4 Surface water impacts

Although it is important to assess the surface water impacts of the proposed solar facility and the associated components, it is equally important to assess the potential cumulative surface water impact that could materialise in the area should other renewable energy facilities (both wind and solar facilities) be granted environmental authorisation and be constructed. Cumulative impacts are the impacts, which combine from different developments / facilities and result in significant impacts that may be larger than the sum of all the impacts combined.

It must be noted that surface water resources change from one site to another and can range in number of surface water resources from one property to another depending on factors such as topography, geology, local rainfall and other environmental factors. Additionally, the characteristics of surface water resources can change along its course where longitudinal hydrological systems are involved. Nonetheless, the most important factor to consider when evaluating surface water impacts from a cumulative perspective is downstream impacts. Where a development takes place upstream, should impacts occur these are likely to have a downstream impact to some degree.

In the context of the proposed development, similar developments (wind farms and solar facilities) are located directly to the east. Several more are located to the north and north east where a cluster of developments are being proposed. Importantly, drainage is mainly towards the north east on the proposed development site. As such, the proposed development could have a potential cumulative impact on surrounding properties and the surface water resources found on each. Hence, the potential cumulative impact is not anticipated on the proposed development site but rather on the neighbouring properties. The primary impact of concern relates to increased surface run-off and consequent potential erosion and sedimentation primarily as a result of construction activities. The degree of impact can be expected to be compounded with construction activities taking place at the same time should construction of the Helena 1 and 2 solar facilities take place, and where sudden and heavy rainfall is experienced. However, where mitigation measures are strictly adhered to, potential impacts radiating outwards as a result of the proposed development can be minimized significantly. Additionally, it is expected that should any cumulative impacts occur, these will take place on the properties directly adjacent and not those located several kilometres away. Overall, the cumulative impact is therefore also limited to the immediate project site and directly adjacent proposed developments.

11.5 Agriculture and Soils impacts

The main cumulative impact for this project may be as a result of several similar solar power projects in close proximity to Helena 3. Regarding the soil resource, this should not have any significant effect, due to the dry climate and predominance of shallow, low potential agricultural soils that occur. Each project is developed in isolation and the soils as such will not be affected.

However, the possibility of an increased wind erosion hazard may be significant. This is because the prevailing sandy topsoils in the vicinity are prone to removal by wind action if vegetation is disturbed or removed. If this happens, the soil becomes air-borne dust and is subject to the force and direction of the prevailing wind, which can result in such dust being transported many kilometres in almost any direction. One of the potential results of increased dust content in the atmosphere could be the build-up of a layer on infrastructure, including solar panels, which would lessen efficiency of solar radiation collection.

For this reason, effective soil conservation and dust suppression measures are essential for mitigation purposes.

11.6 Heritage impacts

A large number of solar projects are proposed and some have been approved and are currently in construction around the study area. The heritage specialist report identified finds and conclusions made by other HIA's from other projects that has shown the vast distribution of Stone Age sites over the larger area around Copperton. The need for the implementation of the recommended mitigation measures is of great importance and must be seen in the context of the large areas to be impacted by the construction activity. By implementing the mitigation measures the cumulative effect will be reduce from a Medium to a Low negative impact rating.

11.7 Visual impacts

Although it is important to assess the visual impacts of the proposed PV energy facility on its own, it is equally important to assess the cumulative visual impact that could materialise in the area should other renewable energy facilities (both wind and PV facilities) be granted authorisation to proceed. Cumulative impacts are the impacts, which combine from different developments / facilities and result in significant impacts that may be larger than sum of all the impacts.

These renewable energy facilities and their potential for large scale visual impacts could significantly alter the sense of place and visual character in the study area, if constructed. The cumulative visual impact experienced by each visual receptor will depend on the number of proposed developments within a 5km radius from the receptor location, as beyond 5km the visual impact of the development would diminish to an insignificant level.

The renewable energy developments that are being proposed within a 5km radius from the receptor locations are indicated in Table 88 and Figure 77 below.

Table 88: Renewable energy developments proposed within a 5km radius from the receptor locations

Proposed Development	DEA Reference Number	Current Status of EIA	Proponent	Proposed Capacity	Farm Details
Helena 1 PV Energy Facility	14/12/16/3/3/2/765	EIA Underway	BioTherm Energy (Pty) Ltd	75MW	Ptn 3 of Farm Klipgats Pan 117
Helena 2 PV Energy Facility	14/12/16/3/3/2/766	EIA Underway	BioTherm Energy (Pty) Ltd	75MW	Ptn 3 of Farm Klipgats Pan 117
Mierdam Solar PV Facility	12/12/20/2320/2	Environmental Authorisation (EA) Issued	South Africa Mainstream Renewable Power Mierdam (Pty) Ltd	75MW	Portion 1 of Farm Kaffirs Kolk 118

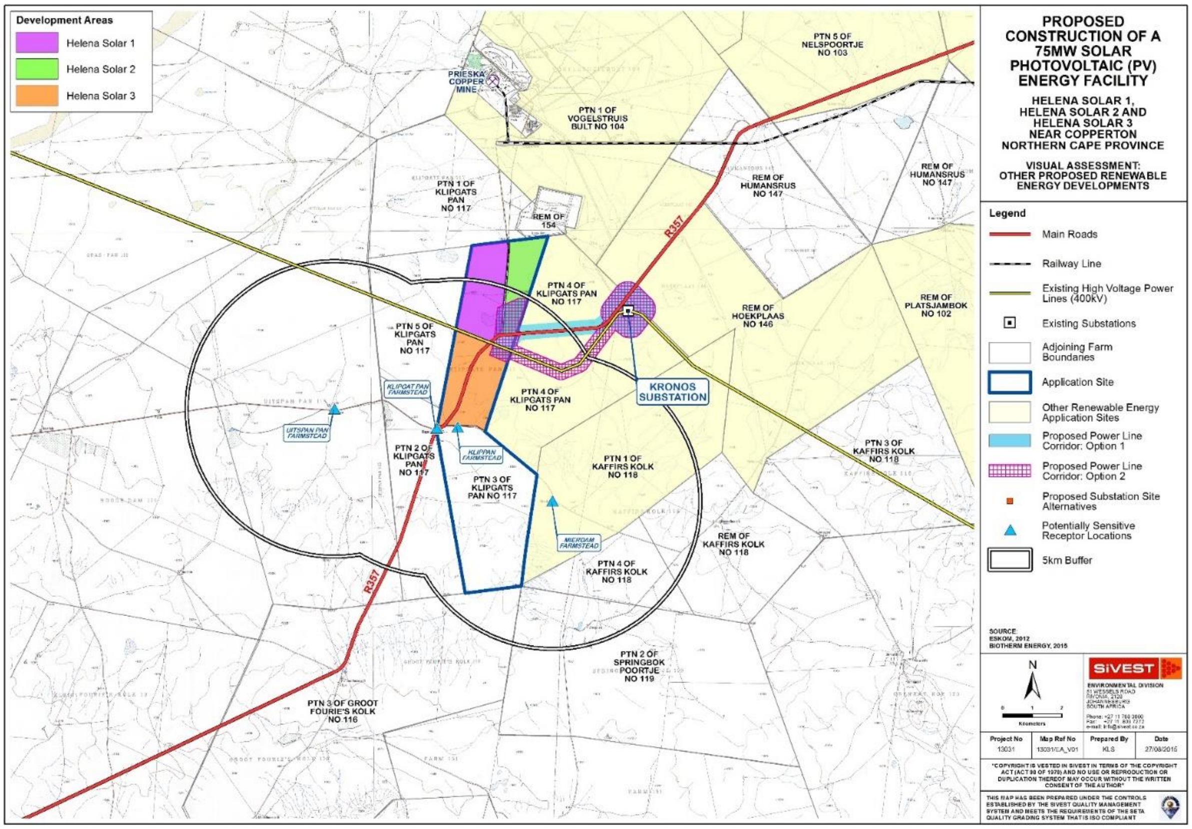

Figure 77: Renewable energy facilities proposed within a 5km radius from the potentially sensitive receptor locations

The number of proposed developments that each receptor would be visually exposed to (i.e. the cumulative impact experienced at each location) is indicated in Table 89 below. It should be noted that the impact on each receptor location is indicative of the 'worst case' scenario which assumes that all of the proposed facilities would be developed.

Key

Likely to be visually exposed to the proposed development (within viewing distance)
Limited visual exposure to the proposed development (not within viewing distance)

Table 89: Cumulative visual impact on potentially sensitive receptors

Potentially Sensitive Visual Receptors	**Helena 1 PV Energy Facility**	**Helena 2 PV Energy Facility**	**Mierdam Solar PV Facility**
Klipgat Pan Farmstead	√	√	√

Uitspan Pan Farmstead	√		
Klippan Farmstead	√	√	√
Mierdam Farmstead			√

As indicated in the table above, the greatest cumulative impact will be experienced from the main dwellings on Klippan Farmstead as they could be visually exposed to four additional proposed PV energy facilities should they all be constructed. As mentioned above, the landowner of the Klippan Farmstead would benefit financially from the proposed Helena 1, 2 and 3 solar PV facilities. This would likely offset the cumulative visual impact experienced by the landowner as it would reduce any negative sentiments towards the PV developments. Although the landowner of Mierdam Farmstead could be visually exposed to two additional proposed PV energy facilities, they would benefit financially from the proposed Mierdam Solar PV Facility if constructed, thus also reduce their negative sentiments towards the proposed PV developments.

11.8 Socio-economic impacts

The Helena 3 Solar PV facility is one of the 14 renewable energy projects planned for the area. The potential for significant cumulative impacts is therefore likely to be high. Assuming that all the proposed projects are approved, the local, regional and national economies could benefit substantially. Aspects that will potentially be significant include employment creation, and local procurement which will result in an increase in new business sales and value added. The introduction of a number of solar PV facilities could provide opportunities for local component manufacturing, and with an appropriate industrial policy it would be possible to leverage the country's existing industrial capacity. However, the amount of imported goods and services will be initially high, which will result in an increase in the trade deficit.

On the other hand, the cumulative impact in terms of loss of agricultural land could potentially be extensive due to the large land take required for PV power facilities. However, the agricultural potential of the land at the site and in the surrounding area is classified as low for crop production and moderate for grazing and therefore, these impacts are not likely to result in significant cumulative impacts. Overall, should adequate mitigation measures be implemented and adequate regional planning be applied, the cumulative impact on agricultural land is likely to be minor negative.

Table 90: Summary of potential cumulative impacts

Positive impacts	Negative impacts
Increase in production and GDP	Increase in crime through influx of workers
Employment creation	Increased pressure on infrastructure
Local economic development through socio-economic and enterprise development initiatives	Loss of agricultural land

Stimulation of the local manufacturing	Impact on rural sense of place
Improved standards of living of households benefiting from the projects	

12 DESCRIPTION AND COMPARATIVE ASSESSMENT OF ALTERNATIVES

As described above two site alternatives have been investigated for the proposed solar PV facility. Due to the elimination of all sensitive areas from the potential buildable area, the proposed layouts were severely constrained in terms of the area available. It was therefore not possible to have two layout alternatives for the PV array area, however two road layout, substation site and power line corridor alternatives were assessed. The two substation alternatives were positioned as far apart as possible and the two power line alternatives follow entirely different routes. Identifying two relatively similar layouts that are both environmentally feasible was considered more beneficial to the EIA process than only considering one alternative against the option of not implanting the activity or no-go alternative.

Each of these alternatives are comparatively assessed below in terms of the findings from the specialist studies conducted during the EIA.

Table 91 below highlights the issues and preferences associated with each alternative thereby identifying the preferred alternative.

Key

PREFERRED	The alternative will result in a low impact / reduce the impact
FAVOURABLE	The impact will be relatively insignificant
NOT PREFERRED	The alternative will result in a high impact / increase the impact
NO PREFERENCE	The alternative will result in equal impacts

Table 91: Alternatives Assessment summarising the impacts, highlighting issues/concerns and indicating the preference associated with each alternative

ALTERNATIVE	ENVIRONMENTAL ASPECT	PREFERENCE	CONCERNS / IMPACT SUMMARY	FATAL FLAWS
SUBSTATION SITE				
Substation Site Alternative 1	Biodiversity	No Preference	Does not directly affect sensitive ecological features, but is in close proximity to drainage area.	No Fatal Flaws
	Avifauna	No Preference	The habitat at the two substation alternatives is very similar. The alternative will result in equal impacts	No Fatal Flaws
	Surface Water	No Preference	Not within any surface water feature	No Fatal Flaws
	Agricultural Potential and Soils	No Preference	Shallow soils, dry climate	No Fatal Flaws
	Heritage	No Preference	No heritage resources identified	No Fatal Flaws
	Visual	No Preference	Both alternative sites are located on flat terrain in an area dominated low shrubs. Both Klipgat Pan Farmstead and Klippan Farmstead are located at a relatively equal distance from the two site alternatives.	No Fatal Flaws
	Socio-economic	No Preference	Impact is the same	No Fatal Flaws
Substation Site Alternative 2	Biodiversity	No Preference	Does not directly affect sensitive ecological features, but is in close proximity to drainage area.	No Fatal Flaws

ALTERNATIVE	ENVIRONMENTAL ASPECT	PREFERENCE	CONCERNS / IMPACT SUMMARY	FATAL FLAWS
	Avifauna	No Preference	The habitat at the two substation alternatives is very similar. The alternative will result in equal impacts	No Fatal Flaws
	Surface Water	No Preference	Not within any surface water feature	No Fatal Flaws
	Agricultural Potential and Soils	No Preference	Shallow soils, dry climate	No Fatal Flaws
	Heritage	No Preference	No heritage resources identified	No Fatal Flaws
	Visual	No Preference	Both alternative sites are located on flat terrain in an area dominated low shrubs. Both Klipgat Pan Farmstead and Klippan Farmstead are located at a relatively equal distance from the two site alternatives.	No Fatal Flaws
	Socio-economic	No Preference	Impact is the same	No Fatal Flaws
INTERNAL ROAD LAYOUT				
Internal Road Alternative 1	Biodiversity	No Preference	Affect similar areas of similar habitat.	No Fatal Flaws
	Avifauna	No Preference	The extent of the impacts of the two internal road network alternatives is very similar. The alternative will result in equal impacts.	No Fatal Flaws
	Surface Water	Favourable	Only a segment of the road layout routes directly through the ephemeral depression wetland as well as the drainage pathway. This option has slightly less environmental impact on surface water resources and is viewed as favourable.	No Fatal Flaws
	Agricultural Potential and Soils	No Preference	Shallow soils, dry climate	No Fatal Flaws
	Heritage	Favourable	Some heritage resources identified close by	No Fatal Flaws

ALTERNATIVE	ENVIRONMENTAL ASPECT	PREFERENCE	CONCERNS / IMPACT SUMMARY	FATAL FLAWS
	Visual	No Preference	Both alternative road layouts are located on flat terrain in an area dominated low shrubs. Both Klipgat Pan Farmstead and Klippan Farmstead are located at a relatively equal distance from the two road layouts.	No Fatal Flaws
	Socio-economic	No Preference	Impact is the same	No Fatal Flaws
Internal Road Alternative 2	Biodiversity	No Preference	Affect similar areas of similar habitat.	No Fatal Flaws
	Avifauna	No Preference	The extent of the impacts of the two internal road network alternatives is very similar. The alternative will result in equal impacts.	No Fatal Flaws
	Surface Water	Not Preferred	Road layout routes directly through the ephemeral wetland and both drainage pathways. Due to potential increased impact to surface water resources, this option is viewed as not preferred.	No Fatal Flaws
	Agricultural Potential and Soils	No Preference	Shallow soils, dry climate	No Fatal Flaws
	Heritage	Preferred	No resources identified in close vicinity	No Fatal Flaws
	Visual	No Preference	Both alternative road layouts are located on flat terrain in an area dominated low shrubs. Both Klipgat Pan Farmstead and Klippan Farmstead are located at a relatively equal distance from the two road layouts.	No Fatal Flaws
	Socio-economic	No Preference	Impact is the same	No Fatal Flaws
POWER LINE CORRIDORS				
	Biodiversity	Favourable	This alternative is less likely to affect drainage areas or pans.	No Fatal Flaws

ALTERNATIVE	ENVIRONMENTAL ASPECT	PREFERENCE	CONCERNS / IMPACT SUMMARY	FATAL FLAWS
Power Line Corridor Alternative 1	Avifauna	No Preference	The extent of the impacts of the two power line corridor alternatives is very similar. The alternative will result in equal impacts.	No Fatal Flaws
	Surface Water	Favourable	This alternative corridor has four surface water features either overlap or are contained within the corridor that may potentially be impacted on. These include the ephemeral depression wetland, the drainage pathway, the man-made impoundment and the old excavated borrow pit area. Despite power line corridor alternative 1 containing one extra surface water feature, this alternative is seen as favourable since the potential impact will be similar for both alternative corridors in that both share the same area for the initial part of the power line and will therefore have the same diversion and/or spanning issues. The impact is not seen as significant since with careful placement of the electricity pylons/towers, the surface water features can be spanned and direct impact can be avoided. Additionally, the proposed power line will be able to easily span the additional surface water feature (the man-made impoundment) given its limited extent.	No Fatal Flaws
	Agricultural Potential and Soils	No Preference	Shallow soils, dry climate	No Fatal Flaws
	Heritage	Favourable	More heritage sites identified in this corridor	No Fatal Flaws
	Visual	Favourable	The corridor is aligned parallel to an existing gravel road, in an area where the terrain is mostly flat. All the potentially sensitive receptor locations are located more than 2km from the power line corridor within the low impact zone.	No Fatal Flaws

ALTERNATIVE	ENVIRONMENTAL ASPECT	PREFERENCE	CONCERNS / IMPACT SUMMARY	FATAL FLAWS
	Socio-economic	No Preference	Impact is the same	No Fatal Flaws
Power Line Corridor Alternative 2	Biodiversity	Favourable	This option is more likely to affect drainage areas and/or pans, although these can be avoided if necessary, by locating tower structures appropriately.	No Fatal Flaws
	Avifauna	No Preference	The extent of the impacts of the two power line corridor alternatives is very similar. The alternative will result in equal impacts.	No Fatal Flaws
	Surface Water	Favourable	This alternative corridor has three surface water features either overlap or are contained within the corridor that may potentially be impacted on. These include the ephemeral depression wetland, the drainage pathway and the old excavated borrow pit area. Although power line corridor alternative 2 containing one less surface water feature, this alternative is seen as favourable since the potential impact will be similar for both alternative corridors in that both share the same area for the initial part of the power line and will therefore have the same diversion and/or spanning issues. This is despite having one less surface water feature. Overall, the impact is not seen as significant since with careful placement of the electricity pylons/towers, the surface water features can be spanned and direct impact can be avoided.	No Fatal Flaws
	Agricultural Potential and Soils	No Preference	Shallow soils, dry climate	No Fatal Flaws
	Heritage	Preferred	Less heritage sites identified in this corridor.	No Fatal Flaws

ALTERNATIVE	ENVIRONMENTAL ASPECT	PREFERENCE	CONCERNS / IMPACT SUMMARY	FATAL FLAWS
	Visual	Preferred	The corridor is aligned parallel to an existing 400kV power line, in an area where the terrain is mostly flat. All the potentially sensitive receptor locations are located more than 2km from the power line corridor within the low impact zone.	No Fatal Flaws
	Socio-economic	No Preference	Impact is the same	No Fatal Flaws

As depicted in Table 91 above, there is no preference between **Substation Site Alternative 1 and 2** as they will result in equal impacts. There is no Internal Road preferred because Alternative 1 would be preferred from a surface water perspective and Alternative 2 would be preferred from a heritage perspective. Power Line Corridor Alternative 2 is preferred because it has a lower visual impact and would impact fewer heritage resources. Although the preferred power line corridor alternative traverses some sensitive areas, the final power line alignment can and should be routed to avoid these areas. Substation Alternative 2 was selected as preferred by the EAP due to its close proximity to the road, and in order to optimise the PV panel array layout, the PV panel array area was amended to avoid sensitive areas to the south-east of the site. As a result of amended the PV panel array layout, the roads were amended to match the new layout. The final preferred road layout avoids all sensitive areas. The only sensitive areas that may be affected by the final Helena 3 preferred layout are those identified by the heritage and avifaunal specialists, impacts on heritage and avifauna are proposed to be addressed by the provided mitigation measures No fatal flaws were identified and therefore all the alternatives mentioned above are considered to be acceptable, although not necessarily preferable from an environmental perspective.

As such, the preferred site layout including the amended PV array layout and adjusted road is indicated in Figure 78 below. The preferred site layout in relation to the sensitive areas identified by the specialists is indicated in Figure 79.

It should be noted that some micro siting may be required at the construction phase within the authorised buildable area. This is to enable the avoidance of any unidentified features on site or any design constraints when the project reaches construction.

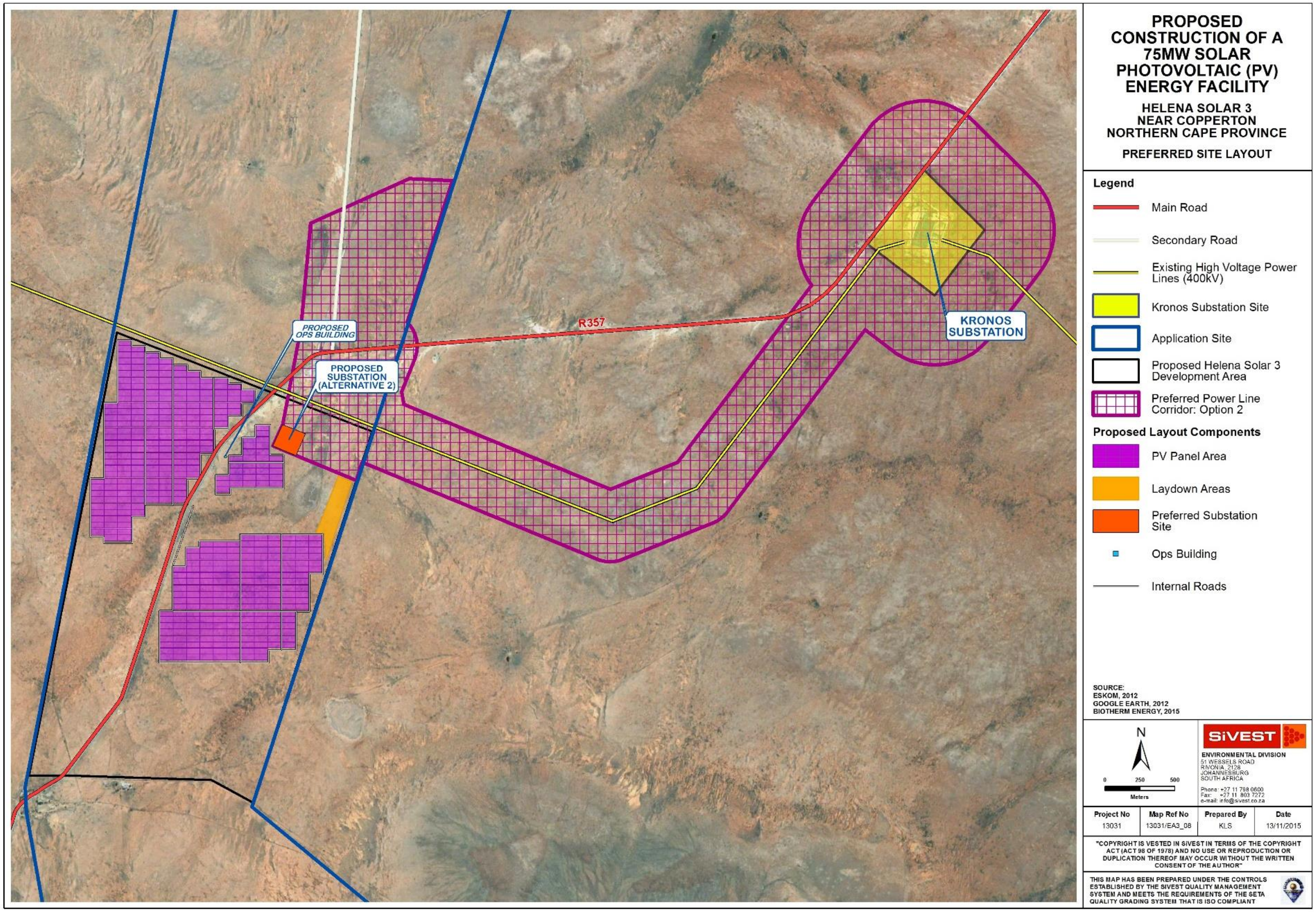

Figure 78: Preferred Site Layout

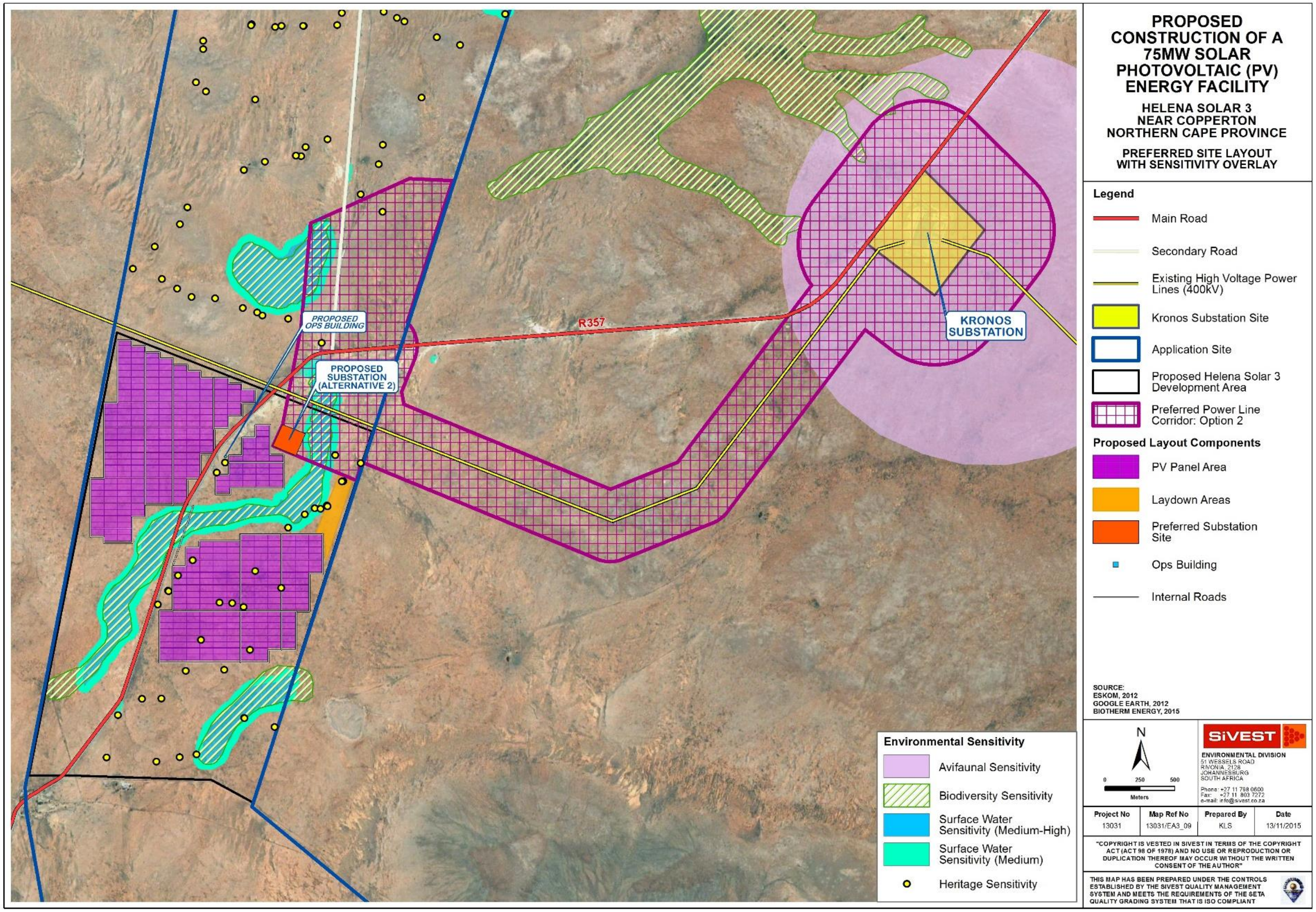

Figure 79: Preferred Site Layout in relation to Sensitive Areas

12.1 No Go Alternative

The No-Go Alternative is the option of not establishing the proposed Helena solar facility near Copperton, implying a continuation of the current situation or the status quo. The “no-go” or “no-action” alternative is regarded as a type of alternative that provides the means to compare the impacts of project alternatives with the scenario of a project not going ahead. In evaluating the “no-go” alternative it is important to take into account the implications of foregoing the benefits of the proposed project.

The No-Go option would therefore result in not contributing to meeting the demand for electricity and more specifically renewable energy targets in South Africa. This would also hinder the economic injection that the project promises to provide for the towns of Copperton and Prieska in the form of short term employment, long term job creation and financial injection.

Although the negative impacts identified, such as visual impacts and impacts on biodiversity, would not occur if the project did not go ahead, the socio economic benefit of the proposed project should not be overlooked. The No-Go alternative has thus been eliminated due to the fact that the identified environmental impacts can be suitably mitigated and that by not building the project, the socio-economic benefits would be lost.

13 ENVIRONMENTAL MONITORING AND AUDITING

The Environmental Management Programme (EMPr) becomes a tool by which compliance on the proposed site can be measured against. In order to utilise this tool, environmental monitoring needs to take place with regular audits against the EMPr to ensure that all aspects are attended to.

Environmental monitoring establishes benchmarks to judge the natural and magnitude of potential environmental and social impacts.

Some of the key parameters for monitoring and auditing of the proposed project include the following inter alia:

- Soil erosion and siltation.
- Oil spillages
- Dust and gaseous emissions.
- Water quality
- Noise and vibration
- Change in biodiversity
- Socio-economic change
- Land use changes.

The overall objective of environmental and social monitoring is to ensure that mitigation measures are implemented and that they are effective. Environmental and social monitoring will also enable responses to new and developing issues of concern. The activities and indicators that have been recommended for monitoring are presented in the EMPr.

Environmental monitoring will be carried out to ensure that all construction activities comply and adhere to environmental provisions and standard specifications, so that all mitigation measures are implemented. The contractor shall employ an officer responsible for implementation of social/environmental requirements. This person will maintain regular contact with the local / district Environmental Officers. The contractor and proponent will have a responsibility to ensure that the proposed mitigation measures are properly implemented during the construction phase.

The environmental monitoring program will operate through the preconstruction, construction, and operation phases. It will consist of a number of activities, each with a specific purpose with key indicators and criteria for significance assessment. The following aspects will be subject to monitoring:

- Encroachment into sensitive areas
- Maintenance of project footprint

- Vegetation maintenance around project work sites, workshops and camps
- Health & Safety

Monitoring should be undertaken at a number of levels. Firstly, it should be undertaken by the Contractor at work sites during construction, under the direction and guidance of the Supervision Consultant who is responsible for reporting the monitoring to the implementing agencies. It is not the Contractor's responsibility to monitor land acquisition and compensation issues. It is recommended that the Contractor employ local full time qualified environmental inspectors for the duration of the Contract. The Supervision Consultant should include the services of an independent environmental and monitoring specialist on a part time basis as part of their team.

Environmental monitoring is also an essential component of project implementation. It facilitates and ensures the follow-up of the implementation of the proposed mitigation measure, as they are required. It helps to anticipate possible environmental hazards and/or detect unpredicted impacts over time.

Periodic ongoing monitoring will be required during the life of the Project and the level can be determined once the Project is operational.

The EMPr is included in Appendix 8.

14 COMPLIANCE WITH WORLD BANK STANDARDS AND EQUATOR PRINCIPLES

This report has been prepared to comply with various environmental legislation as well as World Bank Standards (IFC Guidelines) and the Equator Principles. Thus in order to ensure compliance with these, a checklist has been compiled to ensure that all aspects of these guidelines have been taken into account when compiling this document. Table 92 below indicates that all applicable performance standards have been complied with.

The performance standards which have not been addressed at this stage as indicated in Table 92 below will be addressed at a later stage when the proponent has reached financial closure. Therefore, the compliance level is partially compliant at this stage. It is important to note that the project proponent is committed to achieving compliance with the EPs.

The coding key is as follows:

Compliance level			
Clear			
Not assessed/determined	Not compliant	Partially compliant	Compliant

Appendix 10 includes the IFC Performance Standards on Environmental and Social Sustainability.

Table 92: Compliance with Equator Principles

PRINCIPLES	COMPLIANCE LEVEL	REFERENCE
Performance Standard 1 Environmental & Social Reporting		
1. Baseline Information		Refer to Chapter 6
2. Impacts and Risks		Refer to Chapter 9
3. Global impacts		N/A
4. Transboundary		N/A
5. Disadvantaged / vulnerable groups		Refer to Chapter 8.7
6. Third party		Refer to Chapter 8.7
7. Mitigation measures		Refer to Chapter 10.1 and the EMPr - Appendix 8
8. Documentation of Assessment process		Refer to Chapter 9
9. Action Plans		No major Action Plans required as mostly generic mitigation

		measures have been required.
10 Organizational capacity		Refer to Appendix 10
11. Training		Refer to Appendix 10
12. Grievance mechanism	The proponent will commit to full compliance with this standard when financial closure has been reached. The proponent is fully aware of the implications of this standard and this information will be made available in due course as part of the development planning for the project.	Refer to Appendix 10
Performance Standard 2, Labour & Working Conditions		
1. Human Resource Policy	The proponent commit to full compliance with this standard when financial closure has been reached. The proponent is fully aware of the implications of this standard and this information will be made available in due course as part of the development planning for the project.	Refer to Appendix 10
2. Working relationship		Refer to Appendix 10
3. Working conditions with and terms of employment		Refer to Appendix 10
4. Workers organization		Refer to Appendix 10
5. Non-discrimination and equal opportunities		Refer to Appendix 10
7. Occupational Health and Safety		Refer to Appendix 10
8. Non-employee workers		Refer to Appendix 10
9. Supply Chain		Refer to Appendix 10
10. Labour Assessment Component of a Social and Environmental Assessment		Refer to Appendix 10
Performance Standard 3, Pollution		
1. Pollution Prevention, Resource Conservation & Energy Efficiency		Refer the EMPr - Appendix 8

2. Wastes		Refer the EMPr - Appendix 8
3. Hazardous material		Refer the EMPr - Appendix 8
4. Emergency preparedness & response	The proponent commit to full compliance with this standard when financial closure has been reached. The proponent is fully aware of the implications of this standard and this information will be made available in due course as part of the development planning for the project.	Refer to Appendix 10
5. Technical guidance – ambient considerations		Refer to Appendix 10
6. Greenhouse gas emissions		No greenhouse gas emissions will result from the proposed development.
Performance Standard 4, Health & Safety		
1. Hazardous materials safety		Refer the EMPr - Appendix 8
2. Environmental and natural resource issues		Refer to chapters 6 and 8
Performance Standard 5, Land Acquisition		**Refer to chapter 5**
Performance Standard 6, Biodiversity		**Refer to Chapter 6.6 and 8.1**
Performance Standard 7, Indigenous People		**Refer to Chapter 8.7**
Performance Standard 8, Cultural Heritage		**Refer to Chapter 8.7**

15 EVALUATION AND RECOMMENDATIONS

Table 93 summarises the key recommendations for the environmental issues identified in the FEIAr. In order to achieve appropriate environmental management standards and ensure that the findings of the environmental studies are implemented through practical measures, the recommendations from this EIA (where practical and possible) must be included within an Environmental Management Programme (EMPr). This EMPr should form part of the contract with the contractors appointed to construct and maintain the proposed. The EMPr would be used to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases (i.e. construction, operation and de-commissioning) of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project.

An Environmental Management Programme is included with this Environmental Impact Assessment Report as Appendix 8.

It is also recommended that the process of communication and consultation with the community representatives is maintained after the closure of this EIA process, and, in particular, during the construction phase associated with the proposed project.

15.1 Summary of Findings

Table 93: Summary of findings and Recommendations

Environmental Parameter	Summary of major findings	Recommendations
Biodiversity	The vegetation types that occur on site (Bushmanland Basin Shrubland, Bushmanland Vloere and possibly floristic elements of Bushmanland Arid Grassland) are classified as Least Threatened and also have a wide distribution and extent. The natural vegetation on the sites is therefore not considered to have high conservation status. The area is not within a Centre of Plant Endemism, nor does it occur in close proximity to an area identified as part of the National Parks Area Expansion Strategy or in areas identified in Provincial Conservation Plans to be of concern. Local factors that may lead to parts of the sites having elevated ecological sensitivity are the presence of the following: ▪ Presence of natural vegetation on site, although of low conservation priority. ▪ Presence of pans and drainage lines. ▪ Potential presence of plant species protected according to the Northern Cape Nature Conservation Act. ▪ Potential presence of the following animals of potential conservation concern: ○ Honey Badger (NT) ○ Geoffroy's Horseshoe Bat (NT/LC) ○ Darling's Horseshoe Bat (NT) ○ Leseuer's Wing-gland Bat (NT) ○ Kori Bustard (VU),	Control measures for some potential impacts are relatively well-known and easy to implement and it is recommended that these be applied as mitigation measures for some potential impacts. These mitigation measures are described in Chapter 10. Mitigation measures include: ▪ Implement alien plant management plan. ▪ Undertake regular monitoring. ▪ Implement surface Runoff and Stormwater Management Plan. ▪ Establish a Rehabilitation Programme. ▪ Undertake a botanical walk-through survey. ▪ Obtain permits for protected plants.

	○ Ludwig's Bustard (VU), ○ Blue Crane (VU), ○ Martial Eagle (VU), ○ Lanner Falcon (NT), ○ Lesser Kestrel (NT), ○ Secretarybird (NT). ▪ Potential invasion of natural habitats by alien invasive plants, thus causing additional impacts on biodiversity features. Potential ecological impacts for the project were determined to be as follows: 10. Impacts on indigenous natural vegetation; 11. Impacts on a plant species of low conservation concern; 12. Impacts on protected plant species; 13. Impacts on a protected tree species; 14. Impacts on pans / drainage lines; 15. Mortality of sedentary animals; 16. Displacement of mobile fauna; 17. Mortality of birds by collision with power lines; 18. Establishment and spread of declared weeds and alien invader plants. Following a field assessment of the site, four of these impacts were assessed as unlikely to occur (Impacts 2, 4, 6 and 7).	
Avifauna	An estimated 121 species could potentially occur in the study area. Of these, 10 are South African Red Data species, 18 are southern African endemics and 29 are near-endemics. This means that 8.2% of the species that could potentially occur in the study area are Red Data species, and 38.8% are southern African endemics or near-endemics. Overall, the study area potentially contains a total of 47 endemics and	▪ Construction and decommissioning activity should be restricted to the immediate footprint of the infrastructure. ▪ Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species.

	near-endemics, which is 28% of the 167 southern African endemics and near-endemics (Hockey et al. 2005). The potential impact on avifauna associated with the proposed development is as follows: ▪ Temporary displacement due to disturbance associated with the construction of the solar facility and associated infrastructure; ▪ Collisions with the solar panels; ▪ Permanent displacement due to habitat transformation; and ▪ Collisions with the associated power lines resulting in mortality. The negative impacts of the proposed Helena PV solar facility on local priority avifauna will range from low to high, depending on the type of impact. In the case of the PV facility and associated infrastructure, the displacement impact due to disturbance during construction is rated as high to start with, and will remain as such after application of mitigation measures. In the case of habitat transformation during operation, the displacement impact is medium – negative and will remain as such after the application of mitigation measures. The impact of direct mortality due to collisions with the solar panels is likely to be low. The displacement impact associated with the construction of the on-site substation will be low, but should not be viewed in isolation, but rather as part of the overall displacement impact associated with the PV facility. The proposed 132kV circuit grid connection will have a medium negative collision impact on avifauna during operation which should be reduced to low-negative through the application of anti-collision mitigation	▪ Measures to control noise and dust should be applied according to current best practice in the industry. ▪ Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum. ▪ An avifaunal specialist must be appointed to oversee all aspects of operational phase monitoring (including carcass searches) and assist with the on-going management of bird impacts that may emerge as the monitoring programme progresses. ▪ As an absolute minimum, operational phase monitoring should be undertaken for the first two years of operation, and then repeated again in year 5, and again every five years thereafter. ▪ Carcass searches should be implemented to search the ground between arrays of solar panels on a weekly basis (every two weeks at the longest) for at least one year to determine the magnitude of collision fatalities. ▪ A range of mitigation measures will have to be considered if mortality levels turn out to be significant. ▪ To protect the Martial Eagle nest site located at Tower 519 of the Hydra-Kronos 400kV line, it shall be necessary to relocate the nest site to a more distant, less disturbed area. The extent and distribution of other renewable

	measures. The impact of displacement caused by the construction of the power line will be medium negative, but it could be reduced to low if the Martial Eagle nest on the Hydra-Kronos 400kV line next to Kronos MTS could be re-located. It is unknown at this stage if the nest is active, the pair of Martial Eagles may have been displaced already due to the ongoing activity in the area, if an artificial nesting platform is provided, and the project could have a positive impact on Martial Eagles. The cumulative impacts of the facility on priority avifauna will range from major to minor on a local scale, and minor to insignificant on a regional scale.	energy developments planned for the immediate vicinity probably precludes a short-range relocation, and a dedicated structure, strategically situated off the power line network aggregated around the Kronos substation, may be the best option. The requirements of such an undertaking shall be further investigated if the development is authorised by the DEA and selected as a preferred site by the DoE. ▪ The 132kV grid connection should be inspected at least once a quarter for a minimum of two years by the avifaunal specialist to establish if there is any significant collision mortality. ▪ The proposed transmission line for evacuation of the electricity generated by the PVs should be marked with Bird Flight Diverters (BFDs) for their entire length on the earth wire of the line, 5m apart, and alternating black and white.
Surface Water	A surface water delineation and impact assessment is provided in this report for the proposed development. Findings were based on a method for delineating wetlands and riparian habitat as per the DWAF 2005 guidelines. Ultimately, it was found that there are two (2) ephemeral depression wetlands. One is located on the proposed Helena 3 PV study site and the other on the power line alternative corridors. The power line component of the proposed development was found to contain one (1) man-made impoundment (Power Line Alternative 1). In addition, an old borrow pit excavation area and a drainage pathway was identified within	It has been identified that the PV panel area and an internal access road are directly located in the ephemeral depression wetland on the PV study site as well as the drainage pathways. It is strongly recommended that the layout is revised to avoid directly impacting on this surface water resource. Furthermore, as it is uncertain at this stage where some infrastructure and buildings/substations are to be placed, it is

	both the Power Line Alternative 1 and 2 corridors. The drainage pathway was also identified to extend to the PV study site. An additional drainage pathway was identified in the south eastern area of the PV study site. A 50m buffer zone was applied to the wetland and drainage pathways which was applied with guidance from the Gauteng Minimum Requirements for Biodiversity Studies (GDACE, 2009). A comparative assessment was undertaken to determine which of the proposed substation, internal access roads and power line corridor alternatives would be most suitable from a surface water perspective. Accordingly, there was no preference for the substation locations as there were no surface water resources that could be directly affected in these areas. In terms of the internal access road layouts, internal road access layout 1 was viewed as favourable since only a segment of the road layout routes directly through the ephemeral depression wetland as well as the drainage pathway. This option has slightly less environmental impact on surface water resources. On the other hand, internal road layout 2 routes directly through the ephemeral wetland and both drainage pathways. Due to potential increased impact to surface water resources, this option was viewed as not preferred. Finally, both power line corridor alternatives were found to be favourable since the potential impact will be similar for both alternative corridors in that both share the same area for the initial part of the power line and will therefore have the same diversion and/or spanning issues. The impact is not seen as significant since with careful placement of the electricity pylons/towers, the surface water features can be spanned and direct impact can be avoided. In terms of potentially applicable environmental and water related legislature, several listed activities and water uses have provisionally	strongly recommended that when final designs are established, the identified surface water resources that could potentially be affected (as highlighted in the surface water specialist report**)** are to be avoided. Importantly, with careful placement of the structures, roads and electricity pylons/towers, the surface water features can be avoided or spanned (for power lines). Should no direct impacts need to take place to the identified surface water resources, the need for water use licensing can be avoided where it can be demonstrated to the Department Water and Sanitation (DWS) that significant impacts will not take place and/or where other water uses (other than those identified in the surface water specialist report) are not required. Where impacts to surface water resources is not avoidable, the relevant water use license is to be applied for before construction is allowed to commence. In this instance, where any structures are within 50m of any surface water resource, adequate run-off mitigation measures need to be accounted for as stipulated in Section 10 above to prevent/minimize accelerated run-off, erosion and sedimentation impacts. All the identified triggered activities and water uses identified in the surface water specialist

	been identified that may be applicable to the proposed development. In terms of NEMA and the EIA Regulations (2010), Activities 11 and 18 of Government Notice R544 (Activities 12 and 19 of Government Notice 983 of 2014) have been identified as being applicable where the proposed development will take place within 32m or directly within the identified surface water resources respectively. With respect to the NWA, water uses (c) and (i) will be applicable where the proposed development will be directly with the identified surface water resources. The above identified activities and water uses should however be confirmed with the relevant government departments. Foreseen potential negative impacts in terms of the pre-construction, construction, operation and decommissioning phases of the proposed development were identified and assessed. Mitigation measures have been stipulated and must be included and implemented as part of the Environmental Management Programme (EMPr) for the proposed development.	report should be confirmed with the relevant government authoritative departments.
Agricultural Potential and Soils	The soils are virtually all shallow to very shallow (<500 mm), usually sandy and calcareous, overlying either rock or cemented hardpan calcrete. Some rock outcrops occur in places in the landscape. Virtually the entire Helena 3 study area comprises shallow, calcareous soils with rock (land type **Ah93),** as can be seen from the information contained in Chapter 8 and the agricultural potential and soils specialist report. Coupled with these shallow soils, the very low rainfall in the area means that the only means of cultivation would be by irrigation and the Google Earth image of the area shows absolutely no signs of any agricultural infrastructure and certainly none of irrigation.	▪ Minimise removal of surface vegetation. ▪ Re-vegetate with local species as soon as possible. ▪ Ensure all access roads/tracks are surfaced/treated to increase cohesion.

	The climatic restrictions mean that this part of the Northern Cape is suited at best for grazing and here the grazing capacity is low, around 20-25 ha/large stock unit.	
Visual	The Visual Impact Assessment (VIA) conducted for the proposed PV energy facility and associated infrastructure has demonstrated that much of the study area has a rural visual character and is not valued for its tourism significance. It was ascertained that due to the limited human habitation in the surrounding area, very few sensitive receptors are present in the study area and the proposed development would have a medium impact on most of these receptors. The assessment revealed that overall the proposed PV energy facility would have a low visual impact during construction and a medium visual impact during operation, with very few mitigation measures available. The associated infrastructure would have a low visual impact during construction and operation. The substation, internal road and power line corridor alternatives were comparatively assessed. It was established that there is no preference for the substation site and internal road alternatives, but Alternative 2 is preferred from a visual perspective for the power line. Overall it can be concluded that although the visual impact of the PV energy facility would be reduced due to the lack of visual receptors present, the facility does not correspond with the typical land use and would visually contrast with the natural earthly tones of the prevailing Karoo vegetation by creating a dark grey mass within the relatively uniform flat landscape.	▪ Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. ▪ Maintain a neat construction site by removing rubble and waste materials regularly. ▪ Make use of existing gravel access roads where possible. ▪ Ensure that dust suppression techniques are implemented on all access roads. ▪ All reinstated cable trenches should be re-vegetated with the same vegetation that existed prior to the cable being laid. ▪ Light fittings for security at night should reflect the light toward the ground and prevent light spill. ▪ If the operations and maintenance buildings are unstaffed they should not be illuminated at night. ▪ Bury cables under the ground where possible. ▪ The operation and maintenance building should be painted with natural tones that fit with the surrounding environment. Non-reflective surfaces should be utilised where possible. ▪ Select the alternatives that will have the least impact on visual receptors

Heritage	The Heritage Scoping Report has shown that the proposed Helena Solar project may have heritage resources present on the property. This has been confirmed through archival research and evaluation of aerial photography of the sites.
	
	A total of a 110 find spots were logged of which 13 (9 in proposed power line corridors and 4 in Helena 3 footprint area) can be described as archaeological sites.
	
	The find spots varied from Later Stone Age (LSA) scatters consisting of flakes, chips and some cores manufactured from fine-grained quartzite, chalcedony, and cryptocrystalline (ccs) material; Middle Stones Age (MSA) lithics consisting of cores, chips and flakes with a low occurrence of formal tools. The majority of the material utilised were either lideanite that occur in the form of medium sized boulders or round washed pebbles in the area or coarse-grained quartzite that occur as sporadic outcrops.
	
	Earlier Stone Age (ESA) lithics found at some of these finds spots consisted of hand axes, cleavers and large flakes. Most of the lithics were either rolled or heavily weathered with patination evident on 95% of the lithics.
	
	All these site have a low significance, however the possibility of subsurface deposits cannot be discounted and was kept in mind with the development of the mitigation recommendations.
	
	During the fieldwork 13 archaeological sites were identified of which all were archaeological sites representing the Earlier, Middle and Later
		Find Spots
		▪ The final alignment and pylon positions of the power line needs to be walked down and heritage features demarcated;
		▪ Where required the sites identified during the walkdown will then need mitigation measures developed that will need to be completed before construction can commence;
		▪ Such mitigation measures will require a permit from SAHRA before mitigation can be done as well as a final destruction permit on completion of the mitigation work.
		
		PV Footprint
		▪ All sites will require mitigation work before construction can commence.
		▪ The mitigation work will be at a minimum:
		    ▪ a controlled surface collection of the material,
		    ▪ excavation should be considered at 092-093
		    ▪ analysis of material and final report;
		▪ Such mitigation measures will require a permit from SAHRA before mitigation can be done as well as a final destruction permit on completion of the mitigation work.
		
		Due to the large amount of Stone Age material present on site it is recommended that the

	Stone Age. The sites are all rated as having local heritage significance. All the sites will require mitigation prior to construction.	**ECO must have an archaeological background or undergo training, as appropriate, to identify newly discovered sites. Should the finds be significant, an archaeologist may need to be appointed to determine appropriate mitigation measures.**
Socio-economic	The proposed Helena 3 Solar Photovoltaic Energy Facility is to be located near Copperton in the Siyathemba Local Municipality, Northern Cape Province. It was assumed that the construction of the facility will last for about one year to 18 months and will require an investment of about R1 500million. It was also assumed that the facility's operations will generate about R50 million per year in revenue for about 20 years. Updated estimates suggest that the required investment will be R1 750 million and that R250 million will be generated in revenue annually. The national, provincial, and local government policy and strategy documents analysed in the report support the establishment of renewable energy projects as they have been recognised as potential stimulants of local economic growth, job creation, and also with regards to their contribution to sustainable development. The NCPGDS also notes that "sustainable utilisation of the natural resource base on which agriculture depends is critical in the Northern Cape with its fragile eco-systems and vulnerability to climatic variation". In this regard, care needs to be taken to ensure that renewable energy facilities do not impact negatively on the region's natural environment. However, there will be no significant threats to the natural environment as has been noted during the impact assessment.	In order to optimise the stimulation of the local economy through direct, indirect, and induced effects, the following should be applied where possible: ▪ Procure construction materials, goods, and products from local suppliers if feasible. ▪ Employ local contractors where possible. ▪ Recruit local labour. ▪ Sub-contract to local construction companies. ▪ Use local suppliers where viable and arrange with the local Small and Medium Enterprises to provide transport, catering, and other services for the construction crew. ▪ Employ labour-intensive measures in construction ▪ Set-up a skills desk at the local municipal office and in the nearby communities to identify skills available in the community and assist in recruiting local labour during both construction and operation. ▪ Contractors should consider providing learnerships and on-job training, if possible.

	The economy of the Siyathemba LM is in need of diversification and the establishment of the solar PV facility in the area will offer such an opportunity. Furthermore, if the other proposed projects are approved, this could contribute to the growth of this sector as well as stimulate economic development further. The project will have the potential to improve the standard of living of the communities located within a 50 km radius given the commitments towards socio-economic and enterprise development. The construction and operation of the facility will result in the following various positive economic impacts: ▪ It was estimated that the capital expenditure on the 75 MW solar facility will be R1 500 million, however updated estimates indicate that this may be R1 750 million. At minimum, 129 employment opportunities will be created during the construction phase. The majority of the employment opportunities, specifically for unskilled and semi-skilled individuals are likely to be available to local community members. Employment opportunities for skilled individuals are likely to be associated with contractors appointed during the construction phase. It is thus assumed that 80% of the positions will be filled by local people. ▪ The annual revenue generated by the plant was estimated at amounting to up to R50 million, however updated estimates indicate that this may be R250 million. Furthermore, it is expected that, at minimum, 43 jobs per annum will be created during operations. It is clear from the impact assessment that the proposed solar PV facility will have a significant positive effect on the national economy in terms of stimulation of domestic production, job creation, government revenue,	▪ Where specialist training can be provided, candidates from local communities should be prioritised for training; and ▪ Share knowledge with the sub-contracting companies during the construction period. ▪ Goods and services are procured domestically instead of imported, where possible. ▪ Engage with local authorities and inform them of the development as well discuss with them the ability of the municipality to meet the demands for social and basic services created by the migrant construction workers. ▪ Where feasible, assist the municipality in ensuring that the quality of the local social and economic infrastructure does not deteriorate further (especially the local roads). ▪ Control the movement of workers between the site and areas of residence to minimise loitering. ▪ The contractors should make the necessary arrangements for allowing workers from outside the area to return home over weekends and/ or on a regular basis. This would reduce the risk posed to local family structures and social networks. ▪ Implementing health awareness campaigns to curb the potential of spreading disease, use of drugs, or alcohol abuse for example.

	and export earnings. The project has the ability to increase the size of the local economy by about 5%, and reduce local unemployment. Furthermore, the project falls within the developmental priorities of the local municipality that have identified the promotion of the renewable energy sector as one of the means to reverse the current trends of decline and lack in diversity of the economy and alleviate electricity shortages. Based on the above, it can be safely concluded that the proposed project will be highly beneficial for the national economy and local communities. From a socio-economic perspective, the project should be approved for development.	▪ Local small businesses should also be approached to investigate the possibility of supplying inputs for maintenance and operations where viable, this should increase local indirect employment creation. ▪ In order to improve the chances of skills being developed during the operational period it is recommended that vocational skills transfer/training programmes be developed and knowledge sharing among employees encouraged. ▪ It is recommended that the project owner develops practical SED and ED programmes throughout the project's lifespan. The plan should be developed in consultation with local authorities and existing strategy documents to identify community projects that would result in the greatest social benefits. With regard to ED initiatives, focus should be on developing plans to support and create sustainable, self-sufficient enterprises. It is important that these plans be reviewed annually and where possible updated.

A summary of the impact rating of the proposed development according to each environmental aspect are provided in Table 94 below.

Key

LOW NEGATIVE	**LOW POSITIVE**
MEDIUM NEGATIVE	**MEDIUM POSITIVE**
HIGH NEGATIVE	**HIGH POSITIVE**

Table 94: Impact rating summary for the proposed Helena 3 solar energy facility during the construction phase

Environmental Aspect	Environmental Impacts	Impact Rating without Mitigation	Impact Rating with Mitigation
Biodiversity	Impacts on indigenous natural vegetation for solar array, laydown area, buildings, on-site substation (both options) & internal roads (both options).	-36 (medium negative)	-36 (medium negative)
	Impacts on indigenous natural vegetation for power lines (both options).	-26 (low negative)	-24 (low negative)
	Impacts on protected plant species for all infrastructure components.	-11 (low negative)	-9 (low negative)
	Impacts on pans for solar array and internal roads (both options)	-30 (medium negative)	-10 (low negative)
Avifauna	Displacement of priority species due to disturbance and habitat transformation associated with construction of the PV facility and associated infrastructure.	-54 (High negative)	-51 (High negative)
	Displacement of priority species due to disturbance and habitat transformation associated with construction of the 132kV power line (Option 1 and 2).	-34 (medium negative)	-18 (low negative)
	Displacement of priority species due to disturbance and habitat transformation associated with construction of the substation (Option 1 and 2)	-12 (low negative)	-11 (low negative)
Surface Water	Construction Lay-down Area	- 22 (low negative)	- 6 (low negative)
	Vehicle and Machinery Degradation	- 24 (low negative)	- 6 (low negative)

	Human Degradation of Flora and Fauna associated with Surface Water Resources	- 10 (low negative)	- 6 (low negative)
	Degradation and Removal of Soils and Vegetation associated with surface water resources	- 28 (low negative)	- 6 (low negative)
	Increased Run-off and Sedimentation	- 26 (medium negative)	- 6 (low negative)
Agricultural Potential and Soils	Loss of agriculturally productive soil	-6 (low negative)	-6 (low negative)
	Increased susceptibility of topsoil to removal by wind due to disturbance caused by construction activities.	-32 (medium negative)	-9 (low negative)
Visual	Rating of visual impacts of the proposed PV energy facility during construction	-22 (low negative)	-20 (low negative)
	Rating of visual impacts of the infrastructure associated with the PV energy facility during construction	-22 (low negative)	-20 (low negative)
Heritage	The possibility of encountering previously unidentified heritage resources and specifically Stone Age archaeological sites. As well as the impact on the identified archaeological sites	-51 (high negative)	-24 (low negative)
Socio-economic	Temporary increase in production	+64(high positive)	+64 (high positive)
	Temporary increase in GDP	+48 (medium positive)	+48 (medium positive)
	Temporary increase in employment	+48 (medium positive)	+48 (medium positive)
	Impact on skills development	+42 (medium positive)	+45 (medium positive)
	Temporary increase in household income	+48 (medium positive)	+48 (medium positive)
	Increase in government revenue	+17 (low positive)	+17 (low positive)
	Impact on balance of payment	-13 (low negative)	-12 (low negative)
	Sterilisation of agricultural land	-15 (low negative)	-15 (low negative)
	Increased pressure on basic services	-12 (low negative)	-12 (low negative)
	Increase in social pathologies	-13 (low negative)	-12 (low negative)

Table 95: Impact rating summary for the proposed Helena 3 solar energy facility during the operational phase

Environmental Aspect	Environmental Impacts	Impact Rating without Mitigation	Impact Rating with Mitigation
Biodiversity	Mortality of birds by collision with power lines	-26 (low negative)	-11 (low negative)
	Establishment and spread of declared weeds and alien invader plants for all infrastructure.	-28 (medium negative)	-11 (low negative)
Avifauna	Displacement of priority species due to habitat transformation associated with construction of the PV facility and associated infrastructure.	-48 (medium negative)	-45 (medium negative)
	Mortality of priority species due to collisions with solar panels	-26 (low negative)	-22 (low negative)
	Collisions of priority species with the proposed 132kV line (Option 1 and 2)	-30 (medium negative)	-28 (low negative)
Surface Water	Vehicle Damage to Surface Water Resources	- 42 (medium negative)	- 8 (low negative)
	Stormwater Run-off associated with the PV Facility, Buildings, Substation and associated Infrastructure	- 28 (low negative)	- 11 (low negative)
	Oil Leaks from the Substation	- 48 (medium negative)	- 11 (low negative)
Visual	Rating of visual impacts of the proposed PV energy facility during operation	-36 (medium negative)	-36 (medium negative)
	Rating of visual impacts of the infrastructure associated with the PV energy facility during operation	-28 (low negative)	-14 (low negative)
Socio-economic	Sustainable increase in production	+36 (medium positive)	+36 (medium positive)
	Sustainable increase in GDP	+36 (medium positive)	+36 (medium positive)
	Impact on employment	+16 (low positive)	+16 (low positive)
	Impact on skills development	+32 (medium positive)	+32 (medium positive)
	Increase in household income	+18 (low positive)	+19 (low positive)
	Increase in government revenue	+19 (low positive)	+19 (low positive)
	Investment in local communities	+34 (medium positive)	+34 (medium positive)

	Impact on sense of place	-13 (low negative)	-13 (low negative)

Table 96: Impact rating summary for the proposed Helena 1 solar energy facility during the decommissioning phase

Environmental Aspect	Environmental Impacts	Impact Rating without Mitigation	Impact Rating with Mitigation
Avifauna	Displacement of priority species due to disturbance associated with de-commissioning of the PV facility and associated infrastructure.	-11 (low negative)	-10 (low negative)
	Displacement of priority species due to disturbance and habitat transformation associated with de-commissioning of the 132kV power line (Option 1 and 2)	-20 (low negative)	-18 (low negative)
	Displacement of priority species due to disturbance associated with de-commissioning of the substation (Option 1 and 2).	-10 (low negative)	-9 (low negative)

15.2 Conclusion

The findings of the specialist studies undertaken within this EIA provide an assessment of both the benefits and potential negative impacts anticipated as a result of the proposed solar PV energy facility. The findings conclude that there are no environmental fatal flaws that should prevent the proposed project from proceeding. Areas of special concern have however been identified which will require site specific mitigation measures to reduce impacts. These are included within the EMPr to ensure that these areas receive special attention.

It was determined during the EIA that the proposed project will result in limited potential negative impacts and certain positive impacts. A preferred site layout has been identified which is less environmentally sensitive and will result in the least environmental impact.

A detailed public participation process was followed during the EIA process which conforms to the public consultation requirements as stipulated in the EIA Regulations. In addition, all issues raised by I&APs have been captured in the FEIAr and where possible, mitigation measures provided in the EMPr to address these concerns.

As sustainable development requires all relevant factors to be considered, including the principles contained in section 2 of NEMA, this FEIAr has strived to demonstrate that where impacts were identified, these have been considered in the determination of the preferred site layout.

It is the opinion of the EAP that the information and data provided in this FEIAr is sufficient to enable the DEA to consider all identified potentially significant impacts and to make an informed decision on the application. Further, it is the opinion of the EAP that based on the findings of the EIA that the proposed project should be granted an EA and allowed to proceed provided the following conditions are adhered to:

- The proposed PV array should be constructed within the final preferred PV array area.
- The substation should be constructed within **Substation Alternative 2.**
- Access to the grid should be provided by constructing a 132kV power line within **Corridor Alternative 2**.
- Final routing of the power line within the corridor should avoid tower placement within surface water and biodiversity sensitive areas.
- All practical and appropriate mitigation measures relating to the Martial Eagle nest, as suggested by the avifaunal specialist and included in the FEIAr and EMPr, should be adhered to.
- All specialist recommendations pertaining to the SKA should be adhered to.
- All feasible and practical mitigation measures recommended by the various specialists must be implemented, where applicable to the authorised PV array area, authorised associated infrastructure, and authorised substation site and grid line corridor route.
- Final EMPr should be approved by DEA prior to construction.

SiVEST as the EAP is therefore of the view that:

- A preferred site layout has been identified which is less environmentally sensitive compared to the other considered layouts.
- Preferred grid access options have been identified which are environmentally acceptable and will not result in significant impacts, provided that the recommended mitigation measures are implemented and the routing of the power line within the corridor avoids tower placement within surface water and biodiversity sensitive areas.
- Through the implementation of mitigation measures, together with adequate compliance monitoring, auditing and enforcement thereof by the appointed ECO as well as competent authority, the potential detrimental impacts associated with the solar PV energy facility can be mitigated to acceptable levels.

It is trusted that the FEIAr provides the reviewing authority with adequate information to make an informed decision regarding the proposed project.

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