May 2016

ACWA POWER AFRICA HOLDINGS (PTY) LTD

Draft EIA Report: Proposed 75 MW Photovoltaic (PV1) Solar Power Development on the Remaining Extent of Farm Bokpoort 390, Northern Cape

DEA Reference Number: 14/12/16/3/3/2/881

Submitted to:

Department of Environmental Affairs
Environment House
473 Steve Biko Road
Pretoria
0001

Report Number: 1400951-301175-16

Distribution:

2 x Copies Department of Environmental Affairs
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1 x Orange River Cellars
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DRAFT REPORT

Golder Associates

GENERAL SITE INFORMATION

Description of all affected farm portions including 21 Digit Surveyor General Codes

Farm Name	SG 21 Digit Code	Physical Address	Comments
Remaining Extent of the Farm Bokpoort 390	C02800000000039000000	Farm Bokpoort 390 Groblershoop	Preferred location of solar development and associated infrastructure
Farm Sand Draai 391 Portion 0	C02800000000039100000	Farm Sand Draai 391 Portion 0 Groblershoop	Preferred location for placing water pipeline in existing water pipeline servitude
Farm Sand Draai 391 Portion 5	C02800000000039100005	Farm Sand Draai 391 Portion 5 Groblershoop	Preferred location for placing water pipeline in existing water pipeline servitude

Copies of Deeds of all Affected Farm Portions

The title deed of the Remaining Extent of the Farm Bokpoort 390 situated in the Division Gordonia, Province of the Northern Cape, is attached in APPENDIX P.

Photos of areas that give a visual perspective of all parts of the site

View of the Bokpoort II site from the southern perimeter fence.

View of the project site from the eastern side.

View of the project site from the Transnet service road.

View of proposed pipeline route (The existing Bokpoort I underground pipeline follows same route).

View of the approximate area for the construction of the abstraction point (Bokpoort I abstraction infrastructure is shown in the photo).

Photographs from sensitive receptors

View from Kalahari Oryx Private Game Reserve (The Bokpoort I site is visible in the centre of the photo).

Solar Plant Design Specifications:

A 75 Megawatt (MW) Photovoltaic (PV) Solar Development that will consist of the following infrastructure (Figure 2-4):

- Solar generator comprised of polycrystalline PV modules (JINKO Solar modules JKM 310Wp) that will be able to deliver up to 75 MW to the Eskom National Grid;
- Inverters that convert direct current (DC) generated by the PV modules into alternating current (AC) to be exported to the electrical grid. The inverter is a HSC2160S Solar Station manufactured by Helios Systems. The inverter is an 11.28 m high cube container which includes the DC distribution, the inverter, the medium voltage transformer and the medium voltage switchgear;
- A transformer that raises the system AC low voltage (LV) to medium voltage (MV). The transformer converts the voltage of the electricity generated by the PV panels to the correct voltage for delivery to Eskom;
- Transformer substation; and
- Instrumentation and Control consisting of hardware and software for remote plant monitoring and operation of the facility.

Associated infrastructure includes:

- Mounting structures for the solar panels will be either rammed steel piles or piles with pre-manufactured concrete footings to support the PV panels;
- Cabling between the structures, to be lain underground where practical;
- A new 132 kV overhead power line which will connect the facility to the national grid via Eskom's existing Garona Substation; The powerline will be approximately 5km in length and will be

located within a servitude spanning 50 metres on both sides. The powerline towers will be 35 metres high;

- Internal access roads (4 – 6 m wide roads will be constructed but existing roads will be used as far as possible) and fencing (approximately 3 m in height); and
- Associated buildings, including a workshop area for maintenance, storage (i.e. fuel tanks, etc.), and offices.

Type of Technology

Photovoltaic Solar Power Plant

Structure Height

The proposed PV 1 solar facility will have the following infrastructure that are important in terms of height:

- The PV panels will be 4 metres high; and
- The substation will be 10 metres high.

Surface Area to be Covered

The proposed PV 1 solar facility will cover 250 ha.

Structure Orientation

The PV panels will be installed perpendicular to the sun's rays, which change continuously over the course of the day and season. The PV panels will be installed in a portrait in single axis tracking configuration.

Laydown Area Dimensions

The construction laydown area will be 19.5 hectares.

Generation Capacity

The proposed PV1 solar facility will generate 75 MW.

Generation Capacity of the Facility as a whole at Delivery Points

The proposed PV1 facility will generate 75 MW.

PURPOSE OF THIS DOCUMENT

ACWA Power Africa Holdings (Pty) Ltd (hereafter referred to as ACWA Power) is proposing to establish a solar power facility (Bokpoort II) on the north-eastern portion of the Remaining Extent (RE) of the Farm Bokpoort 390, which is 20 km north-west of the town of Groblershoop within the !Kheis Local Municipality in the ZF Mgcawu District Municipality, Northern Cape Province.

In order to obtain Environmental Authorisation for the proposed project, ACWA Power is required to conduct an Environmental Impact Assessment (EIA) in terms of the National Environmental Management Act, 1998 (Act 107 of 1998) (as amended) and the EIA Regulations GN R. 982. The EIA is being conducted in accordance with international standards, such as the Equator Principles (EP) and the requirements of the International Finance Corporation (IFC). Golder Associates Africa (Pty) Ltd, an independent consultant, is conducting the EIA and is compiling the Environmental Management Programme (EMPr).

The proposed Bokpoort II project will consist of three (3) applications for environmental authorisation, each having a Scoping Report and an Environmental Impact Assessment Report. ACWA Power is applying for environmental authorisation for two 75 Mega Watt (MW) photovoltaic (PV) facilities and one 150 MW Concentrated Solar Power (CSP) Tower facility. The combined power generation capacity of the entire Bokpoort II solar development will be 300 MW. Each of the solar technologies will have its own infrastructure that will not overlap in footprint.

This Environmental Impact Assessment Report will focus on assessing the environmental and social impacts related to the proposed 75 MW PV1 solar power facility and associated infrastructure.

The applicant for environmental authorisation is an Independent Power Producer (IPP) who intends to bid in the Department of Energy's (DoE) Renewable Energy Independent Power Producer Procurement (REIPPPP) Programme, and hence the environmental authorisation applications have been divided according to the DoE's MW unit requirements. Three stand-alone applications will be submitted to Department of Environmental Affairs (DEA) for 2 x 75 MW PV facilities and one applications for a 150 MW CSP Tower.

The south-western portion of the Remaining Extent of the Farm Bokpoort 390 has already been permitted for a 75 MW CSP Parabolic Trough development *via* the '*Environmental Impact Assessment for a Proposed 75 MW Concentrating Solar Thermal Power Plant and Associated Infrastructure in the ZF Mgcawu District Municipality (DEAT 12/12/20/1920)' ('Bokpoort I' site)*. The location of the proposed Bokpoort II solar developments falls within the area previously assessed in this EIA. The Bokpoort I EIA's sensitivity map indicates that the project footprint for the Bokpoort II solar development is in a preferred and acceptable area for solar developments.

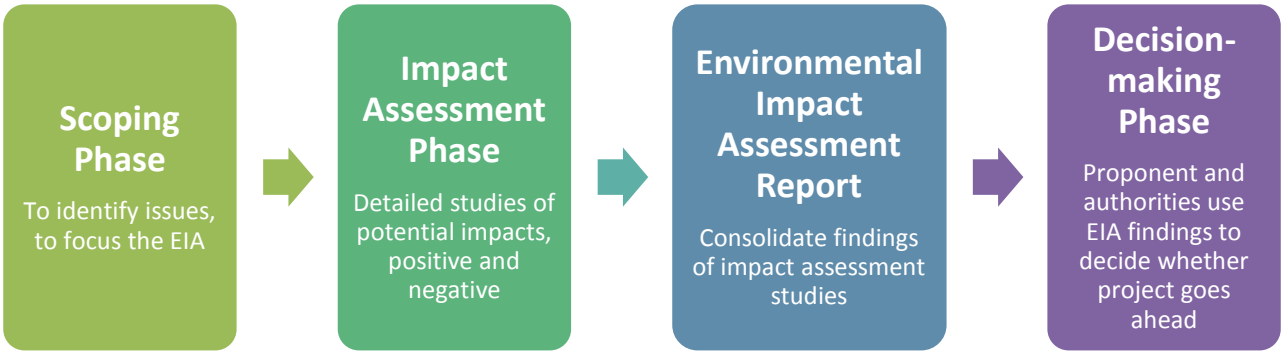
This Draft EIA Report is presented to stakeholders to inform them about the assessed impacts of the proposed development and to give them an opportunity to provide comments and/or raise issues of concern. The public is consulted on an on-going basis during the EIA process, with issues and concerns being recorded and incorporated into the process for evaluation. Feedback will be provided when a decision on the Project has been made. The public is also given the opportunity to comment on the Project, the proposed activities and the proposed scope of the EIA specialist studies. The comments received thus far have been recorded in this draft EIA Report.

This Draft Environmental Impact Assessment Report will be available for public review and comment from **27 May 2016 to 27 June 2016**. After the public comment period, the report will be updated and the final report will be submitted to the DEA for decision making.

SUMMARY OF WHAT THIS DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT CONTAINS

- Details of the Environmental Assessment Practitioner (EAP);
- Location of the proposed development;
- Plan which locates the proposed activities as well as the associated infrastructure applied for at an appropriate scale;
- Description of the scope of the proposed activity including all listed activities triggered being applied for;
- Description of the policy and legislative context applicable to the proposed development;
- Motivation for the need and desirability for the proposed development;
- Motivation for the preferred development footprint;
- Full description of the process followed to reach the proposed preferred activity, site and location within the site;
- An assessment of each identified potentially significant impact and risk, including cumulative impacts;
- Summary of the findings and recommendations of the specialist reports;
- An environmental impact statement including a summary of the key findings, an environmental sensitivity map and a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;
- Impact management objectives and outcomes for inclusion in the EMPr;
- Final proposed alternatives which reflect the impact management measures;
- Aspects which are conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation;
- A description of assumptions, uncertainties and gaps in knowledge relating to the impact assessment and mitigation measures;
- A reasoned opinion as to whether the proposed activity should or should not be authorised, highlighting any conditions to be made in respect of the authorisation;
- Declaration by EAP on correctness of information in the Environmental Impact Assessment Report and the transparency of the stakeholder engagement process; and
- Details of financial provisions for the rehabilitation, closure and ongoing post-decommissioning management of negative environmental impacts.

EIA PROCESS


Scoping Phase
To identify issues, to focus the EIA
Impact Assessment Phase
Detailed studies of potential impacts, positive and negative
Environmental Impact Assessment Report
Consolidate findings of impact assessment studies
Decision-making Phase
Proponent and authorities use EIA findings to decide whether project goes ahead

PUBLIC REVIEW OF THE DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

This Draft EIA Report will be available for comment for a period of **30 days** from **27 May 2016 to 27 June 2016**. Copies of the Report are available to view at the following public places:

Public place	Locality	Contact person	Telephone
!Kheis Local Municipal Clinic	Groblershoop	Aletta Strauss	054 833 0231
!Kheis Municipal Public Library	Groblershoop	Matilda Mathupi	054 833 9500
Orange River Cellars*	Groblershoop	Petra Smit	054 833 0108
Golder Associates Africa	Midrand	Marié Schlechter	011 254 4800

*** CD copies of the report will be available for collection.**

The report is also available on the Golder Associates website: www.golder.com/public

OPPORTUNITIES TO COMMENT

Stakeholders can comment on the Draft EIA Report by:

- Completing the comment sheet enclosed with the report at the public places, and
- Submitting additional comments by e-mail, fax or telephone to the Public Participation Office.

DUE DATE FOR COMMENT ON THIS DRAFT EIA REPORT
27 June 2016

Please submit comments to the Golder Public Participation Office:

Marié Schlechter
Golder Associates Africa
P O Box 6001
HALFWAY HOUSE, 1685
Tel: (011) 254-4800
Fax: 086 582 1561
Email: mschlechter@golder.co.za

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EXECUTIVE SUMMARY

Background

ACWA Power Africa Holdings (Pty) Ltd has applied for an environmental authorisation for the establishment of a 75 MW PV solar power plant on the Remaining Extent of the Farm Bokpoort 390 within the !Kheis Local Municipality in the ZF Mgcawu District Municipality, Northern Cape Province.

ACWA Power appointed Golder Associates Africa (Pty) to undertake the required environmental impact assessment (EIA). The following potential environmental impacts were identified during the scoping phase of this EIA and have been investigated during the environmental impact assessment phase of the project:

Traffic and Air Quality

The construction phase of the project will generate an estimated 78 two-way vehicular trips per day, with up to 32 one-way trips occurring during the morning and afternoon peak periods, potentially having a moderate impact on the local area. During the recent construction period of the Bokpoort I solar trough installation on an adjacent site, several road accidents involving construction vehicles, one of which was fatal, occurred and irrigation farmers along the Orange River complained about dust settling on their crops and affecting their sales value.

In addition to the proposed PV1 solar installation, ACWA Power has also applied for environmental authorisation for the establishment of a 75 MW photovoltaic (PV2) solar facility and a 150 MW CSP Tower power plant on Bokpoort 390 and SolAfrica Energy (Pty) Ltd has applied for authorisation to install a solar power plant based on Parabolic Trough and CSP Tower technology on the adjacent Farm Sanddraai 391. In a worst case scenario, if overlap in the construction periods of these four projects should occur, there would be an estimated 374 two-way vehicular trips per day, with up to 125 one-way trips occurring during the morning and afternoon peak periods.

Mitigation measures, such as applying commercial dust binders to unpaved surfaces, fitting recording tachometers to vehicles to monitor compliance with speed limits, avoiding night time trips and not making use of the unpaved Gariep Road between the N14 and the project site are recommended.

Due to the low personnel complement required to operate and maintain the solar power plant, much lower traffic volumes are expected during the operational phase. Traffic volumes during the closure and rehabilitation phase could be about 40% lower than in the construction phase, which will also be much shorter.

Visual impact and sense of place

The visual impact from the PV1 solar facility will be the glare from the reflective surface that will be visible up to 10 km from the project site. The PV1 facility will be constructed adjacent to the existing Bokpoort I CSP Trough facility and will contribute to the existing significant visual impact on the landscape.

The cumulative visual impact from the existing Bokpoort I CSP Trough facility, the proposed Bokpoort II solar facility and the proposed CSP Trough and Tower facilities on the neighbouring Sanddraai 391 will be dominated by the reflective glare from the 250 m high CSP Towers.

Ecology, soils, land use and land capability

The temporary disturbance of the soil and vegetation along the 20 km water pipeline route will be rehabilitated immediately after completion of the pipeline construction. Vegetation will be largely removed from the *ca.* 250 ha footprint of the PV site and result in the migration of most of the existing fauna away from the site. The site will be rehabilitated after decommissioning of the plant and removal of all infrastructure.

Riparian vegetation will be removed for the construction of the rock and cement foundation to stabilise the steep river bank for the installation of the abstraction pumps. Periodic dredging at the abstraction point may have a limited short term impact on invertebrates in the immediate area of the abstraction point.

With approximately 8 large solar energy facilities in various stages of the EIA application process, the cumulative impact on ecology, soils, land use and land capability is high.

Avifauna

Martial Eagles and Ludwig's Bustard, both classified as *Endangered* species, occur in the vicinity of the proposed site. A nesting pair of Martial Eagles was recorded about 2km from the eastern perimeter of the site. The abundance and flight activity levels of all raptors and priority species recorded at the project site was relatively low.

Collision with powerlines and other infrastructure is well understood and proven mitigation measures are available.

The potential impact on birds was assessed as moderate.

Noise

Noise levels due to the construction activities will be attenuated to about the same level as the current daytime baseline levels at a distance of 1 500 m from the site and to the typical night time level of 35 dBA at distance of 3 000 m. The southern perimeter of the Kalahari Oryx Game Reserve is about 1 900 m from the site. There are no other sensitive receptors within 3 000 m of the site. The potential impact on the sensitive receptors is low.

Surface water and Groundwater

The Bokpoort II PV1 solar project will increase the expected water demand from the Orange River in 2020 by 0.018%. There are no watercourses on the site. A conceptual stormwater management plan has been developed.

The groundwater quality and yield from the local aquifers excludes groundwater as a preferred water source for the proposed development.

With implementation of the recommended control measures the project is unlikely to have any significant impact on the surface water and groundwater resources in the area.

Socio-economics

The Northern Cape contributed about 2.3% or R 61.175 billion to the South African GDP of R 2 607.14 billion in 2010. Construction of the PV1 solar facility will take about 9 months and provide about 40 employment opportunities for local residents, which has been assessed as a positive impact, but of low significance.

Heritage

Middle Stone Age artefact scatters can be found across the study area. Ironstone, quartz and meta-quartzite artefacts were found in association with a calcrete outcrop near the Garona substation. The collection was spread out and there was no dense concentration of artefacts. No other cultural or historical remains or graves were found at the proposed site, therefore the impact is low. Procedures for dealing with chance finds are described.

Public consultation

The project was announced by placing an advertisement in the Gemsbok Newspaper on 28 January 2015 and sending a letter of invitation to participate all I&APs on the database, accompanied by a BIL and a registration, comment and reply sheet. Site notices were put up in Groblershoop and on the boundaries of the project area.

All EIA documents were made available at accessible public places and can be downloaded from the Golder website www.golder.com/public.

An initial draft Scoping Report was made available for public review from 28 January until 27 February 2015 and an Open House was held on Wednesday, 18 February 2015 at the Orange River Wine Cellars, Groblershoop from 12:00 to 18:00. A project progress and feedback letter, dated 5 June 2015, communicated the new project configuration and technology layouts and explained the reduction in the number of environmental authorisation (three instead of six) applications. Stakeholders were invited to submit any additional comments on the proposed new layout.

The amended draft Scoping Report (dated 6 January 2016), detailing the updated project configuration, was made available for additional public comment for a period of 30 days.

The draft EIA/EMPr report is available for public comment from 27 May to 27 June 2016. A public meeting will be held on Tuesday 14 June 2016 at the Orange River Wine Cellars, near Groblershoop, from 10:00 to 12:00.

An advert was placed in the Die Gemsbok and Volksblad newspapers and a letter was sent to all registered I&APs informing them of the availability of the draft EIA reports, public places where copies of the document can be viewed, and the date and time of the public meeting.

All comments received to date are included in the Comments and Response Report

Conclusion

No fatal flaws or impacts that cannot be mitigated to environmentally acceptable levels were identified and there are no environmental grounds on which to recommend that the Department of Environmental Affairs should not issue an environmental authorisation.

OPSOMMING

Agtergrond

ACWA Power Africa Holdings (Edms) Bpk het aansoek gedoen om omgewingsgoedkeuring vir die oprig van ‘n 75 MW Fotovoltaïse (FV) tegonolgie sonkragaanleg op die plaas Bokpoort 390 in die !Kheis Plaaslike Munisipaliteit en die ZF Mgcawu Distriksmunisipaliteit in die Noord-Kaap.

ACWA Power het Golder Associates Africa (Pty) aangestel om die nodige omgewingsimpakbepaling (OIB) te onderneem. Die onderstaande potensiële omgewingsimpakte is tydens die bestekbepalingsfase van die OIB geïdentifiseer en is tydens die impakbepalingsfase ondersoek.

Verkeer en luggehalte

Tydens die konstruksiefase sal daar ‘n beraamde 78 voertuie na en van die perseel beweeg. Daar sal ongeveer 32 een-rigting reise tydens die oggend en middag spitstye plaasvind en kan dus ‘n potensiële matige impak op die omliggende roetes hê. Tydens die onlangse konstruksie van die Bokpoort I paraboliese trog-gebaseerde sonkrag installasie op ‘n aangrensende perseel was konstruksievoertuie by verskeie padongelukkige, waarvan een noodlottig was, betrokke. Besproeiingsboere langs die Oranjerivier het gekla oor stof wat op hulle produkte beland en die markwaarde daarvan verlaag.

Behalwe vir die voorgestelde FV1 fasiliteit het ACWA Power ook aansoek gedoen om omgewingsgoedkeuring vir die oprig van ‘n 75 MW fotovoltaïse (FV2) kragopwekker en ‘n 150 MW Gekonsentreerde Sonkrag (GSK) Toring op Bokpoort 390 en Solafrica Energy (Edms) Bpk het aansoek gedoen vir magtiging om ‘n paraboliese trog-gebaseerde installasie en ‘n GSK Toring kragopwekker op die aangrensende plaas Sanddraai 391 op te rig. Indien konstruksie op al vier projekte sou oorvleuel, sal daar na beraming 374 voertuie daagliks na en van die projekgebied reis en sal daar sowat 125 een-rigting reise tydens die oggend en middag spitstye plaasvind.

Stofbekampingsmaatreëls, soos die gebruik van kommersiële bindmiddels op grondpaaie, registrerende tachometers op voertuie om spoed te moniteer, vermyding van nagreise en vermyding van die gebruik van die ongeteerde Garieppad tussen die N14 en die projekgebied, word aanbeveel.

‘n Sonkrag installasie het slegs ‘n klein werksmag nodig en die verkeersvolumes sal baie laer wees tydens die bedryfsfase. Verkeersvolumes tydens die sluitingsfase sal sowat 40% laer as tydens die konstruksiefase wees.

Visuele impak

Weerkaatsing vanaf helder oppervlaktes by die FV1 fasiliteit sal sigbaar wees tot en met ‘n afstand van 10km vanaf die perseel. Die FV1 fasiliteit sal reg langsaan die bestaande Bokpoort I paraboliese trog-gebaseerde sonkrag installasie opgerig word en dus sal die voorgestelde fasiliteit bydra tot die alreeds bestaande visuele impak.

Die kumulatiewe visuele impak komende van die bestaande Bokpoort I CSP parabolise trog-gebaseerde sonkrag installasie, die voorgestelde Bokpoort II sonkrag installasie en die voorgestelde CSP parabolise trog- en –toring installasies op die aangrensende Sanddraai 391 sal oorheers word deur die weerkaatsing vanaf die helder oppervlakte van die CSP torings.

Ekologie, grond, grondgebruik en dravermoë

Die tydelike versteuring van die grond en plantegroei langs die 20 km roete van die waterpyplyn sal onmiddellik na voltooiiing van konstruksie gerehabiliteer word. Die plantegroei op die sowat 250 ha FV1 perseel sal grotendeels verwyder word en dit sal migrasie van die bestaande fauna tot gevolg hê. Die perseel sal aan die einde van die leeftyd van die projek, na verwydering van alle infrastruktuur, gerehabiliteer word.

Plantegroei sal op die rivieroewer verwyder word waar die ankerpunt vir die drywende pompstasie met klip en beton gebou sal word. Periodieke baggering by die onttrekkingspunt sal ‘n beperkte korttermyn impak op ongewerwelde lewe in die onmiddellike omgewing van die onttrekkingspunt hê.

Met ongeveer 8 groot sonkrag installasies wat in verskeie stadia van die omgewingsgoedkeuringsproses is, sal die impak op ekologie, grond, grondgebruik en dravermoë potentieel hoog wees.

Avifauna

Breëkoparendande en Ludwigse poue, beide waarvan as *Bedreigde* spesies geklassifiseer word, kom voor in die omgewing. ‘n Broeipaar Breëkoparendande is sowat 2 km van die oostelike grens van die FV1 perseel waargeneem. Die getalle roofvoëls en ander prioriteit spesies en hulle aantal vlugte oor die perseel was relatief laag.

Die verskynsel van voëls wat in kragdrade en ander infrastruktuur vasvlieg is deeglik nagevors en effektiewe teenmaatreëls is beskikbaar.

Die potensiële impak op voëls word as matig aangeslaan.

Geraas

Geraasvlakke as gevolg van konstruksie sal na verwagting op ‘n afstand van 1 500 m na die vlakke wat tans bedags voorkom daal en op ‘n afstand van 3 000 m na sowat 35 dBA, wat tipies is van huidige geraasvlakke in die nag.

Die suidelike grens van die Kalahari Oryx Wildreservaat is ongeveer 1 900 m van die FV1 perseel. Daar is geen ander sensitiewe reseptore binne 3 000 m nie. Die potentiële impak op die sensitiewe reseptore as gevolg van geraas is laag.

Oppervlak water en Grondwater

Die Bokpoort II FV1 projek sal die verwagte wateronttrekking uit die Oranjerivier met 0.018% teen 2020 verhoog. Daar is geen lopende water of panne op die perseel nie, maar ‘n konsepsuele stormwaterplan, met ‘n verdampingsdam wat ‘n 1 in 50 jaar storm kan akkomodeer, is saamgestel.

Die gehalte en beskikbaarheid van die grondwater is nie voldoende om as bron vir die projek te dien nie.

Indien die aanbevole beheermaatreëls toegepas word is dit onwaarskynlik dat die projek enige betekenisvolle impakte op die oppervlak water en grondwater in die omgewing sal hê.

Sosio-ekonomie

Die Noord-Kaap het in 2010 sowat 2.3% of R 61.175 biljoen tot die Suid-Afrikaanse BNP van R 2 607.14 biljoen bygedra. Konstruksie van die FV1 projek sal ongeveer 40 werksgeleenthede vir plaaslike inwoners oor ‘n tydperk van 9 maande skep.

Erfenis

Werktuie uit die Middel Steentydperk kom verspreid voor in die projekgebied. Verskeie items van ysterklip, kwarts en meta-kwartsiet is in assosiasie met ‘n dagsoom van kalkreet naby die Garona substasie gevind. Die versameling was uitgesprei en daar was geen digte konsentrasie van werktuie nie. Geen ander kultuur-historiese oorblyfsels of grafte is op die perseel gevind nie en dus is die impak laag. Prosedures wat gevolg moet word tydens toevallige ontdekkings is beskryf.

Publieke deelname

Die projek is aangekondig deur die plasing van ‘n advertensie in die Gemsbok Koerant op 28 Januarie 2015 en ‘n brief aan al die ge-interesseerde en geaffekteerde partye op die databasis, om die projek bekend te stel en hulle te nooi om as belanghebbendes te registreer en kommentaar te lewer. Kennisgewingsbordjies is ook in Groblershoop en langs die grense van die projekgebied aangebring.

Relevante dokumente is in toeganklike publieke geboue en op Golder se webwerf www.golder.com/public beskikbaar gestel.

‘n Voorlopige Bestekbepalingsverslag is van 28 Januarie tot 27 Februarie 2015 vir publieke kommentaar beskikbaar gestel en daar was ‘n Opehuis van 12:00 tot 18:00 op Woensdag 18 Februarie 2015 by die Oranjerivier Wynkelders.

Terugvoer oor veranderinge in die projekparameters en tegnologie en ‘n verlaging in die aantal aansoeke om omgewingsgoedkeuring van ses na drie is by wyse van ‘n brief op 5 Junie 2015 gegee. Belanghebbendes is genooi om kommentaar te lewer.

‘n Gewysigde Bestekbepalingsverslag is op 6 Januarie 2016 vir 30 dae vir bykomende kommentaar beskikbaar gestel.

Die konsep Omgewingsimpakbepalingsverslag en Omgewingsbestuursverslag sal van 27 Mei tot 27 Junie 2016 beskikbaar wees vir publieke kommentaar. ‘n Publieke vergadering sal op Dinsdag 14 Junie 2016 van 10:00 tot 12:00 by die Oranjerivier Wynkelders gehou word.

‘n Advertensie is in die Gemsbok en Volksblad koerante geplaas en ‘n brief is aan alle geregistreerde belanghebbendes gestuur om die vergadering aan te kondig en aan te dui waar die verslag gevind kan word.

Alle kommentaar wat tot dusver ontvang is, is in ‘n Kommentaar en Antwoord Verslag op rekord gestel.

Gevolgtrekking

Geen onoorkomelike struikelblokke of impakte wat nie tot aanvaarbare vlakke vanuit ‘n omgewingsoogpunt versag kan word nie is geïdentifiseer nie en daar is geen omgewingsgronde vir ‘n aanbeveling aan die Departement van Omgewingsake om ‘n omgewingsgoedkeuring te weerhou nie.

LIST OF ACRONYMS AND ABBREVIATIONS

Abbreviation	Explanation
BIL	Background Information Letter
CSP	Concentrated Solar Power
DEA	Department of Environmental Affairs
DEIAR	Draft Environmental Impact Assessment Report
DENC	Northern Cape Department of Environment and Nature Conservation
DNI	Direct Normal Irradiance (or Insolation)
DoE	Department of Energy
DSR	Draft Scoping Report
DWS	Department of Water and Sanitation
EIA	Environmental Impact Assessment
EIA Regulations	National Environmental Management Act, 1998 (Act 107 of 1998) Environmental Impact Assessment Regulations, 2014
EMPr	Environmental Management Programme
GN	General Notice
ha	Hectares
HTF	Heat Transfer Fluid
I&APs	Interested and affected parties
IFC	International Finance Corporation
km	Kilometre
m	metres
MW	Megawatt
MWe	Megawatt electrical
NEMA	National Environmental Management Act, 1998 (Act 107 of 1998)
PS	Performance Standards
PV	Photovoltaic
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
SG	Surveyor General

1.0 INTRODUCTION

ACWA Power Africa Holdings (Pty) Ltd (hereafter referred to as ACWA Power) is proposing to construct a solar energy facility (Bokpoort II) on the north-eastern portion of the Remaining Extent (RE) of the Farm Bokpoort 390, located 20 km north-west of the town of Groblershoop within the !Kheis Local Municipality in the ZF Mgcawu District Municipality, Northern Cape Province.

Construction has been completed on an already authorised 75 MW Concentrated Solar Power (CSP) parabolic trough development, located on the south-western portion of the Remaining Extent (RE) of the Farm Bokpoort 390, in July 2013. The authorisation was granted by the Department of Environmental Affairs (DEA) in June 2011 ('Bokpoort I' site).

The site for the proposed Bokpoort II solar development is located within the area previously considered at scoping and site selection level and presented in the Environmental Impact Assessment (EIA) reports for the Bokpoort I site. The Bokpoort I EIA's sensitivity zoning map indicates that the project footprint for the proposed Bokpoort II solar development is in a preferred and acceptable area for solar power development when considering incident solar radiation and supporting infrastructure and proximity to available water. Refer to Section 6.0 for details on the site selection methodology followed.

ACWA Power has indicated that the development will be funded from local and international sources and hence the EIA for the proposed development would need to comply with the International Finance Corporation Performance Standards (IFC) 2012 and the Equator Principles.

ACWA Power is proposing to bid the two different solar technologies under the Department of Energy's (DoE) Renewable Energy Independent Power Producer Procurement Programme (REIPPPP). Each of the applications submitted to the DEA, if authorised, will be tendered in the DoE REIPPP. Only successful bids in the REIPPPP will be considered for development. The applicant is proposing to bid for two (2) 75 Mega Watt (MW) Photovoltaic (PV) solar power plant technology applications, and one (1) 150 MW CSP Tower. The combined power generation capacity of the entire Bokpoort II solar development applications will be 300 MW. However, the final technology choice and MW capacity will be determined through the outcome of the REIPPPP, based on successful bids awarded to ACWA Power.

This Environmental Impact Assessment Report focuses on assessing the environmental and social impacts, related to the proposed 75 MW PV1 solar power facility and associated infrastructure.

Golder Associates Africa (Pty) Ltd (Golder) has been appointed by ACWA Power as the independent Environmental Assessment Practitioner (EAP) to conduct the Environmental Impact Assessment process for the proposed development.

1.1 Environmental Applications

The Department of Energy's Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) requirements necessitated that three separate environmental authorisation applications be submitted to the competent authority (the DEA), for the Bokpoort II project as described in Table 1-1.

Table 1-1: Environmental applications applicable to the Bokpoort II solar development

Reference Number	Project Title	Abbreviated Project Title
Application applicable to this draft Environmental Impact Assessment Report		
DEA Reference: 14/12/16/3/3/2/881	Proposed Bokpoort II 75 Megawatt (MW) Photovoltaic Solar Development (PV1) on the Remaining Extent of the Farm Bokpoort 390 near Groblershoop, !Kheis Local Municipality, Northern Cape Province	PV1

Parallel applications submitted for the Bokpoort II project		
DEA Reference: 14/12/16/3/3/2/880	Proposed Bokpoort II 75 Megawatt (MW) Photovoltaic Solar Development (PV2) on the Remaining Extent of the Farm Bokpoort 390 near Groblershoop, !Kheis Local Municipality, Northern Cape Province	PV2
DEA Reference: 14/12/16/3/3/2/879	Proposed Bokpoort II 150 Megawatt (MW) Concentrating Solar Power (CSP) Tower Development Tower on the Remaining Extent of the Farm Bokpoort 390 near Groblershoop, !Kheis Local Municipality, Northern Cape Province	CSP Tower

1.2 Overview of the EIA Process

Figure 1-1 illustrates the EIA process being followed for the three environmental applications submitted for the Bokpoort II solar development. DEA required that three Scoping and EIA/EMPr Reports be compiled for the three applications, described above in Table 1-1 to streamline the process. Three EIA/EMPr reports, corresponding to the three applications, have been prepared, which describe the impacts and mitigation measures for each solar technology (PVs and CSP Tower) at their respective locations within the project area. One combined public participation process is being followed for all three applications.

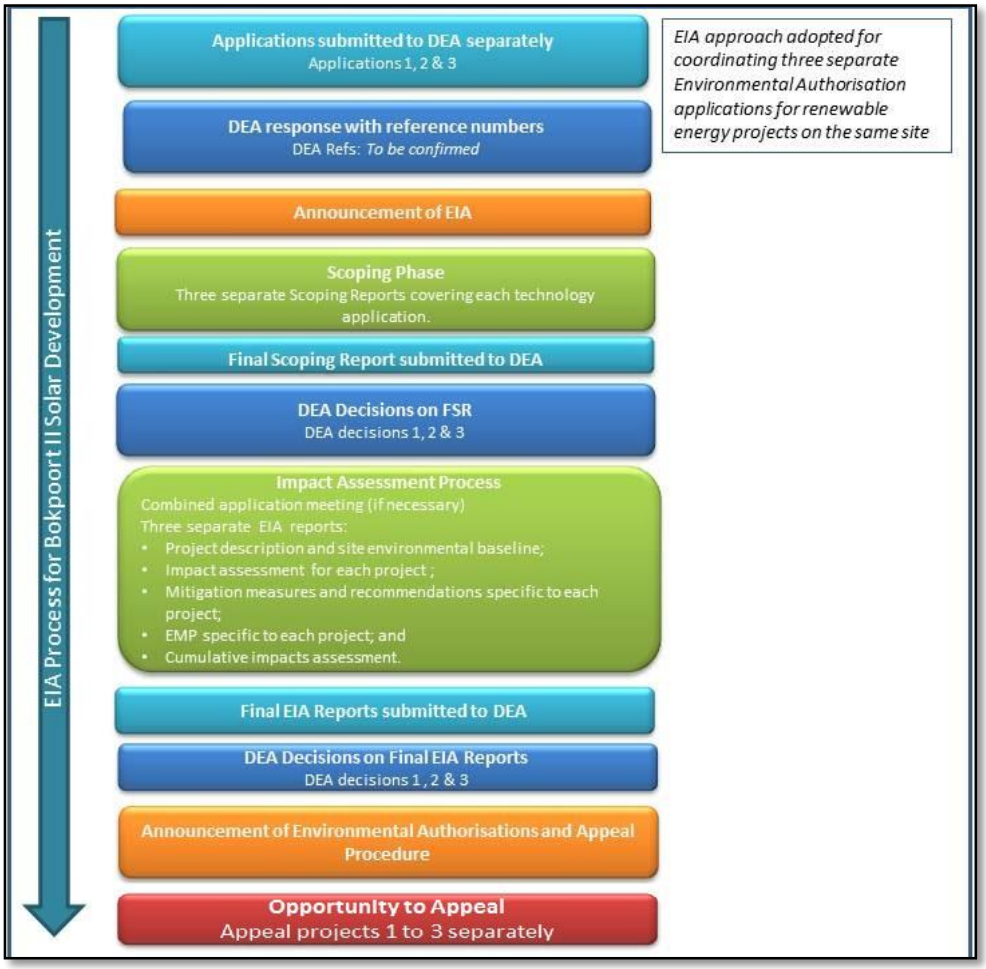


Figure 1-1: EIA Process for the Bokpoort II Solar Development

1.3 Objectives of the EIA Process

The objectives of the EIA process, as per Appendix 3 Section 2 of the 2014 EIA Regulations GN R.982 are to, through a consultative process:

a) determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;

b) describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;

c) identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;

d) determine the-

(i) nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and

(ii) degree to which these impacts-

(aa) can be reversed;

(bb) may cause irreplaceable loss of resources; and

(cc) can be avoided, managed or mitigated;

e) identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;

f) identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;

g) identify suitable measures to avoid, manage or mitigate identified impacts; and

h) identify residual risks that need to be managed and monitored.

1.4 Content of Draft EIA Report

This document is the Draft Environmental Impact Assessment/ Environmental Management Programme Report (DEIAR/EMPr) for the proposed 75 MW PV1 solar power development on the Remaining Extent of the Farm Bokpoort 390 near Groblershoop in the Northern Cape.

The DEIAR/EMPr contains the information necessary for a good understanding of the project, describing all preferred alternatives, including location alternatives, the scope of the assessment, and the consultation process undertaken throughout the Environmental Impact Assessment (EIA) process. This report further provides information on the expected impacts resulting from the proposed development and the most appropriate means of mitigation.

The summarised content of this DEIAR, as prescribed by National Environmental Management Act (Act 107 of 1998) (NEMA) Environmental Impact Assessment (EIA) Regulations, 2014 is presented in Table 1-2.

Table 1-2: EIA Report content as per NEMA EIA Regulations, 2014 GN R 982 Appendix 3

Section of the EIA Regulations, 2014	Description of EIA Regulations Requirements for EIA Reports	Location in this DEIAR/EMPr
Appendix 3, section 3 (a)	Details of the EAP who prepared the report; and the expertise of the EAP, including curriculum vitae.	Section 2.2

Section of the EIA Regulations, 2014	Description of EIA Regulations Requirements for EIA Reports	Location in this DEIAR/EMPr
		Table 2-2 APPENDIX B
Appendix 3, section 3 (b)	The location of the activity, including: (i) The 21 digit Surveyor General code of each cadastral land parcel; (ii) Where available, the physical address and farm name; and (iii) Where the required information in items (i) and (ii) is not available, coordinates of the boundary of the property or properties.	Section 2.3 and Figure 2-2
Appendix 3, section 3 (c)	A plan which locates the proposed activity or activities applied as well as the associated structures and infrastructure at an appropriate scale, or, if it is: (i) A linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or (ii) On land where the property has not been defined, the coordinates within which the activity is to be undertaken.	Section 2.4 and Figure 2-3, Figure 2-4
Appendix 3, section 3 (d)	A description of the scope of the proposed activity, including: (i) All listed and specified activities triggered and being applied for; and (ii) A description of the associated structures and infrastructure related to the development.	Section 3.0
Appendix 3, section 3 (e)	A description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context.	Section 4.0
Appendix 3, section 3 (f)	A motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred location.	Section 5.0
Appendix 3, section 3 (g)	A motivation for the preferred development footprint within the approved site.	Section 6.1
Appendix 3, section 3 (h)	A full description of the process followed to reach the proposed development footprint within the approved site, including: (i) Details of the development footprint alternatives considered; (ii) Details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs; (iii) A summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them; (iv) The environmental attributes associated with the development footprint alternatives focusing on the	Section 6.0 Section 7.0 Section 8.0 Section 8.0

Section of the EIA Regulations, 2014	Description of EIA Regulations Requirements for EIA Reports	Location in this DEIAR/EMPr
	geographical, physical, biological, social, economic, heritage and cultural aspects;	
	(v) The impacts and risks identified including the nature, significance, consequence, extent, duration, and probability of the impacts, including the degree to which the impacts: (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed, or mitigated.	Section 9.0
	(vi) The methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks;	Section 9.1
	(vii) Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographic, physical, biological, social, economic, heritage and cultural aspects;	Section 9.3, 10.1, 10.3
	(viii) The possible mitigation measures that could be applied and level of residual risk;	Section 9.0, 0
	(ix) If no alternative development locations for the activity were investigated, the motivation for not considering such; and	Section 6.0
	(x) A concluding statement indicating the preferred alternative development location within the approved site.	Section 10.5
Appendix 3, section 3 (i)	A full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred location through the life of the activity, including: (i) A description of all environmental issues and risks that were identified during the environmental impact assessment process; and (ii) An assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures.	Section 9.0
Appendix 3, section 3 (j)	An assessment of each identified potentially significant impact and risk, including: (i) Cumulative impacts;	Section 9.0

Section of the EIA Regulations, 2014	Description of EIA Regulations Requirements for EIA Reports	Location in this DEIAR/EMPr
	(ii) The nature, significance and consequences of the impact and risk; (iii) The extent and duration of the impact and risk; (iv) The probability of the impact and risk occurring; (v) The degree to which the impact and risk can be reversed; (vi) The degree to which the impact and risk may cause irreplaceable loss of resources; and (vii) The degree to which the impact and risk can be mitigated.	
Appendix 3, section 3 (k)	Where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report.	Section 11.7
Appendix 3, section 3 (l)	An environmental impact statement which contains: (i) A summary of the key findings of the environmental impact assessment; (ii) A map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and (iii) A summary of the positive and negative impacts and risks of the proposed activity and identified alternatives.	Section 10.1, 10.2, 10.3
Appendix 3, section 3 (m)	Based on the assessment, and where applicable, recommendations for specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation.	Section 11.7
Appendix 3, section 3 (n)	The final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment.	Section 10.5
Appendix 3, section 3 (o)	Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation.	Section 10.6
Appendix 3, section 3 (p)	A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed.	Section 13.0
Appendix 3, section 3 (q)	A reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation.	Section 10.8
Appendix 3, section 3 (r)	Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised.	NA

Section of the EIA Regulations, 2014	Description of EIA Regulations Requirements for EIA Reports	Location in this DEIAR/EMPr
Appendix 3, section 3 (s)	An undertaking under oath or affirmation by the EAP in relation to: (i) The correctness of the information provided in the reports; (ii) The inclusion of comments and inputs from the stakeholders and I&APs; (iii) The inclusion of inputs and recommendations from the specialist reports where relevant; and (iv) Any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties.	Section 12.0
Appendix 3, section 3 (t)	Where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts.	N/A
Appendix 3, section 3 (u)	An indication of any deviation from the approved scoping report, including the plan of study, including: (i) Any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and (ii) A motivation for the deviation.	N/A
Appendix 3, section 3 (v)	Any specific information that may be required by the competent authority.	N/A
Appendix 3, section 3 (w)	Any other matters required in terms of section 24(4)(a) and (b) of the Act.	N/A

2.0 PROJECT IDENTIFICATION DETAILS

2.1 Company responsible for the solar development project (Applicant)

Table 2-1: Details of Proponent

Item	Description
Applicant name	International Company for Water and Power Projects
	Applicant is trading as: ACWA Power Africa Holdings (Pty) Ltd
Responsible person	Prabashen Govender
Address	7th Floor 90 Grayston Drive Sandton 2196
Contact details	Tel: (011) 722 4100 pgovender@acwapower.com
Land Owners	*Remaining Extent of the Farm Bokpoort 390:* ACWA Power SolAfrica Bokpoort CSP Power Plant (RF) Proprietary Limited *Sand Draai 391 Portion 0 and 5:* Johannes Fourie. ACWA Power has permission through an agreement with the landowner to use an existing 50m wide water pipeline servitude that runs across the farm Sand Draai 391 Portion 0 and 5 to the Remaining Extent of the Farm Bokpoort 390.

2.2 Details of the Environmental Assessment Practitioner

ACWA Power has appointed Golder, an independent consultancy to undertake the environmental authorisation process for the proposed project in accordance with the NEMA Environmental Impact Assessment (EIA) Regulations, 2014 (GN. R.982 to R.985). The EIA process is also being undertaken in conformance with the International Finance Corporation (IFC) Performance Standards (2012) and Equator Principles as the project proponent will seek international finance for the development.

Golder is a member of the world-wide Golder Associates group of companies, offering a variety of specialised engineering and environmental services. Employee owned since its formation in 1960, the Golder Associates group employs more than 8 000 people who operate from more than 160 offices located throughout Africa, Asia, Australasia, Europe, North America and South America. Golder Associates Africa (Pty) Ltd has offices in Midrand, Pretoria, Durban, Maputo and Accra. Golder Associates Africa has approximately 300 skilled employees and is able to source additional professional skills and inputs from Golder offices around the world.

Golder has no vested interest in ACWA Power or the proposed project and hereby declares its independence as required by the EIA Regulations. Refer to APPENDIX B for the Declaration of Independence signed by the EAP.

Table 2-2: Details of Golder Associates

Name	Golder Associates Africa (Pty) Ltd
Address	Building 1, Magwa Cresent West, Maxwell Office Park, Waterfall City, Midrand P O Box 6001, Halfway House, 1685, South Africa Telephone: (011) 254 4800 Fax: (086) 582 1561
Environmental Assessment Practitioner (EAP)	**Marié Schlechter** (Senior Environmental Specialist) Ms Schlechter has worked in the mining industry and environmental consultancy for more than fifteen years, gaining experience in the environmental management discipline. Marié has experience in conducting and managing environmental impact assessment projects, implementation, maintenance and internal auditing of environmental management systems as well as compliance audits. Full CV is provided APPENDIX B.
Public Participation Coordinator	Antoinette Pietersen (Public Participation Specialist)

2.3 Project Location

The project area is located on the north eastern portion of the Remaining Extent of the Farm Bokpoort 390 which is 20 km north-west of the town of Groblershoop within Ward 3 of the !Kheis Local Municipality in the ZF Mgcawu District Municipality, Northern Cape Province as indicated in Figure 2-2. The total Bokpoort II project area designated for the development is approximately 1 500 ha. The project site is situated approximately 77 km south-east of Upington. The Orange River is located approximately 12 km south-west of the site.

The coordinates of the proposed site, pipeline and abstraction point is listed in Table 2-3 and illustrated in Figure 2-1.

Table 2-3: Coordinates for the project site, pipeline and abstraction point

Coordinate Identification Number	X Coordinate	Y Coordinate
Proposed PV1 Facility		
14	21.99866	-28.7102
15	21.99876	-28.7103
16	21.99879	-28.7132
17	22.00212	-28.7131
18	22.00244	-28.7133
19	22.00277	-28.7135
20	22.0028	-28.716
21	22.01474	-28.716
22	22.01477	-28.7189
23	22.01278	-28.7189
24	22.01281	-28.7218
25	22.01082	-28.7218

Coordinate Identification Number	X Coordinate	Y Coordinate
26	22.01085	-28.7248
27	22.00885	-28.7248
28	22.00888	-28.7277
29	22.0049	-28.7277
30	22.00482	-28.719
31	21.98819	-28.7191
32	21.98688	-28.7175
33	21.98687	-28.7162
34	21.98684	-28.7132
35	21.98485	-28.7133
36	21.98482	-28.7103
37	21.99866	-28.7102
Bokpoort II Site Boundary		
79	21.9818	-28.7121
80	21.99509	-28.6986
81	22.02126	-28.6756
82	22.03558	-28.6942
83	22.00463	-28.7333
84	22.0046	-28.7196
85	21.98869	-28.7197
86	21.9818	-28.7121
Construction Laydown Area		
93	21.99064	-28.7055
94	21.99485	-28.7055
95	21.99489	-28.7095
96	21.99068	-28.7096
97	21.99065	-28.7073
98	21.99064	-28.7055
Proposed Pipeline		
99	21.88784	-28.8051
100	21.95287	-28.7634
101	21.99018	-28.7069

The 21 digit Surveyor General code of each cadastral land parcel is provided in Table 2-4

Table 2-4: Location of the activity

Farm Name	SG 21 Digit Code	Physical Address	Comments
Remaining Extent of the Farm Bokpoort 390	C02800000000039000000	Farm Bokpoort 390 Groblershoop	Preferred location of solar development and associated infrastructure
Farm Sand Draai 391 Portion 0	C02800000000039100000	Farm Sand Draai 391 Portion 0 Groblershoop	Preferred location for placing water pipeline in existing water pipeline servitude
Farm Sand Draai 391 Portion 5	C02800000000039100005	Farm Sand Draai 391 Portion 5 Groblershoop	Preferred location for placing water pipeline in existing water pipeline servitude

2.4 Plan Locating the Proposed Activity

Figure 2-2 illustrates the proposed layout plan where the solar development will be positioned within the Remaining Extent of the Farm Bokpoort 390. A new 20km water pipeline will follow the existing water pipeline servitude being used for the Bokpoort I development. The proposed water pipeline will extend through the 50m buffer zone to which ACWA Power has landowner consent to utilise (Refer to Figure 2-3). Figure 2-4 and Figure 2-5 illustrates the infrastructure associated with this PV1 solar power facility application.

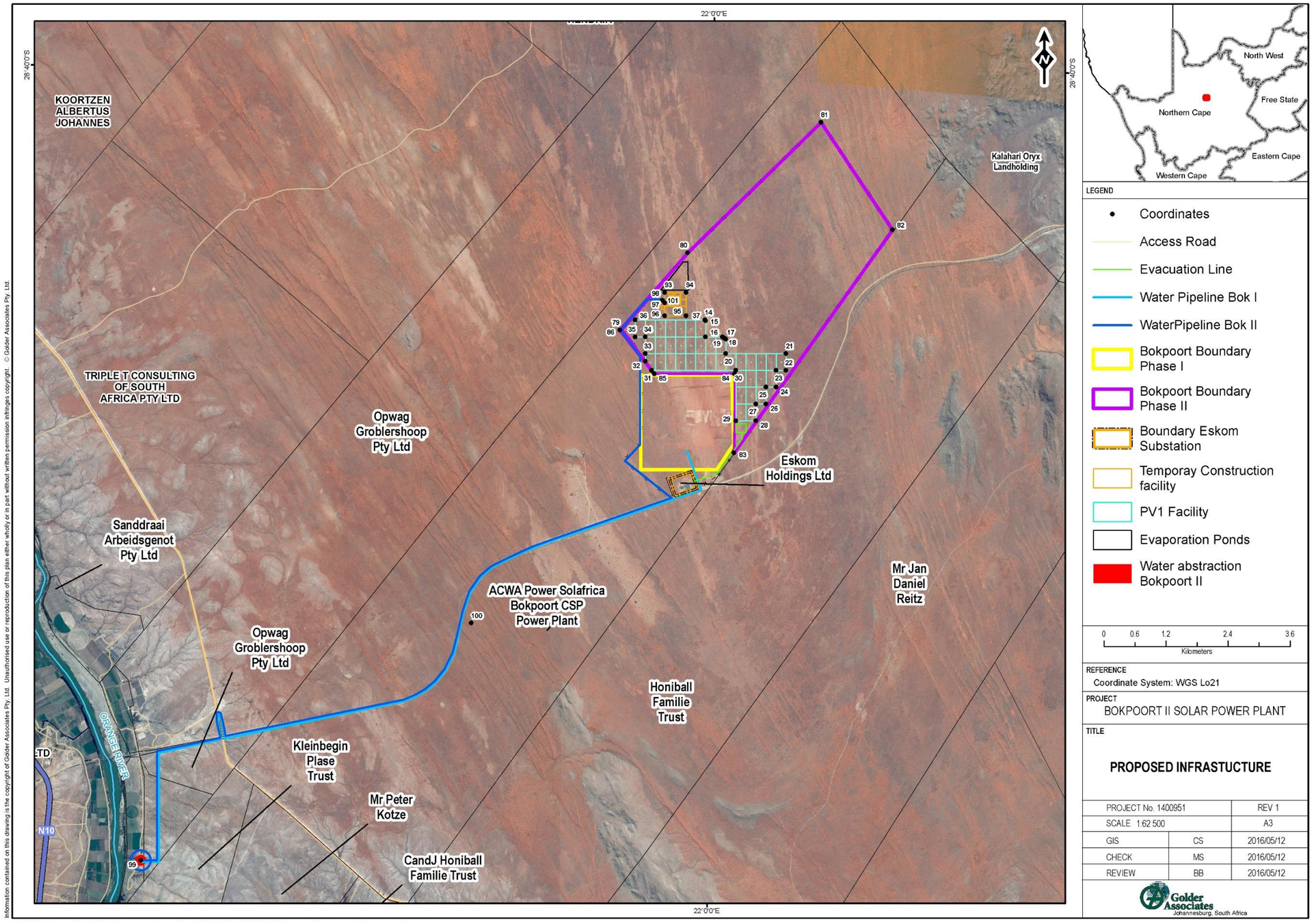


Figure 2-1: Coordinates of the project site, pipeline and abstraction point

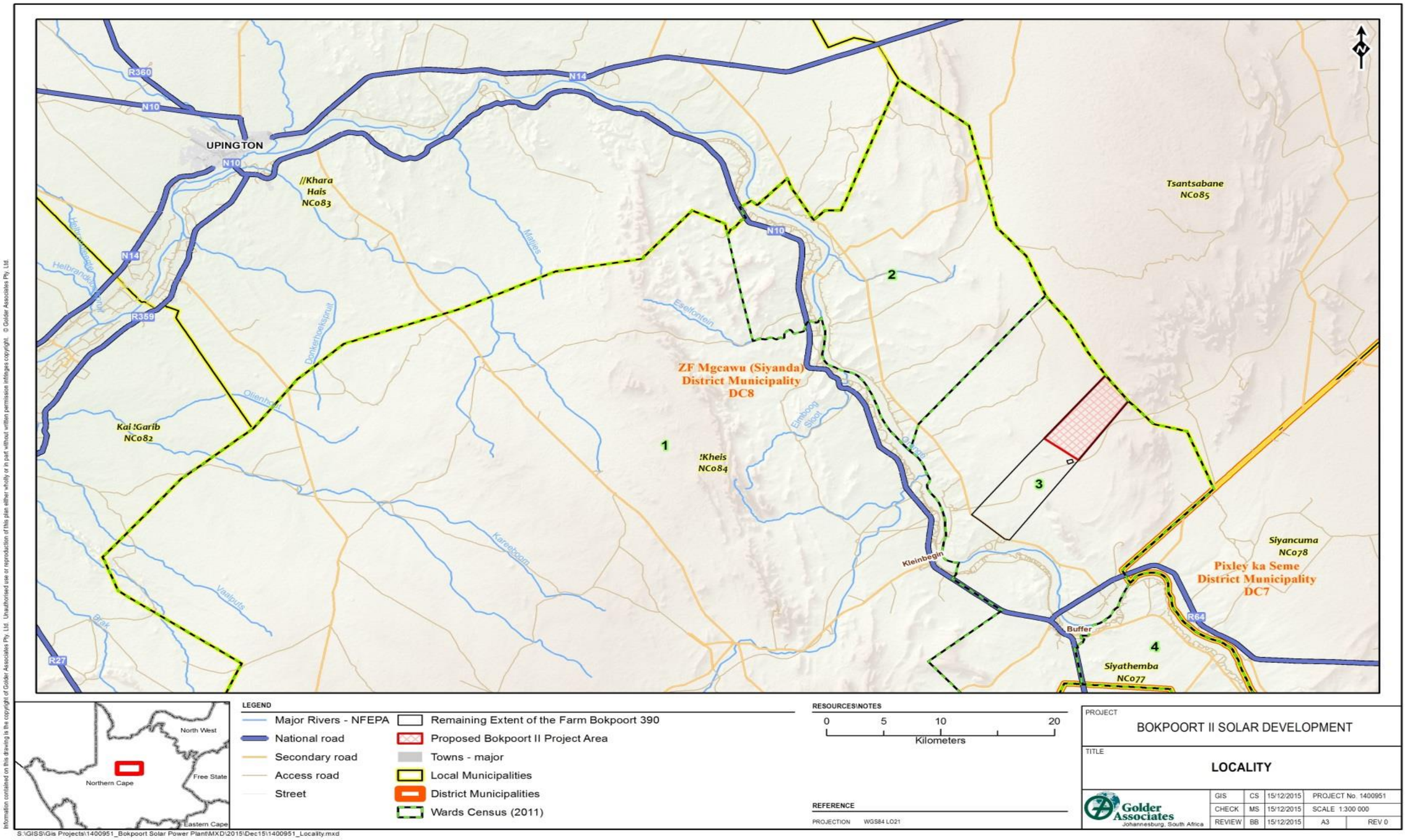


Figure 2-2: Locality map for the proposed Bokpoort II solar development

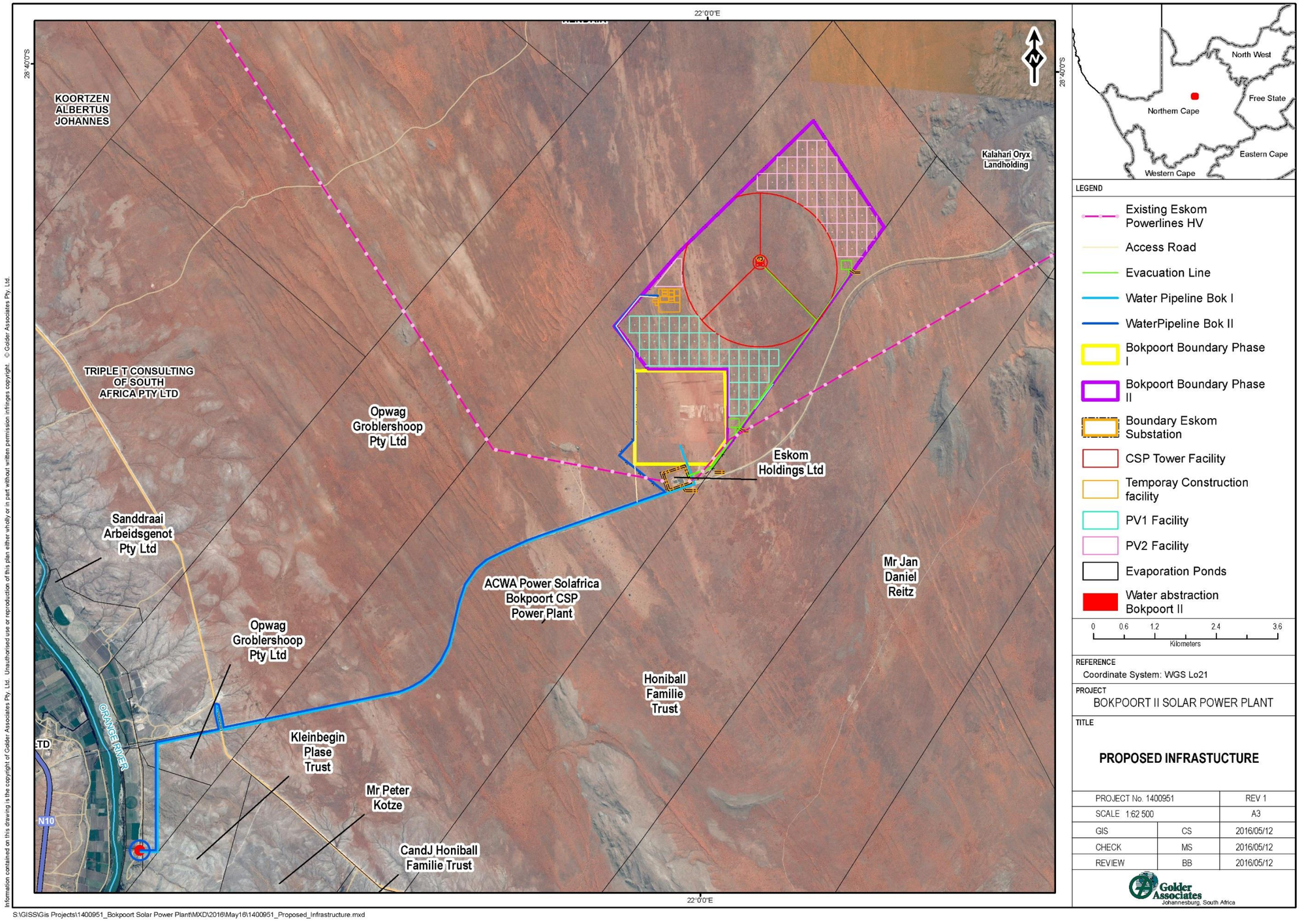


Figure 2-3: Proposed Infrastructure Layout of the entire Bokpoort II Solar Development

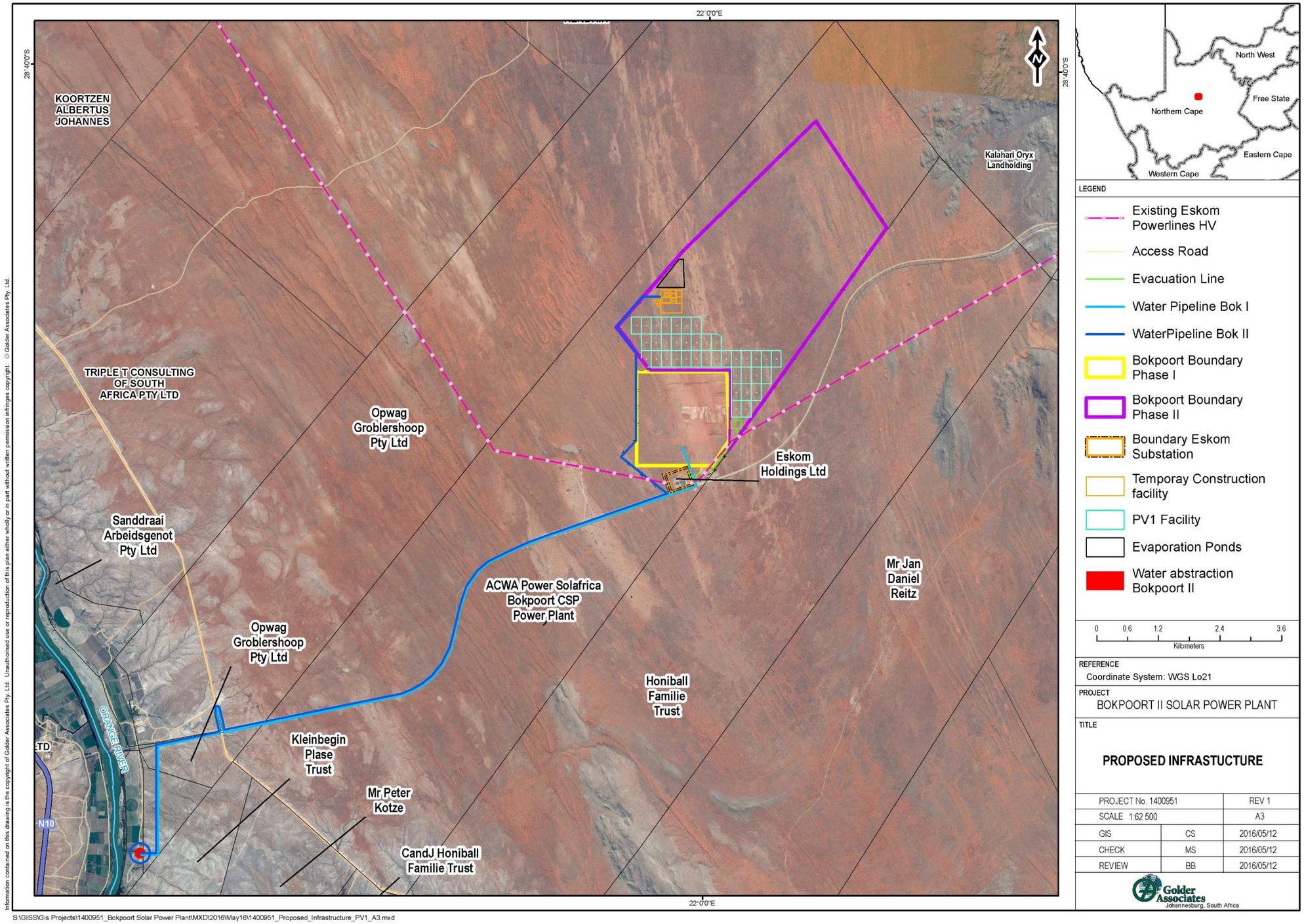


Figure 2-4: Proposed 75 MW Photovoltaic (PV1) solar power facility Infrastructure

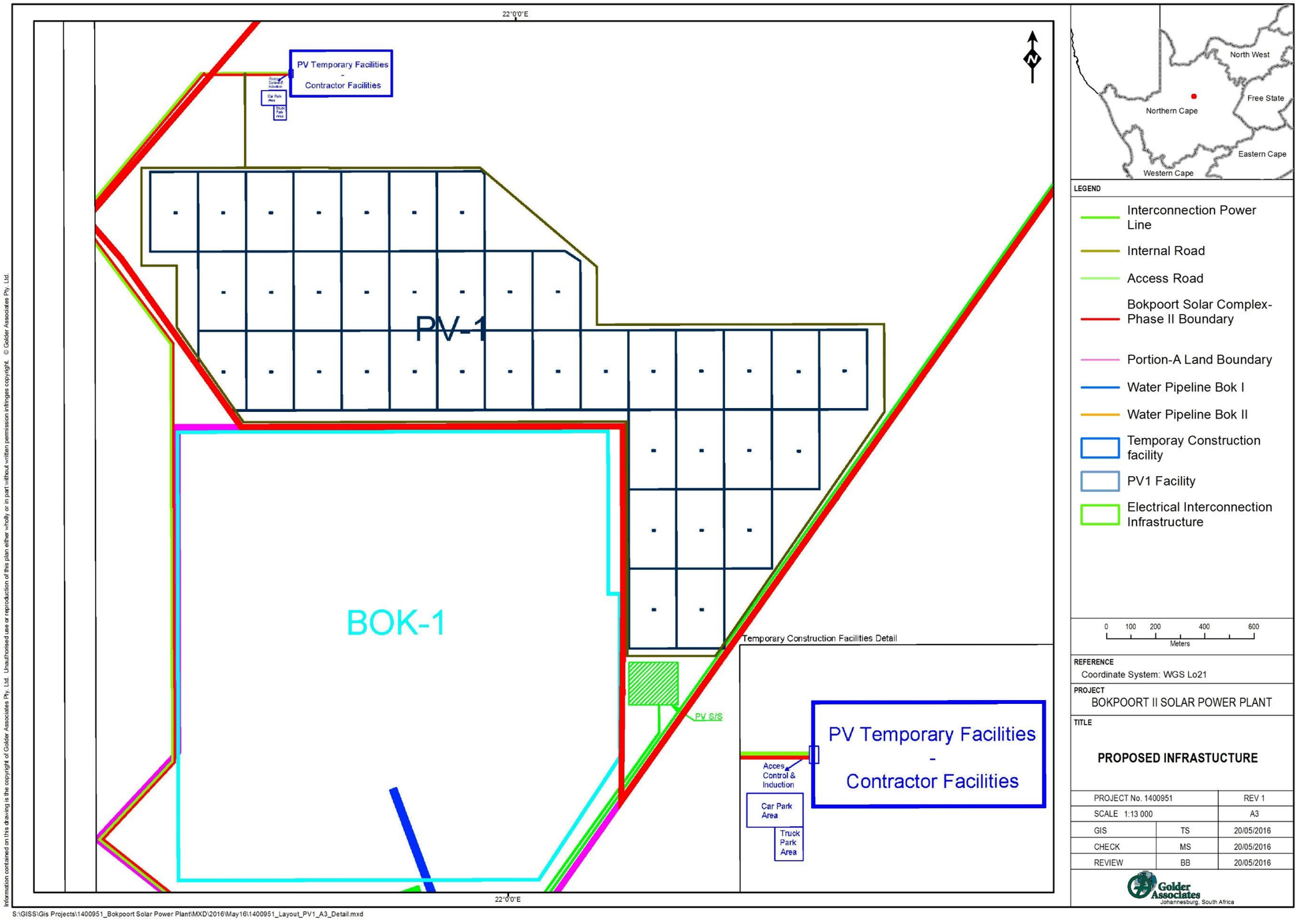


Figure 2-5: Detailed View of the Associated Infrastructure for the Proposed 75 MW PV1 Solar Facility

3.0 SCOPE OF THE PROPOSED ACTIVITY

The Bokpoort II project will include different types of solar power technologies and associated infrastructure. **The proposed Photovoltaic Solar Technology, to which this EIA/EMPr Report is applicable, is discussed below.**

3.1 Photovoltaic Solar Facility

The Photovoltaic (PV) solar power plant converts the sun's energy directly into electrical energy. The PV plant will consist of 75 MW photovoltaic solar arrays. The general position of the PV plant is shown in Figure 2-3. The facility consists of the following main functional groups (Figure 2-4):

- Solar generator comprised of polycrystalline PV modules (JINKO Solar modules JKM 310Wp) that will be able to deliver up to 75 MW to the Eskom National Grid;
- Inverters that convert direct current (DC) generated by the PV modules into alternating current (AC) to be exported to the electrical grid. The inverter is a HSC2160S Solar Station manufactured by Helios Systems. The inverter is an 11.28 m high cube container which includes the DC distribution, the inverter, the medium voltage transformer and the medium voltage switchgear;
- A transformer that raises the system AC low voltage (LV) to medium voltage (MV). The transformer converts the voltage of the electricity generated by the PV panels to the correct voltage for delivery to Eskom;
- Transformer substation; and
- Instrumentation and Control consisting of hardware and software for remote plant monitoring and operation of the facility.

Associated infrastructure includes (Figure 2-4):

- Mounting structures for the solar panels will be either rammed steel piles or piles with pre-manufactured concrete footings to support the PV panels;
- Cabling between the structures, to be lain underground where practical;
- A new 132 kV overhead power line which will connect the facility to the national grid via Eskom's existing Garona Substation. The powerline will be approximately 5km in length and will be located within a servitude spanning 50 metres on both sides. The powerline towers will be 35 metres high;
- Internal access roads (4 – 6 m wide roads will be constructed but existing roads will be used as far as possible) and fencing (approximately 3 m in height); and
- Associated buildings, including a workshop area for maintenance, storage (i.e. fuel tanks, etc.), and offices.

3.1.1 Technical Details of the Proposed PV1 Solar Facility

Table 3-1 summarises the main technical details for the proposed PV1 solar facility and associated infrastructure.

Table 3-1: Technical details of the proposed PV1 solar facility

Facility Component	Description / Dimensions
Height of PV panels	4 metres
Number of panels	Approximately 280 000
Panel dimensions	1 956 x 992 mm
Panel direction	Portrait in single axis tracking configuration
Area of PV Array	250 ha
Number of inverters required	38 units of 2 MW_{ac} each
Area occupied by inverter / transformer stations / substations	150m x 150m
Capacity of on-site substation	132 kV on site substation 75 MW Step-up Transformer
Area occupied by both permanent and construction laydown areas	150 ha
Area occupied by buildings	20 ha
Length of internal roads	To be finalised during detailed design of facility
Width of internal roads	4 metres
Proximity to grid connection	Approximately 5 km
Height of fencing	6 metres
Type of fencing	Security Fencing
Overhead powerline length	Approximately 5 km
Overhead powerline servitude	50 metre on each side
Overhead powerline tower height	35 metre

An example of an installed PV facility is shown in Figure 3-1 and Figure 3-2.

Figure 3-1: The Lesedi Solar Park near Postmasburg in the Northern Cape. This solar park is an example of a Photovoltaic (PV) Solar Power Plant[1]

Figure 3-2: Example of PV Solar Power Facility's Tracker View[2]

[1] Sourced from http://mybroadband.co.za/news/wp-content/uploads/2015/02/Lesedi.jpg

[2] Sourced from http://cdn.aiidatapro.net/media/63/48/df/t780x490/6348dfa42dd64b85fcb0f345befaaef776a3e4df.jpg

3.2 Listed Activities Triggered

The NEMA EIA Regulations, 2014 GN R.983, 984, and 985 listed activities associated with the project are indicated in Table 3-2.

Table 3-2: NEMA 2014 Listed activities triggered

Listed activity as described in GN R.983, 984 and 985	Description of project activity that triggers listed activity – if activities in GN R. 985 are triggered, the triggering criteria as described in the second column of GN R. 983 are indicated
GN R.983 Item 9: The development of infrastructure exceeding 1 000 m in length for the bulk transportation of water or storm water: (i) With an internal diameter of 0.36 metres or more; or (ii) with a peak throughput of 120 litres per second or more	The proposed solar development will require facilities or infrastructure exceeding 1 000 metres in length for the bulk transportation of water. A 20 km (approximately) pipeline will be constructed from the Orange River to the proposed solar development for the transportation of bulk water. The pipeline will have a throughput of more than 120l/sec and a diameter of 0.36m.
GN R.983 Item 10: The development and related operation of infrastructure exceeding 1 000 m in length for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes – (i) With an internal diameter of 0.35 m or more; or (ii) With a peak throughput of 120 litres per second or more.	Pipelines exceeding 1 000 metres will be constructed to transport wastewater and treated water within the power plant area. The pipelines will have a throughput of more than 120l/sec and a diameter of 0.36m.
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 solar facility will require the construction of a 132 kV overhead line to connect the facility to the grid via the Garona Substation located on the Remaining Extent of the Farm Bokpoort 390. The new overhead power line will be approximately 5km long with a servitude of 50 metres on either side. The power line towers will be 35 metres high.
GN R.983 Item 12: The development of: (ii). Channels exceeding 100 square metres in size; (x). buildings exceeding 100 square metres in size; or (xi). Infrastructure or structures with a physical footprint of 100 square metres or more, Where such development occurs within a watercourse or, if no development setback exists, within 32 m of a watercourse, measured from the edge of a watercourse	The proposed solar facility will require the construction of pumps on a floating pump platform within the Orange River. Due to the steep river bank at the area of pump installation, the river bank will be stabilised with a rock and cement foundation. Concrete plinths will be constructed on both sides to connect anchor cables to the pipes. The area that will be covered by the cement foundation will exceed 100 square meters.
GN R. 983 Item 14: The development of facilities or infrastructure for the storage, or for the storage and handling, of a dangerous good,	The proposed development will require the storage of fuel for construction vehicles and generators on site. The fuel

where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 cubic m	storage facilities will have a combined capacity of 500 cubic metres.
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 from- (i). a watercourse.	The installation of the water abstraction pumps and pump platform in the Orange River will probably require the dredging of silt along the river bottom to ensure adequate water depth for the pumps to operate without drawing excessive silt. The dredging will be confined to the area immediately below the pumps. The dredged material will not be removed from the river but merely moved downstream within the river.
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 ha.	The development of the solar facility will involve the development of 250 ha of agricultural land. The project site is located outside an urban area.
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 km – (ii) where no reserve exists, where the existing road is wider than 8 m.	An access road leading from the current private Transnet service road will be constructed to create an access road from the proposed solar facility. The existing road will be lengthened by more than 1 km and will be approximately 6m in width.
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 facilities or infrastructure is for photovoltaic installations and occurs within an urban area.	The electricity generation capacity of the proposed PV1 solar facility will be 75 MW. The solar facility will be located outside an urban area.
GN R.984 Item 15: The clearance of an area of 20 ha or more of indigenous vegetation.	The construction of the proposed PV1 solar facility will require the clearance of more than 20 ha of indigenous vegetation.
GN R.985 Item 12: The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan. (a). Northern Cape Province (i). Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004,	The abstraction of water will require the installation of water abstraction pumps on a floating pump platform and the construction of a cement and rock foundation (for the stabilisation of the river bank). The indigenous riparian vegetation that will be cleared during the construction of the cement and rock river bank foundation will exceed 300 square metres and will be located within the endangered Lower Gariep Alluvial Vegetation ecosystem.

(ii) Within critical biodiversity areas identified in bioregional plans.	
GN R. 985 Item 14: The development of (iv). Infrastructure or structures with a physical footprint of 10 square metres or more where such development occurs within a watercourse or, if no development setback has been adopted, within 32 m of a watercourse, measured from the edge of a watercourse (a). Northern Cape Province (ii). Outside urban areas, in: (dd). Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority (ff). Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plan.	The abstraction of water will require the installation of water abstraction pumps on a floating pump platform and the construction of a cement and rock foundation (for the stabilisation of the river bank). The construction of the cement and rock river bank foundation will have a physical footprint in excess of 10 square metres and will be located on the orange River bank within the endangered Lower Gariep Alluvial Vegetation ecosystem.

4.0 POLICY AND LEGISLATIVE CONTEXT

This section provides a brief overview of both the national and international requirements that must be met by this project. It includes international conventions and agreements, as well as the IFC Standards and the Equator Principles.

4.1 South African Legislation

4.1.1 National Environmental Management Act

In terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA), as amended and the EIA Regulations, 2014, an application for environmental authorisation for certain listed activities must be submitted to either the provincial environmental authority, or the national authority (Department of Environmental Affairs, DEA), depending on the types of activities being applied for (see 4.1.2 below). The National Department of Environmental Affairs (DEA) is the competent authority for applications involving power generation and/or transmission.

The current EIA regulations, GN R. 982, GN R. 983, GN R. 984 and GN R. 985, promulgated in terms of Sections 24(5), 24M and 44 of the NEMA and subsequent amendments, commenced on 08 December 2014. GN R. 983 lists those activities for which a Basic Assessment is required, GN R. 984 lists the activities requiring a full EIA (Scoping and Impact Assessment phases) and GN R. 985 lists certain activities and competent authorities in specific identified geographical areas. GN R. 982 defines the EIA processes that must be undertaken to apply for Environmental Authorisation. The listed activities that are applicable to this project are discussed in Section 3.2.

4.1.2 National Environmental Management: Waste Act

The National Environmental Management: Waste Act, 2008 (Act 59 of 2008) (NEMWA) was implemented on 1 July 2009 and section 20 of the Environment Conservation Act 73 of 1989, under which waste management was previously governed, was repealed. One of the main objectives of the NEMWA is to reform the law regulating waste management in order to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development and to provide for:

- National norms and standards for regulating the management of waste by all spheres of government;
- Specific waste management measures;
- The licensing and control of waste management activities;
- The remediation of contaminated land; to provide for the national waste information system; and
- Compliance and enforcement;

In terms of the NEMWA, certain waste management activities must be licensed and in terms of Section 44 of the Act, the licensing procedure must be integrated with an environmental impact assessment process in accordance with the EIA Regulations promulgated in terms of the NEMA.

Government Notice 921, which was published in Government Gazette No. 37083, on 29 November 2013 and implemented with immediate effect, lists the waste management activities that require licensing. A distinction is made between Category A waste management activities, which require a Basic Assessment, and Category B activities, which require a full EIA (Scoping followed by Impact Assessment).

The proposed 75 MW PV1 solar facility will not require a waste management license.

4.1.3 National Water Act

The National Water Act, 1998 (Act No. 36 of 1998) (NWA) is the primary legislation regulating both the use of water and the pollution of water resources. It is applied and enforced by the Department of Water Affairs (DWA).

Section 19 of the National Water Act regulates pollution, which is defined as “the direct or indirect alteration of the physical, chemical or biological properties of a water resource so as to make it:

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

The persons held responsible for taking measures to prevent pollution from occurring, recurring or continuing include persons who own, control, occupy or use the land. This obligation or duty of care is initiated where there is any activity or process performed on the land (either presently or in the past) or any other situation which could lead or has led to the pollution of water.

The following measures are prescribed in the section 19(2) of the NWA to prevent pollution:

- cease, modify or control any act or process causing the pollution;
- comply with any prescribed standard or management practice;
- contain or prevent the movement of pollutants;
- eliminate any source of the pollution;
- remedy the effects of pollution; and

- remedy the effects of any disturbance to the bed or banks of a watercourse.

Section 21 of the NWA lists the water uses for which a water use licence (WUL) is required. ACWA Power intends to abstract water from the Orange River to provide water to the project area through a 20km water pipeline which will most likely be placed within the existing Bokpoort I water pipeline servitude. The current estimated amount of water to be used for the proposed 75 MW PV1 solar facility is 25 000m^3.

In terms of the NWA, water uses include the following activities:

(a) Taking water from a water resource;

(b) Storing water;

(c) Impeding or diverting the flow of water in a watercourse;

(d) Engaging in a stream flow reduction activity contemplated in section 36;

(e) Engaging in a controlled activity identified as such in section 37(1) or declared under section 38(1);

(f) Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;

(g) Disposing of waste in a manner which may detrimentally impact on a water resource;

(h) Disposing in any manner of water which contains waste from or which has been heated in, any industrial or power generation process;

(i) Altering the bed, banks, course or characteristics of a watercourse:

(j) Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and

(k) Using water for recreational purposes.

In addition, any development proposed within or within 500m of a watercourse requires a WUL.

For the purposes of the Renewable Energy Procurement process, a non-binding letter of water availability confirmation is required from the DWS in lieu of an actual WUL, on the premise that a WUL would be applied for and obtained from the Department upon the project applicant being identified as a preferred bidder in the procurement process.

4.1.4 National Heritage Resources Act, 1999

The National Heritage Resources Act, 1999 governs the management of heritage resources which are of cultural significance. The South African Heritage Resources Agency is the national body responsible for the protection of South Africa's cultural and heritage resources.

A Phase I heritage impact assessment is required as part of the environmental impact assessment process.

4.1.5 Electricity Regulation Act 4 of 2006 as amended by the Electricity Regulation Amendment Act 28 of 2007

These regulations regulate the use and generation of electricity.

4.1.6 Other Policies, Plans and Guideline Documents

Other policies, municipal plans and guideline documents that are relevant to the project are listed below:

- Guidelines published in terms of the NEMA EIA Regulations;
- Environmental Impact Assessment Guidelines for Renewable Energy Projects, GNR 989 of 2015 in terms of NEMA (Act 107 of 1998);
- National Environmental Management Biodiversity Act (NEMBA) (Act 10 of 2004);
- Electricity Act (Act 41 of 1987);
- Promotion of Administrative Justice Act (Act 2 of 2000);
- Civil Aviation Act (Act 13 of 2009) and Civil Aviation Regulations (CAR) of 1997;
- Civil Aviation Authority Act (Act 40 of 1998);
- White Paper on Renewable Energy (2003);
- Integrated Resource Plan for South Africa (2010);
- Conservation of Agricultural Resources Act (Act No. 43 of 1983);
- Astronomy Geographic Advantage (Act 21 of 2007);
- Land Use Planning Ordinance (Ordinance 15 of 1985); and
- National Road Traffic Act (Act No. 93 of 1996);
- Draft Birds and Solar Energy Best Practice Guidelines, BirdLife South Africa, November 2015.

4.2 International Conventions and Agreements

Relevant environmental and social international conventions and agreements to which South Africa is a party are presented in Table 4-1.

Table 4-1: Relevant international conventions to which South Africa is a party

Convention	Summary of objectives or relevant conditions	South African Status
Convention on Biological Diversity (29 December 1993)	Develop strategies, plans or programs for conservation and sustainable use of biological diversity or adapt for this purpose existing strategies, plans or programs which shall reflect, inter alia, the measures set out in this Convention.	Party to.
Convention on Wetlands of International Importance (Ramsar) (21 December 1975)	To stem the progressive encroachment and loss of wetlands now and in the future.	Party to.
United Nations Framework Convention on Climate Change - Kyoto Protocol (23 February 2005)	To further reduce greenhouse gas emissions by enhancing the national programs of developed countries aimed at this goal and by establishing percentage reduction targets for the developed countries and through the clean development mechanism (CDM) (where developed countries can invest in developing country clean technology to offset emissions).	Party to.

Convention	Summary of objectives or relevant conditions	South African Status
Montreal Protocol on Substances That Deplete the Ozone Layer (1 January 1989)	Calculated levels of consumption and production of CFCs must not exceed the stipulated thresholds.	Party to.
United Nations Convention to Combat Desertification (26 December 1996)	To combat desertification and mitigate the effects of drought through national action programs.	Party to.
United Nations Framework Convention on Climate Change (21 March 1994)	Protection of the climate system: Operations must protect the climate system by controlling greenhouse gases not controlled by the Montreal Protocol, which cause climate change through anthropogenic interference with the climate system.	Party to.
* Sources: United States Central Intelligence Agency World Fact book (www.cia.gov/library/publications/the-world-factbook/index.html)		
Stockholm Convention on Persistent Organic Pollutants (POPs) (17 May 2004)	This convention seeks to ban the production and use of persistent organic chemicals but allow the use of some of these banned substances, such as DDT, for vector control.	Party to.
The Fourth ACP-EEC Convention 15 December 1989 (Lome)	Control of hazardous and radioactive waste: the operation must be aware that international law emphasizes strict control of hazardous waste and compliance with domestic legislation in this regard. It also seeks to prohibit imports and exports of such substances.	Party to.
Convention concerning the Protection of the World Cultural and Natural Heritage 1972 (Paris)	Ensuring the identification, protection, conservation, presentation and transmission to future generations of the cultural and natural heritage	Ratification.
Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (24 February 2004)	Promote shared responsibility and cooperative efforts among Parties in the international trade of certain hazardous chemicals in order to protect human health and the environment from potential harm	Party to.

4.3 International Standards

4.3.1 International Finance Corporation Performance Standards

ACWA Power is committed to complying with the International Finance Corporation (IFC) Performance Standards (PS) on social and environmental sustainability. These were developed by the IFC and were last updated on 1st January 2012. The overall objectives of the IFC PS are:

- To fight poverty;
- To do no harm to people or the environment;
- To fight climate change by promoting low carbon development;
- To respect human rights;
- To promote gender equity;
- To provide information prior to project development, free of charge and free of external manipulation;
- To collaborate with the project developer to achieve the PS;
- To provide advisory services; and
- To notify countries of any Trans-boundary impacts as a result of a Project.

The PS comprise of eight performance standards namely:

- Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts;
- Performance Standard 2: Labour and Working Conditions;
- Performance Standard 3: Resource Efficiency and Pollution Prevention;
- Performance Standard 4: Community Health, Safety and Security;
- Performance Standard 5: Land Acquisition and Involuntary Resettlement;
- Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- Performance Standard 7: Indigenous Peoples; and
- Performance Standard 8: Cultural Heritage.

The PS framework is presented in Figure 4-1. Performance Standard 1 establishes the importance of:

(i) integrated assessment to identify the social and environmental impacts, risks, and opportunities of projects;
(ii) effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them; and
(iii) the management of social and environmental performance throughout the life of a project through an effective Environmental and Social Management System (ESMS).

PS 1 is the overarching standard to which all the other standards relate. The ESMS should be designed to incorporate the aspects of PS 2 to 8 as applicable.

Performance Standards 2 through 8 establish specific requirements to avoid, reduce, mitigate or compensate for impacts on people and the environment, and to improve conditions where appropriate. While all relevant social and environmental risks and potential impacts should be considered as part of the assessment, Performance Standards 2 through 8 describe potential social and environmental impacts that require particular attention in emerging markets. Where social or environmental impacts are anticipated, the developer is

required to manage them through its Social and Environmental Management System consistent with Performance Standard 1.

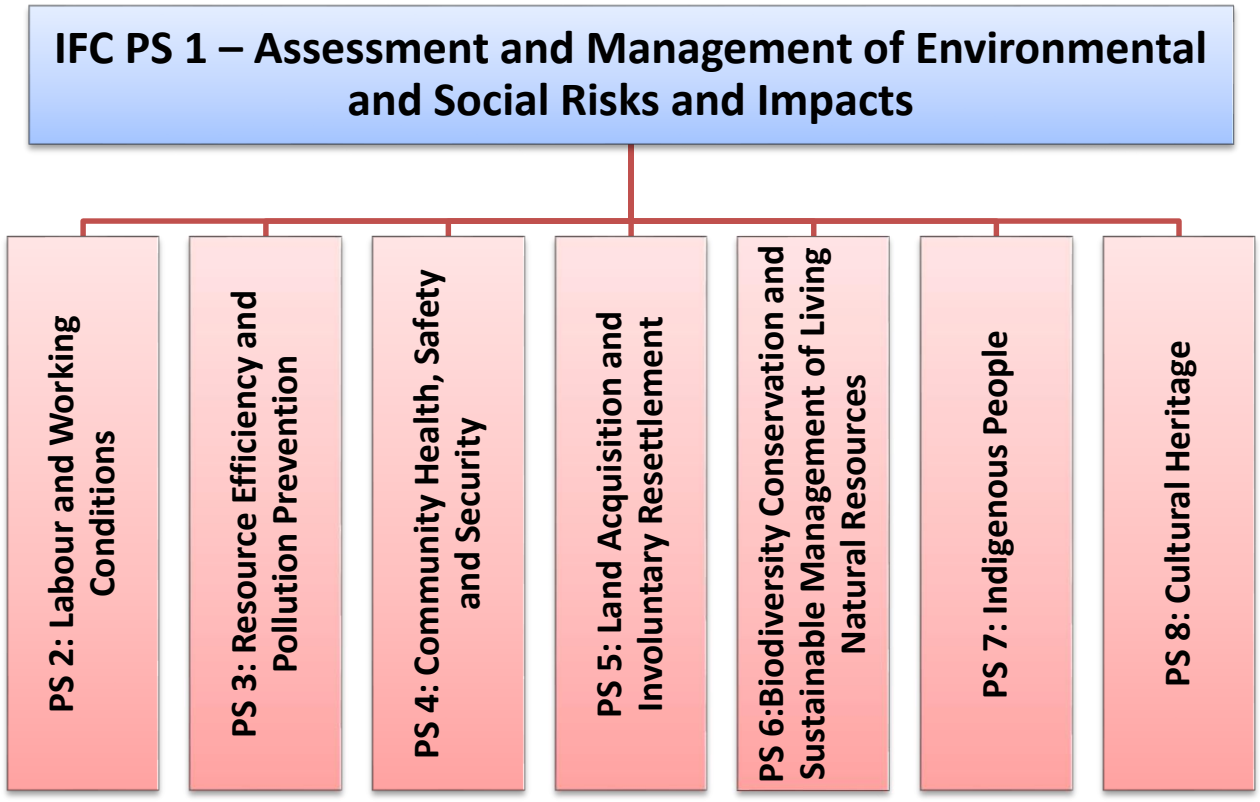


Figure 4-1: The IFC PS Framework

4.3.2 Equator Principles

The Equator Principles (EPs) is a credit risk management framework for determining, assessing and managing environmental and social risk in Project Finance transactions. Project Finance is often used to fund the development and construction of major infrastructure and industrial projects.

The EPs are adopted by financial institutions and are applied where total project capital costs exceed US$10 million. The EPs are primarily intended to provide a minimum standard for due diligence to support responsible risk decision-making.

The EPs are based on the IFC PS 2012 and on the World Bank Group Environmental, Health and Safety Guidelines (EHS Guidelines).

The Equator Principles Financial Institutions (EPFIs) have consequently adopted these Principles in order to ensure that the projects they finance are developed in a manner that is socially responsible and reflect sound environmental management practices.

EPFIs will only provide loans to projects that conform to the following principles:

- Principle 1: Review and Categorisation;
- Principle 2: Social and Environmental Assessment;

- Principle 3: Applicable Social and Environmental Standards;
- Principle 4: Action plan and Management;
- Principle 5: Consultation and Disclosure;
- Principle 6: Grievance Mechanism;
- Principle 7: Independent review;
- Principle 8: Covenants;
- Principle 9: Independent Monitoring and Reporting; and
- Principle 10: EPFI Reporting.

4.3.3 The World Bank Group Environmental Health and Safety (EHS) Guidelines

The EHS Guidelines (World Bank Group, 2007) are technical reference documents with general and industry specific (i.e. mining) examples of Good International Industry Practice (GIIP). Reference to the EHS guidelines is required under IFC PS 3.

The EHS Guidelines contain the performance levels and measures normally acceptable to the IFC and are generally considered to be achievable in new facilities at reasonable cost. When host country regulations differ from the levels and measures presented in the EHS Guidelines, Projects are expected to achieve whichever standard is more stringent.

5.0 PROJECT MOTIVATION: NEED AND DESIRABILITY

5.1 Need for and Desirability of Renewable Energy Facilities on a National Level

The recent power cuts or load shedding by Eskom have emphasised the need for additional power generation capacity in South Africa. There is a focus on moving towards increased generation from renewable energy sources. The Department of Energy's Renewable Energy Independent Power Producer Procurement (REIPPP) Programme is designed to stimulate more independent power producers to meet the country's ever growing electricity demand. The Integrated Resource Plan for Electricity 2010-30 being implemented by the Department of Energy, highlights the electricity demand forecasts and Government's plan to meet this demand through a variety of approaches and technologies, one of which is to implement more renewable energy projects.

The need for solar power technology developments in South Africa has been increasing over the recent years, as it is a means of providing the country with an alternate energy supply, the need for which is directly proportional to the increase in social and economic growth and development within the country. South African citizens are also growing more aware of global issues such as climate change and sustainable development, which also tie into using more "environmentally friendly" methods with which to meet the country's energy requirements.

In the past, most of South Africa's energy demands were met using fossil fuels, mainly coal. South Africa does, however, have the means with which to generate electricity via renewable energy resources, such as solar, wind, hydro, tidal, wave, geothermal, and others. While energy generation via renewable resources is still in the early stages of development in South Africa, photovoltaic technology has been investigated and identified as a potentially viable means of power generation countrywide.

The National Energy Regulator of South Africa (NERSA) has proposed the Renewable Energy Feed-in Tariff or REFIT programme as a means of increasing the deployment of renewable energy in the country, and contributing towards the sustained growth of the sector both in the country and internationally. FIT, or Feed-in Tariffs, are where guaranteed prices for electricity supply are implemented, as opposed to conventional consumer tariffs. The reason for this implementation is that the capital cost associated with the construction and development of renewable energy generating facilities is much greater than the equivalent cost associated with the expansion and continued use of the more traditional generation plants based on fossil fuels. Establishing a tariff would cover the cost of the renewable energy generation as well as a "reasonable return", which would encourage the developers to invest in the project.

The use of renewable energy resources contributes towards diversifying the fuel sources used for energy production, improving electricity production efficiency, decreasing the quantity of fossil fuels burned, decreasing greenhouse gas (GHG) emissions and decreasing the amount of other atmospheric pollutant emissions. This all, in turn, contributes to improving the sustainability of South Africa's development.

South Africa experiences some of the highest levels of solar radiation in the world, which also translates to significant solar resource potential for solar water heating applications, solar photovoltaic and solar thermal power generation.

5.1.1 Strategic Integrated Projects (SIPs)

The South African Government adopted a National Infrastructure Plan in 2012 that intends to transform the economic landscape by means of job creation and to strengthen delivery of basic services. The plan considers infrastructure gaps by analysing future population growth, projected economic growth and areas of the country which are not serviced with water, electricity, roads, sanitation and communication. Based on this, eighteen Strategic Integrated Projects (SIPs) have been developed and approved to support economic development and address service delivery in the poorer provinces.

The eighteen SIPs that have been developed integrate more than 150 of the individual infrastructure plans into a coherent package. The SIPs cover social and economic infrastructure across all 9 provinces. The SIPs cover catalytic projects that can fast-track development and growth.

SIP 8 has been developed in support of sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP2010).

South Africa has a high level of renewable energy potential and presently has in place a target of 10 000 GWh of renewable energy. The Minister (DoE) has determined that 3 725 megawatts (MW) is to be generated from renewable energy sources in order to ensure the uninterrupted supply of electricity. The 3 725 MW is broadly in accordance with the capacity allocated to renewable energy generation in IRP 2010 – 2030 (Department of Energy , 2016).

In support of SIP 8, the DoE has commenced with the Renewable Energy Independent Power Producers (REIPPP) Programme. The REIPPP Programme has been designed to contribute towards the target of 3 725 mw and towards socio-economic and environmentally sustainable growth as well as to start and stimulate the renewable industry in South Africa (Department of Energy , 2016). The proposed Bokpoort II PV1 Solar facility will contribute towards SIP 8 by contributing renewable energy to the national grid.

5.1.2 Renewable Energy Development Zones (REDZ)

The Department of Environmental Affairs (DEA), in discussion with the DoE, has been mandated to undertake a strategic environmental assessment (SEA) to identify and designate areas with the highest potential for development of renewable energy. The purpose of the SEA is to pre-assess on a once-off basis, reducing the necessity to do this process independently for all proposed renewable energy projects. The CSIR has been appointed to manage the SEA for wind and solar PV (Rycroft, 2015).

The areas chosen are known as renewable energy development zones (REDZ). REDZ are gazetted geographical areas:

- In which clusters (several projects) of wind and PV solar development will have the lowest negative impact on the environment while yielding the highest possible social and economic benefit to the country;
- That are widely agreed to have strategic importance for wind and PV solar development;
- Where the environmental and other authorisation processes have been aligned and streamlined based on scoping level pre-assessment and clear development requirements;
- Where pro-active and socialised investment can be made to provide time efficient infrastructure access (Rycroft, 2015).

Figure 5-1 illustrates the proposed REDZs. The proposed PV 1 solar facility is located within the REDZ identified for the Northern Cape Province. The CSIR is currently finalising the SEA.

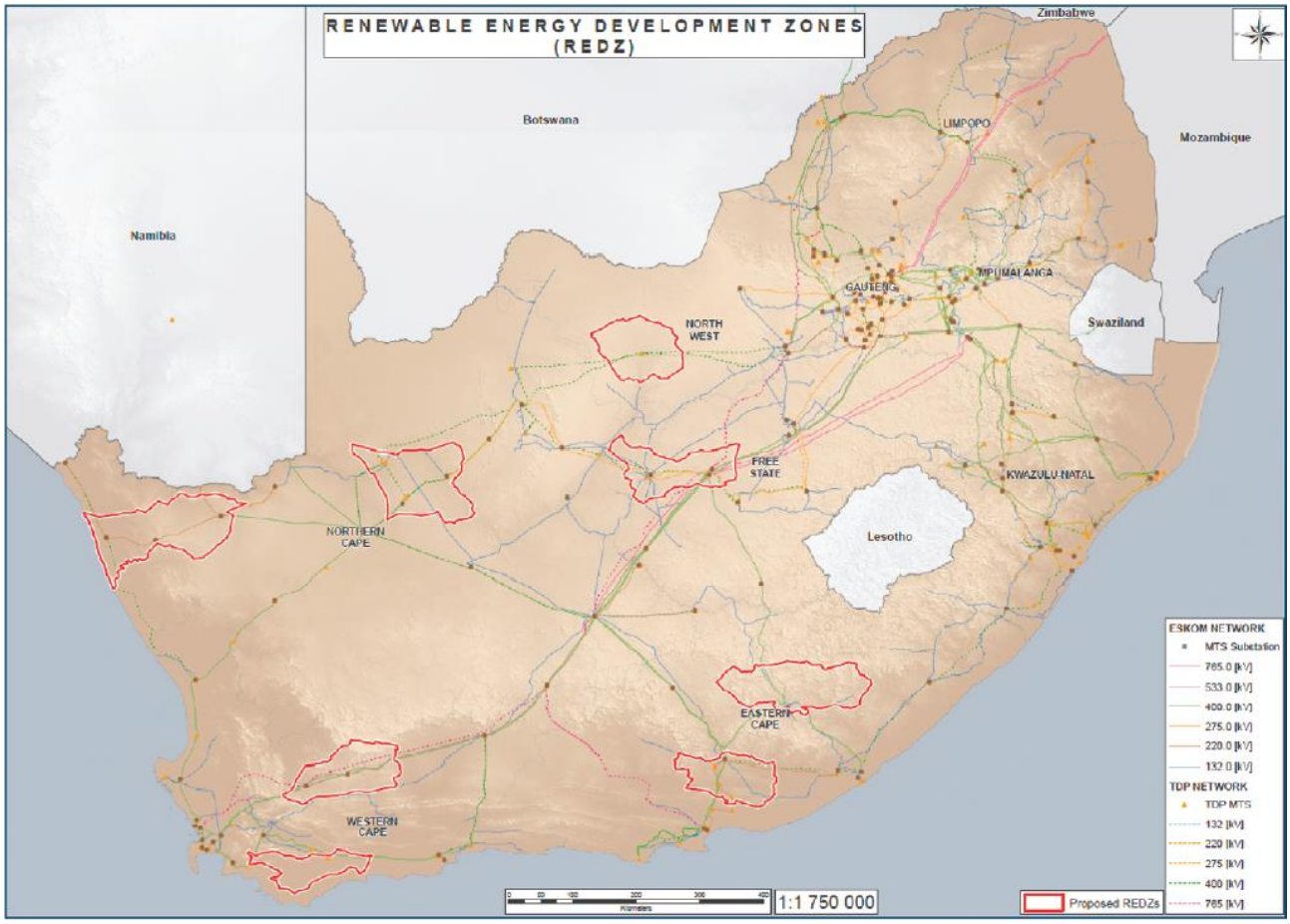


Figure 5-1: Proposed Renewable Energy Development Zones for South Africa (Wind and PV solar) (Rycroft, 2015)

5.2 Need and Desirability for Solar Development on a Provincial Level

In 2009 the Department of Energy and Central Energy Fund commissioned a pre-feasibility study[3] by the Clinton Climate Initiative to assess the potential for developing one or more Solar Parks in South Africa. The pre-feasibility study approved by Cabinet concluded that solar power can be deployed in South Africa in large

[3] Central Energy Fund Solar Park Brochure.

quantities over the next decade at costs that become competitive with coal-fired power, providing the country with clean and secure energy to help meet its growing demand. Furthermore, the study indicated that the Northern Cape has excellent and consistent sun; flat and sparsely-populated land; the ability to connect to the electricity grid at multiple points; water availability from the Orange River; a developed highway system and the Upington Airport.

The Northern Cape's potential as a solar resource was assessed[4] and it showed that the province is one of the best places in the world to harness solar radiation. The high Direct Normal Irradiation for the proposed project area is illustrated in Figure 5-2 where the blue diamond indicates the proposed PV1 project area.

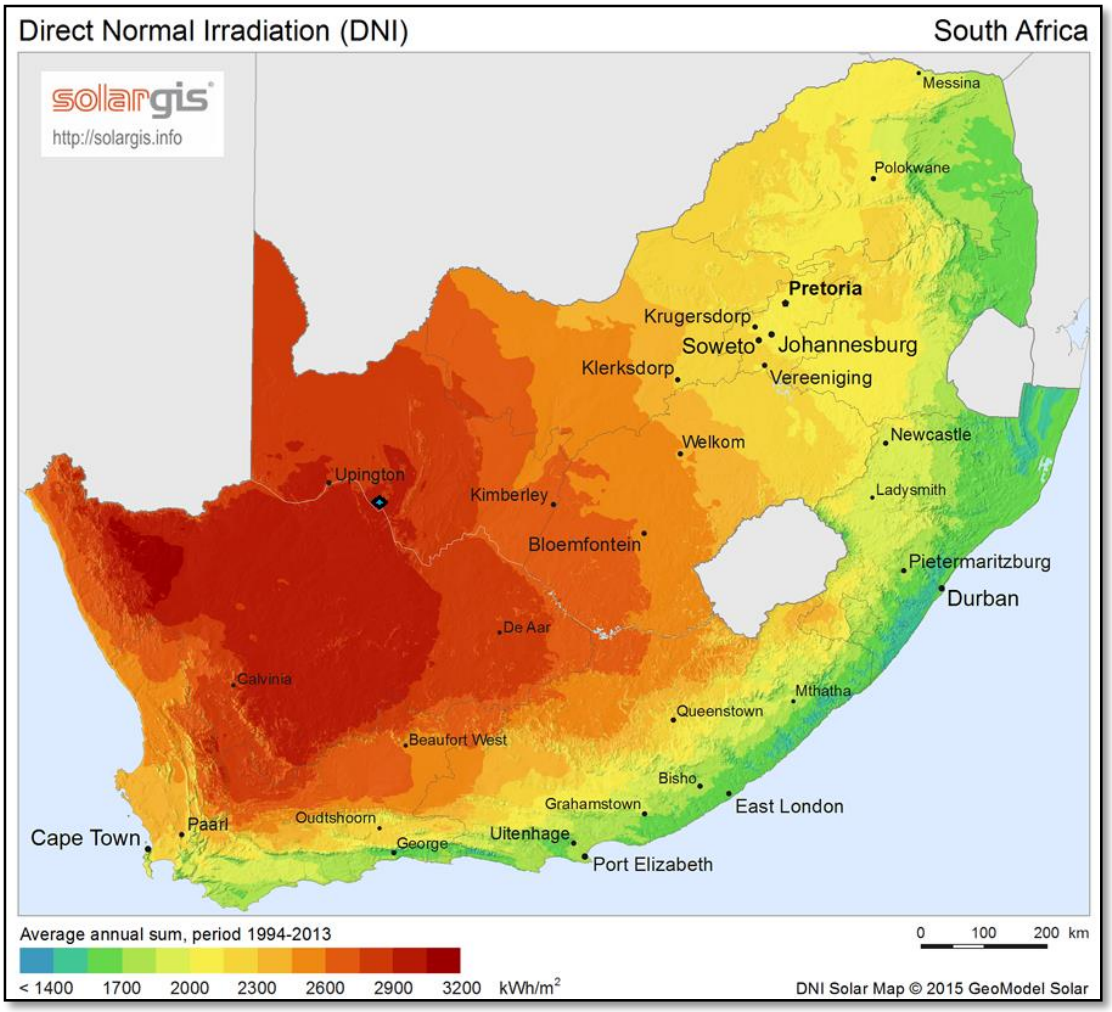


Figure 5-2: Direct Normal Irradiation (DNI) solar resource for South Africa (source: www.solargis.info).

Recognising the suitability of the province to optimise the use of solar power, the Northern Cape Provincial Spatial Development Framework (PSDF) has set the following energy objectives for the province:

- to promote the development of renewable energy supply schemes;

[4] Assessment of Solar Resource. Upington Solar Park. 2011. GeoModel Solar. Reference Number 58-01/2011

- to reinforce the existing transmission network and to ensure a reliable electricity supply in the Northern Cape;
- to develop and institute innovative new energy technologies to improve access to reliable, sustainable and affordable energy services with the objective to realise sustainable economic growth and development; and
- to develop and institute energy supply schemes with the aim to contribute to the achievement of the targets set by IRP 2010 – 20130 (Northern Cape Province , 2012).

The Energy Policy stipulated in the PSDF states that renewable energy sources such as wind, solar thermal, biomass and domestic hydro-electricity are to constitute 25% of the province's energy generation capacity by 2020.

The proposed 75 MW PV1 solar development will contribute to achieving the objectives and policies regarding renewable energy as set out in the PSDF.

5.3 Need and Desirability for Solar Development on District Municipal Level

The ZF Mcgawu District Municipality recognises the need for sustainable development in the district by promoting economic and social development through the sustainable management and utilisation of natural resources and the maintenance of the productive value of the physical environment (ZF MGCAWU District Municipality, 2014).

The ZF Mcgawu District Municipality has adopted the Northern Cape's vision to *"Build a prosperous sustainable, growing provincial economy to reduce poverty and improve social development"*. The ZF Mcgawu District Municipality recognises the contribution that solar power developments will make to economic development within the region.

The proposed 75 MW PV1 solar development will contribute towards achieving the development vision as set out in the ZF Mcgawu Integrated Development Plan for 2012 – 2017 (ZF MGCAWU District Municipality, 2014).

5.4 Need and Desirability for Solar Development on Local Municipal Level

The Integrated Development Plan of the !Kheis Municipality acknowledges the local climatic conditions and the huge potential to use solar energy more widely within the local area. The IDP further states that solar energy can be utilised to provide electricity to areas not currently within the Eskom distribution network. A number of households within the local municipality currently do not have electricity.

The proposed 75 MW PV1 solar facility will contribute towards providing renewable energy to the local Garona Substation situated within the !Kheis Local Municipality.

The proposed PV1 solar facility will create 10 employment opportunities for local residents during the operational phase.

5.5 Need and Desirability for Solar Development on the Remaining Extent of Bokpoort 390

The location of the property Bokpoort 390, on which the proposed development option is under consideration, is good in terms of electricity infrastructure connection (adjacent to the existing Eskom substation, grid connection and transmission infrastructure), road access (N8) and water supply (Orange River). The property has already been developed for solar power (Bokpoort I 75 MW CSP parabolic trough).

Furthermore, during the EIA for the parabolic trough development at the site, the baseline studies were conducted over the entire property, not just the portion where the phase 1 development would take place

(*Phase 1 EIA for a Proposed 75 MW Concentrating Solar Thermal Power Plant and Associated Infrastructure; DEAT 12/12/20/1920*).

The location of the Bokpoort II proposed solar developments falls within an area included in the baseline studies for the Bokpoort I EIA. The Bokpoort I EIA's sensitivity maps (Figure 6-1, Figure 6-2 and Figure 6-3 indicate that the area proposed for the Bokpoort II solar development can be regarded as an area that is preferred and acceptable for surface development. This sensitivity screening was carried out taking into account characteristics of the immediate project footprint based on baseline data gathered during the initial EIA.

If implemented, the proposed Bokpoort II PV1 solar power development would feed an additional 75 MW into the Eskom grid. The development will generate electricity from a renewable energy resource which has nearly zero carbon dioxide emissions, unlike coal fired power plants, South Africa's main electricity resource. A detailed activity motivation is provided in Table 5-1, which further emphasises the need for and desirability of the project.

5.6 Detailed Activity Motivation

Table 5-1: Detailed Activity Motivation considerations[5]

DEA Questions on activity motivation	**Answer**
Explanation	
1) Is the activity permitted in terms of the property's existing land use rights?	**Yes**
ACWA Power SolAfrica is the land owner of the Remaining Extent of the Farm Bokpoort 390 and has land use rights. Additionally ACWA Power SolAfrica has land use rights to use a 50m water pipeline servitude located on Sand Draai 391 Portion 0 and 5.	
2) Will the activity be in line with the following?	
(a) Provincial Spatial Development Framework (PSDF)	**Yes**
The proposed activity is in line with the Northern Cape PSDF (2012) Energy Policy which states that *"renewable energy sources (e.g. wind, solar thermal, biomass, and domestic hydroelectricity generation) are to comprise 25% of the province's energy generation capacity by 2020"* and the PSDF Objectives which include *"to promote the development of renewable energy supply schemes. Large-scale renewable energy supply schemes are strategically important for increasing the diversity of domestic energy supplies and avoiding energy imports while minimizing detrimental environmental impacts"*.	
(b) Urban edge / Edge of Built environment for the area	**Yes**
The proposed development site is located in a remote, rural area and so it will neither contribute to, nor compromise urban growth.	
(c) Integrated Development Plan (IDP) and Spatial Development Framework (SDF) of the Local Municipality (e.g. would the approval of this application compromise the integrity of the existing approved and credible municipal IDP and SDF?).	**Yes**
The !Kheis Municipality IDP (2014-2015) recognises that the supply of electricity along with high unemployment are some of the key issues that require addressing. The Key Performance Area objective Number 12 is to provide all residents within !Kheis Municipality with basic electricity (Eskom or solar) by June 2015. This requires the provision of electricity networks and to make solar electricity available to areas without networks. As part of the Economic Development Programme, objective Number 6 is to reduce unemployment and poverty by at least 5% by June 2016.	

[5] Basic Assessment form 8 December 2014. Section 10 Activity Motivation. Department of Environment

DEA Questions on activity motivation	Answer
The proposed solar energy facility would contribute to addressing the need for increased electricity supply as well as to create temporary and limited permanent employment in the area.	
(d) Approved Structure Plan of the Municipality	**Yes**
As above, the !Kheis Municipality IDP (2014-2015) lists providing electricity to people in the municipality as a priority. The proposed solar energy facility would contribute to addressing the infrastructural needs for increased electricity supply.	
(e) An Environmental Management Framework (EMF) adopted by the Department (e.g. Would the approval of this application compromise the integrity of the existing environmental management priorities for the area and if so, can it be justified in terms of sustainability considerations?)	**Yes**
The Siyanda (now known as ZF Mgcawu) Environmental Management Framework within the !Kheis Municipality IDP (2014-2015) states that due to the climate of the area there is huge potential to utilise solar energy more widely, especially in the remote areas of the district. The proposed activity is a Solar Plant which is a sustainable and renewable operation that provides an additional economic resource to the area. Such an activity is also in line with International Millennium and Local Municipality goals and will therefore not compromise the integrity of any current development plans.	
(f) Any other Plans (e.g. Guide Plan)	**Yes**
The Integrated Resource Plan for Electricity 2010-2030 promotes the use of renewable energy technologies. The proposed development is in line with this plan.	
3) Is the land use (associated with the activity being applied for) considered within the timeframe intended by the existing approved SDF agreed to by the relevant environmental authority (i.e. is the proposed development in line with the projects and programmes identified as priorities within the credible IDP)?	**Yes**
See above.	
4) Does the community/area need the activity and the associated land use concerned (is it a societal priority)? (This refers to the strategic as well as local level (e.g. development is a national priority, but within a specific local context it could be inappropriate.)	**Yes**
Due to South Africa's electricity generation and supply system being overloaded, the demand for an increased and stable electricity supply is a priority not only in the Northern Cape, but in many other South African provinces. Solar energy plants are important for reducing the country's overall environmental footprint from power generation and for directing a pathway towards sustainability. Thus, the proposed project addresses a national/strategic priority. At a local level, the !Kheis Municipality IDP (2014-2015) identifies inadequate electrical supply as a key shortfall of the municipality, identifying the need for additional electrical infrastructure. The proposed development will make available approximately 75 MW of installed capacity with associated distribution infrastructure.	
5) Are the necessary services with adequate capacity currently available (at the time of application), or must additional capacity be created to cater for the development? (Confirmation by the relevant Municipality in this regard will be attached to the final EIA	**Yes**
There are no municipal services at the site. The proposed project includes the construction of a new water supply pipeline, access roads, a power line from the PV installation to Eskom's Garona substation and installation of a package plan (sewage treatment). Domestic and office waste will be removed by a contractor.	

DEA Questions on activity motivation	Answer
6) Is this development provided for in the infrastructure planning of the municipality, and if not what will the implication be on the infrastructure planning of the municipality (priority and placement of services and opportunity costs)? (Comment by the relevant Municipality in this regard will be attached to the final EIA)	**Currently unknown**

The infrastructure required for the proposed development is to be provided and maintained by the proponent, and it will not conflict with municipal infrastructure planning or priorities. In addition, the proposed development is to be constructed on overgrazed agricultural land outside of an urban area, with little or no existing or planned infrastructure.

7) Is this project part of a national programme to address an issue of national concern or importance?	**Yes**

The National Development Plan states the following as a priority objective:

"Procuring at least 20 000MW of renewable electricity by 2030, importing electricity from the region, decommissioning 11 000MW of ageing coal-fired power stations and stepping up investments in energy-efficiency"

8) Do location factors favour this land use (associated with the activity applied for) at this place? (This relates to the contextualisation of the proposed land use on this site within its broader context.)	**Yes**

The Northern Cape has been recognised as having the highest solar resource in the country and so is ideally suited to solar power generation. Further this is in keeping with the Bokpoort I CSP parabolic trough recently constructed close to the proposed site. The proposed site is well located in terms of proximity to Eskom's Garona Substation, road access (Transnet road) and access to water (Orange River).

9) Is the development the best practicable environmental option for this land/site?	**Possibly**

The proposed project site was assessed at baseline level during the Scoping Phase of the EIA process and more thoroughly during the Impact Assessment Phase. With reference to the sensitivity map shown in Figure 9-5, only the water abstraction point in the Orange River will be located within an environmentally sensitive area. The rest of the proposed PV solar installation will not impact on any sensitive areas. However, there are socio-economic considerations related to surrounding land uses that warrant careful consideration. These are discussed further under question 12 below. The property is already partly under development for renewable power generation. The current development (Bokpoort I) comprises a CSP parabolic trough generating 75 MW of electricity. The property is well located in terms of connection to power infrastructure and water availability. Consequently, it is well-positioned for further renewable power generation provided such renewable power generation is of a type that does not create avoidable conflict with surrounding commercial enterprises.

10) Will the benefits of the proposed land use/development outweigh the negative impacts of it?	**Yes**

The proposed activity will supply renewable energy to Eskom, and will consequently increase the amount of electricity available to users. The site is well positioned for production of renewable energy given its proximity to a key grid substation and Eskom transmission lines together with access to water (Orange River). The site is already partly developed for renewable power production. These are positive factors in motivation of extending renewable energy production at the site.

Technology selection will be key, given the surrounding land use which favours a combination of extensive agricultural production and high-end tourism in the form of an exclusive international wilderness-based

DEA Questions on activity motivation	Answer
hunting destination on the northern boundary of the property. Depending on the technology selected, this operation may be materially affected.	
11) Will the proposed land use/development set a precedent for similar activities in the area (local municipality)?	**No**
The existing Bokpoort I project has already set a precedent and the extension of renewable energy production at the site will be in keeping with the prior development of the site as a node for renewable energy production.	
12) Will any person's rights be negatively affected by the proposed activity/ies?	**Possibly**
While the proposed development is located on privately owned land, technology selection will be of particular importance given the surrounding land uses. Due to their low vertical height, photovoltaic based solar power generation will have a low to moderate visual impact on neighbouring properties which include the Kalahari Oryx game farm to the immediate north of the site is a well-established commercial operation that markets high-end exclusive hunting packages to an international clientele.	
13) Will the proposed activity/ies compromise the "urban edge" as defined by the local municipality?	**No**
An urban edge is essentially the border between a city or a suburb and its surrounding environment. It is often used by city planners as a strategy to counter urban sprawl, encourage densification and protect natural resources, by setting a boundary beyond which no urban development is permitted, The proposed development site is located a short distance outside the rural town of Groblershoop and approximately 110 km by road from Upington. Infrastructure within these towns is under pressure from a variety of solar development projects which are currently under construction in the local areas. The introduction of a large construction workforce, as is typical of this type of development, will place further strain on the municipal infrastructure, but the relatively small workforce associated with the operation of the proposed PV solar project is unlikely to require an expansion of the urban edge of any town.	
14) Will the proposed activity/ies contribute to any of the 17 Strategic Integrated Projects (SIPS)?	**Possibly**
Strategic Integrated Projects (SIPS) relate to social and economic infrastructure across all nine provinces and include catalytic projects that can fast-track development and growth. This project has not yet been registered as a Strategic Infrastructure Project, however the proposed activity does have elements which are relevant to SIPS, namely: ■ Green economy + "Green" and energy-saving industries; and ■ Infrastructure – electricity (generation, transmission & distribution). The proponent may choose to register the proposed development as a SIPS project once awarded the preferred bidder status.	
15) What will the benefits be to society in general and to the local communities?	
Society: The operations will contribute electricity to the National Grid, thereby improving Eskom's ability to meet the growing demands of the country. Additional power on the National Grid will in turn mean a lesser likelihood of power shortages and an increased amount of power for the nation's industrial sector to operate more efficiently, which is of critical importance to the national economy. The solar plant also fits into the country's national goals to reduce greenhouse gas emissions and impacts on climate change, which on an international and global scale is aligned with the United Nations Framework Convention on Climate Change (1992), the Kyoto Protocol (1997), the Johannesburg Declaration (2002), the Copenhagen Accord (2009) and the Durban Summit in 2011.	

DEA Questions on activity motivation	Answer
Communities: The Project will have a positive socio-economic impact with an increase in job opportunities and indirect economic spin offs. Among those employed for the project, skills will be developed through training thus bringing about empowerment for both permanent and temporary employees. The jobs generated would benefit households by uplifting their socio-economic standards through an increase in income. Secondary jobs and income will also be created in terms of repair and supply of the solar panels. The circulation of additional money within the micro-economy will also benefit those who are not directly affiliated with the solar project. As people will receive an increased income they will have more money to spend on amenities for both themselves and their families, thus uplifting the local and national economy via the energy saved and jobs created from this initiative.	
16) Any other need and desirability considerations related to the proposed activity?	**Yes**
A reduced carbon footprint per Mwh of power generated will benefit society at large.	

6.0 PROCESS FOLLOWED TO REACH THE PROPOSED PREFERRED ACTIVITY, SITE AND LOCATION WITHIN THE SITE

6.1 Activity Selection

The project site is currently used for grazing. The applicant did not consider any other activity alternatives for the site because the site is considered as highly suitable for the establishment of solar facility due to proximity of the Garona Substation and newly constructed Bokpoort I CSP Trough facility. Except for agricultural activities, it is unlikely that any other activity could be feasibly implemented at the site. The establishment of a photovoltaic solar facility is the only feasible activity considered for the proposed site during the EIA process.

6.2 Selection of the site

Only one project site, for the construction of the proposed PV facility, has been identified and considred by the applicant for consideration during the EIA process. This decision is based on site selection and sensitivity assessment conducted by ACWA Power for the already constructed 75 MW CSP Trough facility already developed on the site.

The Remaining Extent of the Farm Bokpoort 390 was selected for the Bokpoort II project, of which the current 75 MW PV1 solar development forms part, based on the following considerations:

- Site Extent

  The proposed PV1 solar facility will require 250 ha for the construction of the solar panels and associated infrastructure. The proposed site, which is approximately 1500 ha in extent will therefore be sufficient for the construction of the proposed facility. Refer to Section 1.0, Table 1-1 and Figure 2-2 for an understanding of the parallel environmental authorisation applications applicable to the project site. Sufficient extent is available for the construction of all three applications.

- Site Availability

  ACWA Power acquired the project site during the development of the Bokpoort I CSP Trough facility. The site is therefore available for development.

- Site Access

  The project site is most easily accessed from the N8 via the Gariep Road and then via the Transnet service road (Figure 8-22). Alternatively, the site can be accessed from the N14 via the Gariep Road / Loop16 and Transnet service road.

- Grid connection

  The project site is located in close proximity to the Garona Substation, which is located directly adjacent to the Bokpoort I CSP Trough facility (Figure 2-4).

  A new 132kV overhead power line will connect the PV1 facility to the national grid via the substation.

- Site Gradient

  The slope of the project site is considered to be acceptable for the development of a PV facility Figure 8-11. This reduces the need for any extensive earthworks or levelling activities.

- Availability of water

  The proposed PV facility will require 25 000 m^3/year of water that will be used during the construction of the facility as well as for human consumption and panel washing during the operational phase. The Orange River is located approximately 20 km from the project site. It is proposed that water will be abstracted and transferred to the facility via an underground pipeline. There is an established water pipeline servitude currently being utilised by the Bokpoort I CSP Trough Facility.

- Availability of environmental baseline and sensitivity information

  The project site for the proposed Bokpoort II solar development falls within the area previously assessed in the Phase 1 EIA for the Bokpoort I 75 MW CSP parabolic trough facility. During the EIA process for the already constructed Bokpoort I facility, site zoning sensitivity maps were produced which have added value to the process of site selection and considering placement of infrastructure for the current project. The Bokpoort I EIA's sensitivity zoning map indicates that the project footprint for the Bokpoort II solar development does not contain features on the site footprint itself which would limit disturbance of and development on the site (see Figure 6-1 and Figure 6-2). The site sensitivity and zoning process carried through from the previous EIA is discussed and presented below in Section 6.2.2.

6.2.1 Limitations of consideration in site alternatives and site assessment

The applicant only considered one site alternative for investigation during the EIA process based exclusively on the economic considerations presented in Section 6.1.

The site selection process did not take into consideration any environmental and social factors such as neighbouring land use practices. The approach to consider technical and economic factors could be sufficient for the placement of infrastructure on a particular footprint but it could be somewhat limited in contextualising the site itself within the surrounding environment and established land uses. Had this screening of established land use been done more robustly it may have identified that there are sizeable and well-established commercial hunting and wilderness tourism enterprise serving an international clientele adjacent to the project site. While there are valid technical and economic factors in favour of the Bokpoort site, communication with the established commercial land uses adjacent to the property revealed that they view the proposed solar development at the site as having an unacceptable visual impact that could affect their business.

6.2.2 Project Site Sensitivity

A qualitative sensitivity mapping exercise was completed in the Bokpoort I EIA on the Remaining Extent of the Farm Bokpoort 390. The objective of the exercise was to determine the environmental opportunities and constraints (feasibility limits) associated with the Bokpoort site, thereby providing an illustrative overview of the developable portions suitable for the proposed CSP project. The Sensitivity Index Map (Figure 6-1) and Zoning Map (Figure 6-2) were developed according to prescribed groupings of environmental sensitivities.

Individual specialist maps were developed for each of the following disciplines: avifauna, biodiversity, surface water, groundwater, social, soils / agricultural potential, heritage, and tourism. Noise and visual specialist inputs were excluded from the sensitivity mapping. The specialists' maps were demarcated into the following categories: "ideal" (least sensitive areas), "acceptable" (areas with medium or average sensitivity) and "unacceptable / not ideal" (i.e. sensitive areas). Subsequently, sensitivity indexing was done by overlaying each of the specialist sensitivity maps. A sensitivity index range of values from lowest suitability to highest suitability is provided in Table 6-1.

The sensitivity index map shows areas which are least sensitive (or developable areas) and areas that should be avoided. The sensitivity index map (Figure 6-1) was further improved to provide a simplified overview of the developable areas of the site by delineating sensitivity zones (Figure 6-2) based on the classification / grouping of the sensitivity indices into the sensitivity categories initially used by the respective specialists.

Table 6-1: Sensitivity index and zone classifications

Score	Description	Map colour
Index classes 1 - 4	Ideal/preferred (Developable)	Dark green to light green
Index classes 5 – 7	Acceptable (Developable)	Light green to light orange
Index classes 8 - 11	Not preferred (sensitive)	Light orange to red

In addition to this Sensitivity Map, Figure 6-3, depicts cultural and heritage sites of importance and sensitive biodiversity areas.

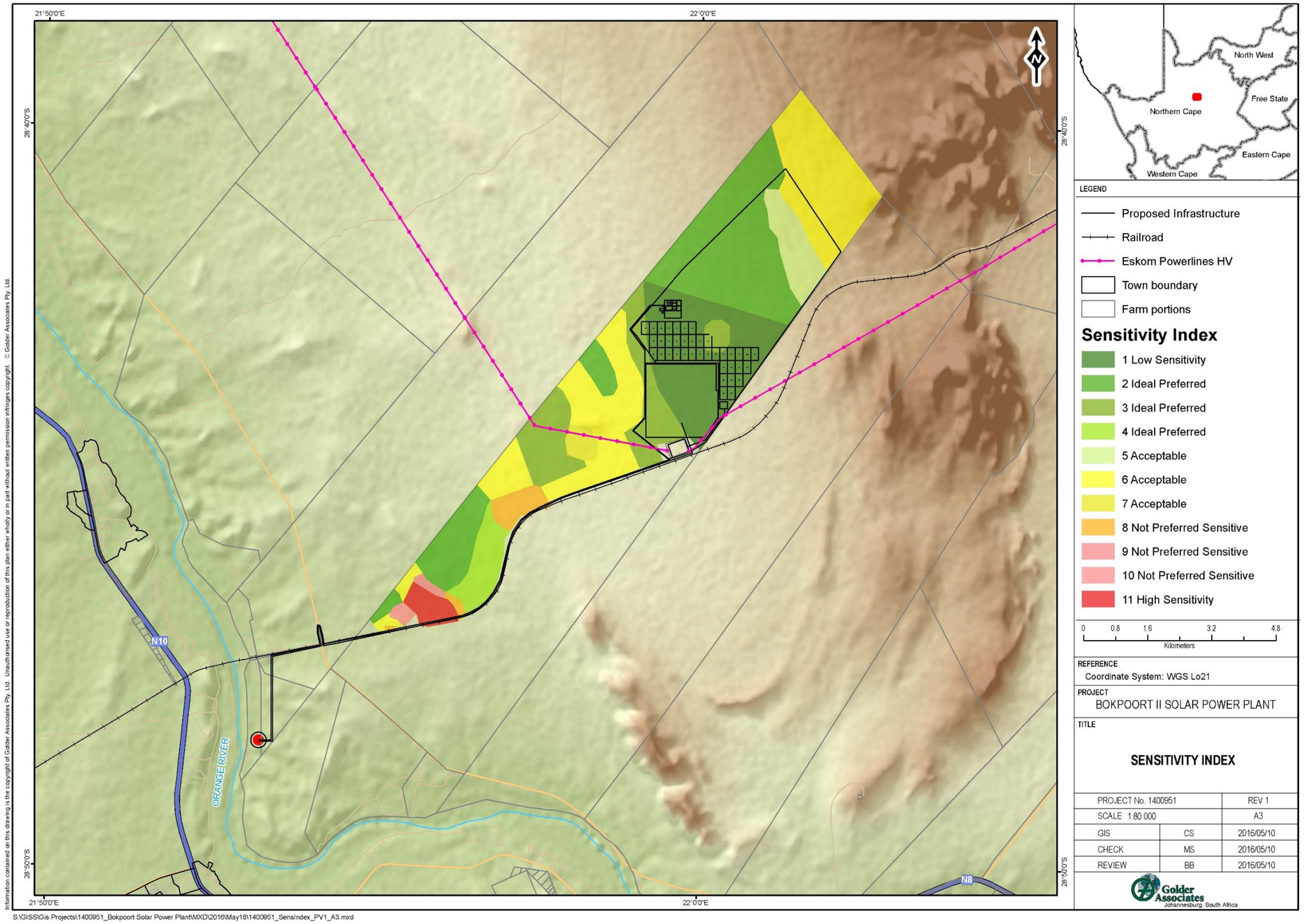


Figure 6-1: Sensitivity index map for Remaining Extent of Bokpoort 390 (Bohlweki 2006)

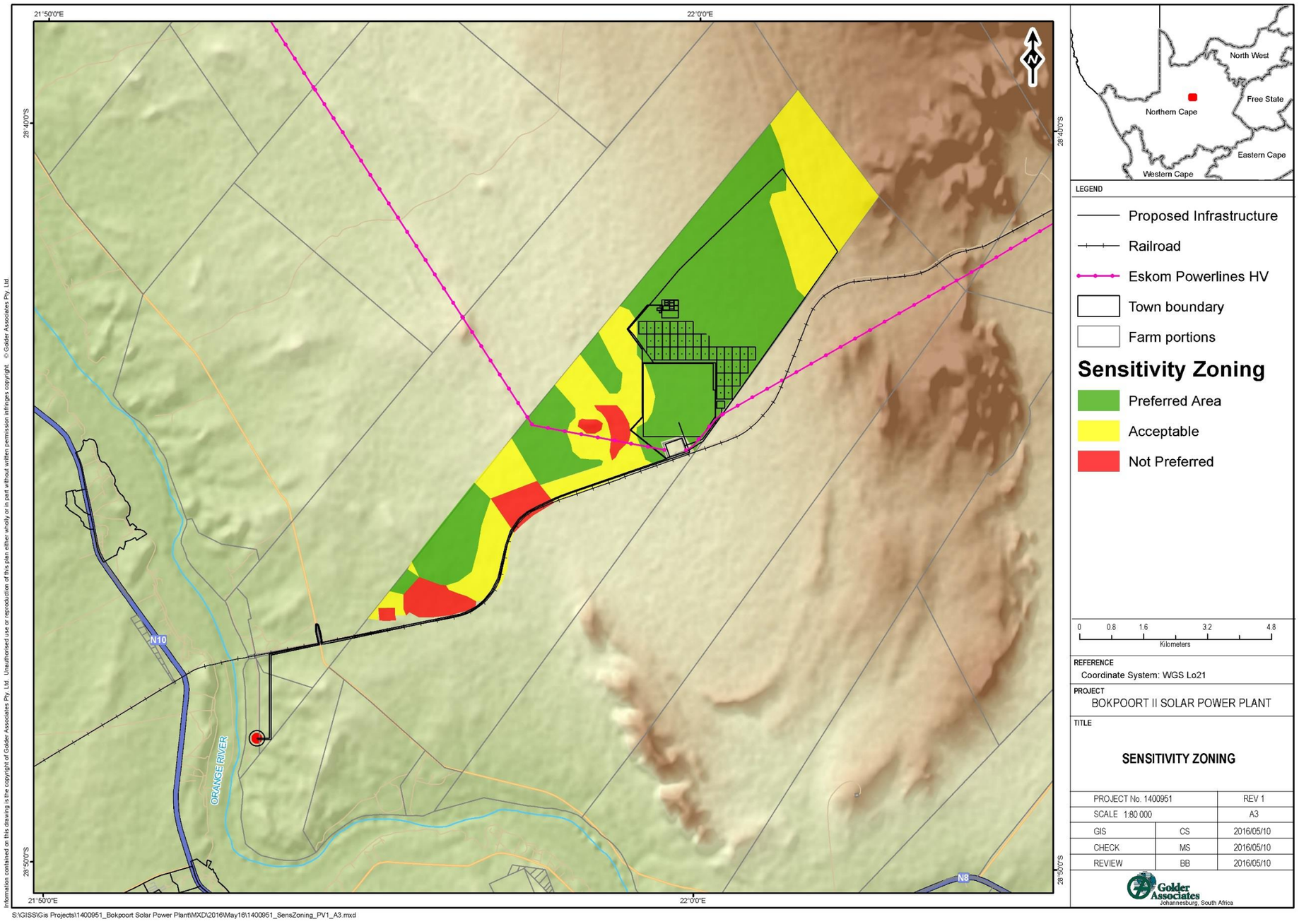


Figure 6-2: Sensitivity zoning map for Remaining Extent of Bokpoort 390 (Bohlweki 2006)

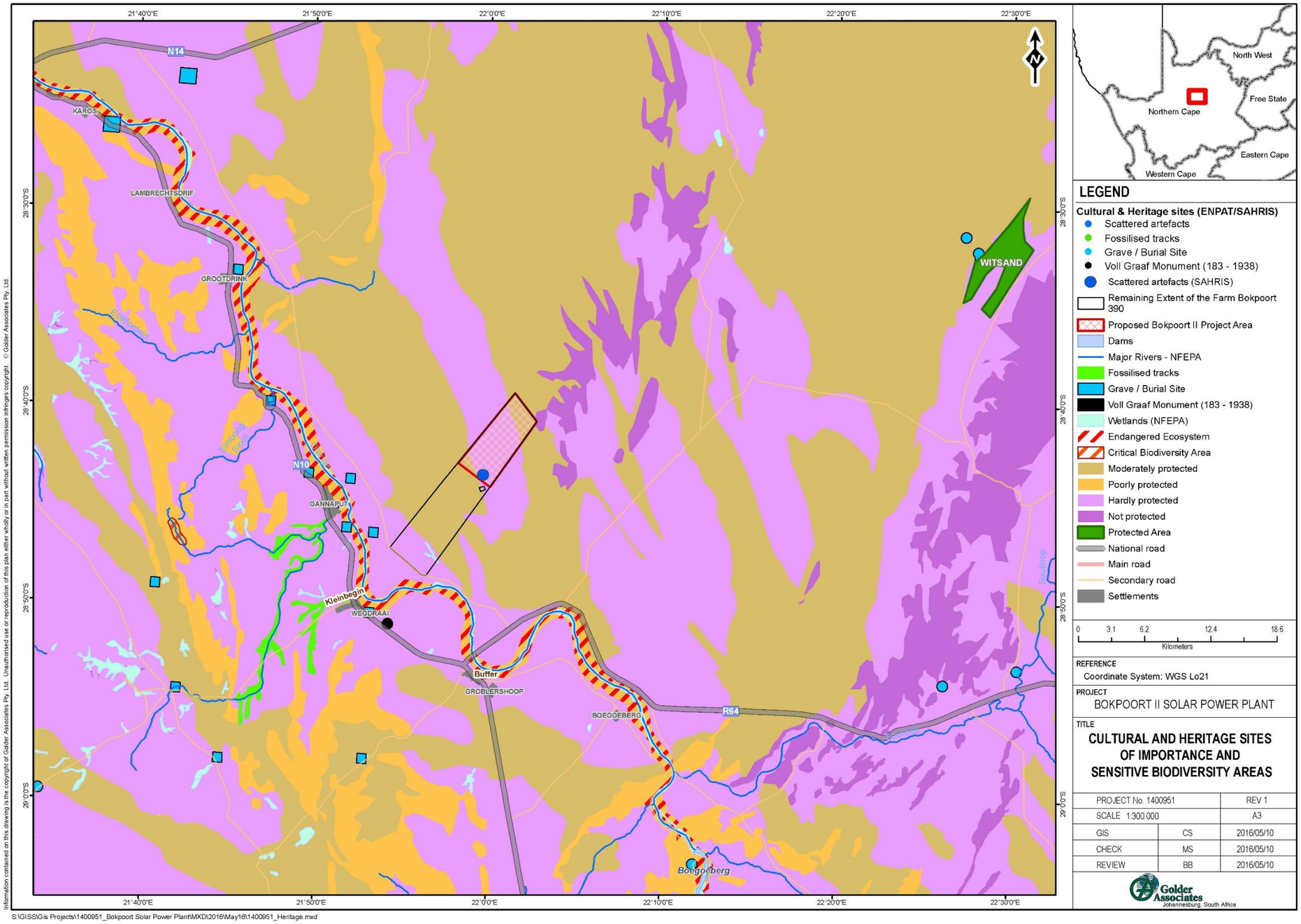


Figure 6-3: Cultural Heritage Sites of Importance and Sensitive Biodiversity Areas

6.3 Technology Alternatives

ACWA Power considered three different technologies for the Bokpoort II Solar Development during technology selection. The technologies include:

6.3.1 Photovoltaic (PV) Solar Technology

Photovoltaic cells are made from semi-conductor materials that are able to release electrons when exposed to solar radiation by using the photo-electric effect. The electrons from many cells are gathered together through conductors to make up the generation capacity of one module and many modules can be connected together to produce power in large quantities (South African Photovoltaic Industry Association , 2015).

PVs have a wide range of applications and are extremely versatile and modular. The same technology can be used as an individual panel for supplementing consumption on a residential home or as a vast collection of panels making up a utility scale power generation facility mega-watts in size (South African Photovoltaic Industry Association , 2015).

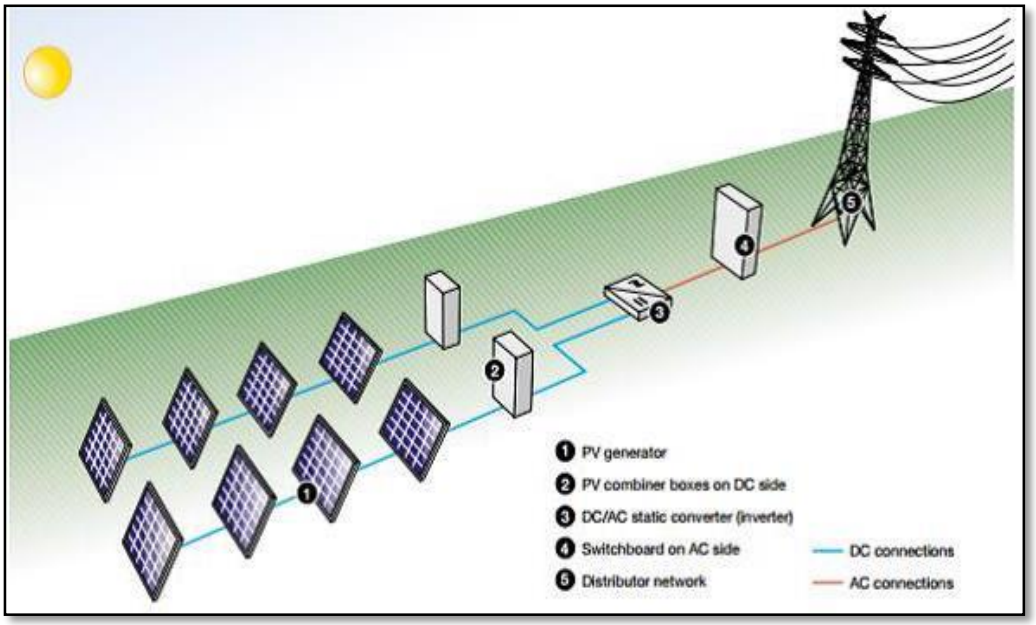


Figure 6-4: A simplistic illustration of a typical PV facility[6]

[6] Sourced from www.solinfra.in

Figure 6-5: The Lesedi PV Project near Kimberley in the Northern Cape[7].

6.3.2 Concentrated Solar Power (CSP)

Concentrating solar power systems make use of the sun's energy by first concentrating solar radiation and then converting it to thermal energy for use in steam generation. The steam drives a standard turbine to generate electricity (Southern Africa Solar Thermal and Electricity Association , 2015). CSP power stations consist of two parts: one that collects solar energy and converts it to heat; and another that converts heat energy to electricity. Most systems use thermal storage during cloudy periods or at night, enabling them to produce electricity when the sun is not shining. Others can also be combined with coal or natural gas power plants or with other steam-based industrial facilities in a hybrid configuration. CSP technology is divided into CSP Tower facilities and CSP Trough facilities.

6.3.2.1 CSP Tower Technology

An array of heliostats (large sun-tracking mirrors) focuses light on a solar receiver located at the top of a tower, approximately 250 metres high. A heat transfer fluid is heated in the receiver and is used to generate steam, which, in turn is used in a conventional turbine generator to produce electricity.

[7] Sourced from http://mybroadband.co.za/news/wp-content/uploads/2015/02/Lesedi-power-plant.jpg

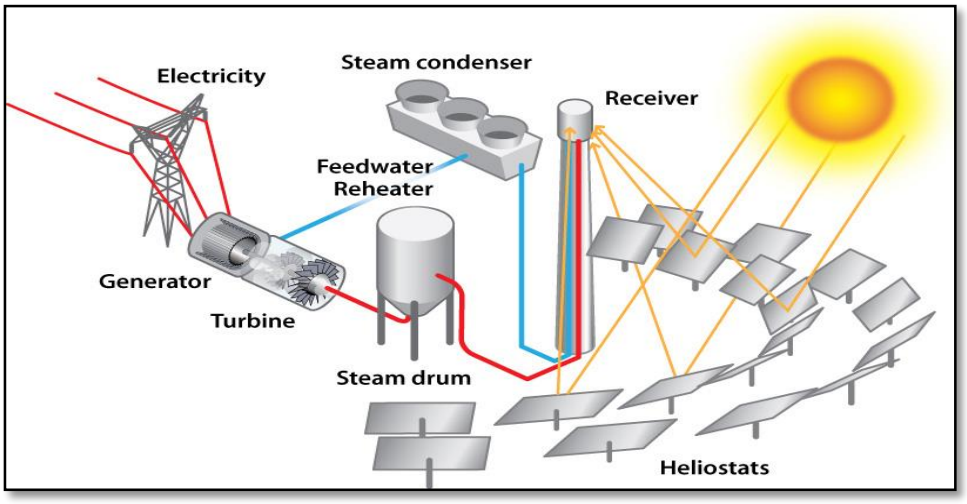


Figure 6-6: A simplistic illustration of a typical CSP Tower facility[8].

Figure 6-7: Khi Solar One 50 MW CSP Tower facility currently under construction by Abengoa Solar near Upington, Northern Cape

[8] Sourced from https://www.eeremultimedia.energy.gov/solar//sites/default/files/graphic_csp_powertower_1996_high.jpg

6.3.2.2 CSP Parabolic Trough Technology

A long parabolic mirror, aligned north-to-south, rotates to track the sun and reflects heat onto a fluid-filled tube that runs along its length. The sun's energy is concentrated by parabolically curved, trough-shaped reflectors onto a receiver pipe running along the inside of the curved surface. This energy heats oil flowing through the pipe and the heat energy is then used to generate electricity in a conventional steam generator.

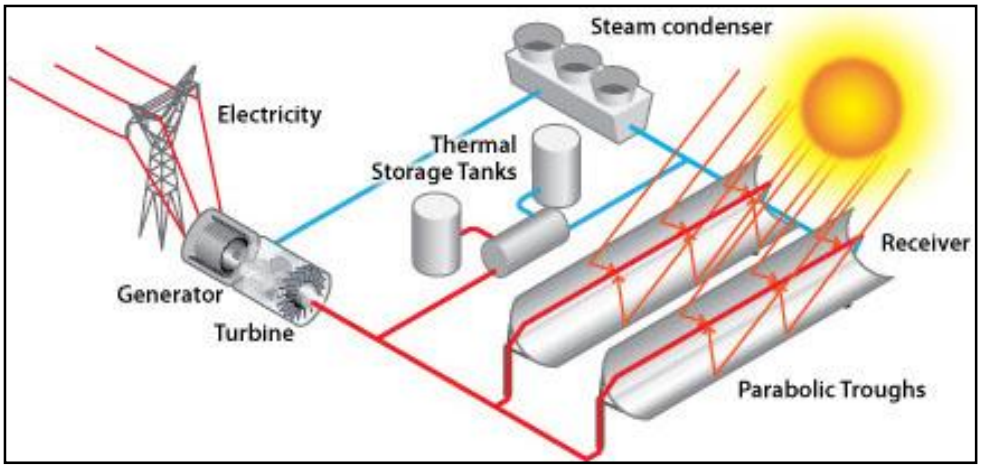


Figure 6-8: A simplistic illustration of a typical CSP Trough facility[9].

Figure 6-9: The Bokpoort I 75 MW CSP Trough Solar Development currently being commissioned near Groblershoop, Northern Cape

[9] Sourced from http://www.ecomena.org/wp-content/uploads/2012/11/parabolic_troughs-CSP.jpg

Figure 6-10: The Bokpoort I 75 MW CSP Trough Solar Development currently being commissioned near Groblershoop, Northern Cape

6.3.3 Technology Selection for the Bokpoort II Solar Development

Originally ACWA Power submitted application forms to the Department of Environmental Affairs (DEA) for three different technologies, by means of six different applications, namely Photovoltaic (PV) solar power technology, Concentrated Solar Power (CSP) Parabolic Trough and CSP Towers. After consultation with the DEA, ACWA Power performed an in depth analysis of the proposed project which resulted in the optimisation of the project development to include only three applications. ACWA Power decided to apply for the development of PV and CSP Tower technologies by means of three different applications. Two of these applications are each for the construction of a 75 MW PV solar plant (PV1 and PV2) and a third application is for a 150 MW CSP Tower (Figure 2-3). ACWA Power has thus decided to exclude CSP Trough as a technology alternative through a technology selection process. This is mainly informed by the current renewable market that has shifted towards the CSP Tower technology.

Table 6-2 summarises the comparison of the three technology alternatives originally considered for the overall Bokpoort II Solar Development in terms of technical, economic and environmental and social considerations. The technologies are ranked based on most favourable (1 – yellow) to least favourable (3 – red). Of importance is to note that although the three technologies are compared against each other, PV cannot technically be compared to CSP Tower and Trough technology. The decision to select PV as preferred and only technology alternative for the current application (PV1) is based on the overall layout and optimisation of the Bokpoort II project and what infrastructure can optimally be placed on the Remaining Extent of the Farm Bokpoort 390 without overlapping occurring between different environmental authorisation applications.

A 75 MW Photovoltaic (PV1) solar facility is proposed and assessed in this draft EIA/EMPr Report. The PV solar facility will consists of a tracking structure based in single horizontal axis. The solar panels convert solar energy into direct current electricity using semi-conducting materials that exhibit the photovoltaic effect. Inverters convert the direct current (DC) generated by the PV modules into alternating current (AC) to be exported to the electricity grid.

6.4 Layout Alternatives

The proposed layout of the PV 1 solar facility is purely based on the optimisation of the site layout of the overall Bokpoort II project (Figure 2-2) to prevent overlapping of infrastructure associated with the different environmental authorisation applications. As discussed in Section 6.3.3, the selection of PV as only technology alternative for the current environmental authorisation application was based on the optimisation of the project in relation to the application for the proposed 150 MW CSP Tower facility (Schlechter & Baxter, February 2016b). The current layout alternative has been designed to ensure maximum use of all available space in order to meet the proposed generating capacity.

The current site layout is the preferred layout and no other feasible design or layout alternatives, including the layout of the PV panels and powerline, have been identified for assessment during the EIA phase.

6.5 No-Go (Project) Option

If the proposed Bokpoort II solar power development does not go ahead, South Africa will not reap the potential benefits of this renewable energy project and the local communities will forego the benefits of the associated additional employment opportunities and revenue streams. The development of renewable energy sources is crucial within the context of South Africa's current power crisis and the world-wide drive towards a reduction in greenhouse gas emissions. The current power constraints are having a dampening effect on the country's economy and future growth.

Without this proposed PV solar development project being implemented, there will be no net gain of an additional 75 MW of renewable electricity exported to the Eskom national electricity grid.

Should this development not go ahead, the current land use being grazing will continue. The project site has very low agricultural potential due to the low rainfall received in the area and the distance from the Orange River.

No environmental impacts will be present in the absence of construction and operation of the proposed solar facility. The no-project option will result in the minimisation of the cumulative impacts identified for the solar developments applied for and constructed in the regional area.

Table 6-2: Solar Technology Comparison for the proposed Bokpoort II Solar Development
Legend:

1	**Most favourable**	**2**	**Favourable**	**3**	**Least Favourable**

Aspect	Description	Photovoltaic Technology	Concentrated Solar Power Trough Technology	Concentrated Solar Power Tower Technology
Technical Considerations				
Time period (hrs per day) of electricity production with reference to the capability to store energy (heat) and thereby extend the period over which power can be produced	PV generates electricity directly from solar radiation on the PV cells. Therefore electricity is only generated when the sun is shining. Salient features are: ■ 10.2 hrs per day electricity production capacity (based on the average hours of sunshine in Upington per day); ■ PV is non-dispatchable, since feasible commercial energy storage does not exist yet for this technology. CSP facilities can incorporate thermal energy storage systems that allow thermal energy to be stored. These systems allow electricity to be generated during cloudy periods, after sunset, before the sun rises or even in the middle of the night. As a result, these plants can produce electricity when needed. ■ CSP Trough: ▪ 10.2 hrs per day electricity production capacity (based on the average hours of sunshine in Upington per day); ▪ Current CSP plants can store thermal energy for up to 16 hours and can technically produce electricity for 24 hours per day. ■ CSP Tower: ▪ 10.2 hrs per day electricity production capacity (based on the average hours of sunshine in Upington per day);	**2**	**1**	**1**

Aspect	Description	Photovoltaic Technology	Concentrated Solar Power Trough Technology	Concentrated Solar Power Tower Technology
	▪ Current CSP plants can store thermal energy for up to 16 hours and can technically produce electricity for 24 hours per day.			
Technology efficiency	▪ CSP Towers have the potential to be much more efficient than CSP troughs because they have far higher concentration ratios (300 to 800 suns vs. 80 or so for troughs). CSP Towers can reach much higher temperatures and pressures (more than 150bar pressure and more than 500 degrees centigrade), leading to greater efficiency relative to CSP Trough installations that have lower temperatures at about 380 degrees centigrade. ***Note:*** *The purpose of this specific comparison is to illustrate the comparison between CSP Trough and CSP Tower only.*		**2**	**1**
Maintenance and refurbishment requirement	The following maintenance and refurbishment requirements are specific to the technology options: ■ PV plants have low maintenance and servicing requirements ▪ Scheduled/ preventative maintenance; ▪ Module cleaning; ▪ Checking module connection integrity; ▪ Junction boxes or string combiner boxes should be checked periodically for water ingress, dirt or dust accumulation and integrity of the connections within the boxes; ▪ The use of thermography to detect potential faults (hot spots) to identify weak and loose connections in junction boxes and inverter connections; ▪ Inverter servicing;	**1**	**2**	**2**

Aspect	Description	Photovoltaic Technology	Concentrated Solar Power Trough Technology	Concentrated Solar Power Tower Technology
	▪ Maintenance of structural integrity: module mounting assembly, cable conduits and any other structures built for the PV plant should be checked periodically for mechanical integrity and signs of corrosion; ▪ Tracker servicing; ▪ Vegetation control. ■ CSP Trough: ▪ Operation and maintenance of a CSP trough power plant is very similar on a day to day basis to that of a conventional steam power plant, except for the material handling components of a conventional steam plant; ▪ Scheduled preventative maintenance; ▪ Maintenance of solar field; ▪ Preventative/ corrective maintenance: mechanics, welders and electricians to maintain the solar technology; ▪ Mirror washing; ▪ Vegetation control. ■ CSP Tower: ▪ Operation and maintenance of a CSP Tower power plant is very similar on a day to day basis to that of a conventional steam power plant except for the material handling components of a conventional steam plant; ▪ Maintenance of solar field ▪ Preventative/ corrective maintenance: mechanics, welders and electricians to maintain the solar technology; ▪ Mirror washing; ▪ Vegetation control.			

Aspect	Description	Photovoltaic Technology	Concentrated Solar Power Trough Technology	Concentrated Solar Power Tower Technology
Time to commissioning	The time period from construction completion to commissioning the plant is as follows: ■ PV: between 90 and 130 days ■ CSP Trough: 8 months ■ CSP Tower: 8 months	**1**	**2**	**2**
Economic Considerations [10]				
All inclusive cost consideration	CSP trough technology is older and more established and dominated the concentrated solar thermal power industry for the last two decades but in recent years CSP Tower has found favour because of a 20-30% cost advantage in the all-inclusive cost per kwh generated. ***Note:*** *The different technologies described in this report have different roles in the energy mix. PV is included for the Bokpoort II solar development to optimise the utilisation of the available area.*	**1**	**3**	**2**
Environmental and Social Considerations				
Land take per MW produced	Based on the current proposed layout for the Bokpoort II site (PV and CSP Tower technologies)and the approximate layout of the Bokpoort I site (CSP Trough technology), the following land take per MW produced estimation was made: ■ CSP Tower: 150 MW over 700 ha = 4.7 ha per 1MW; ■ CSP Trough: 75 MW over 350 ha = 4.7 ha per 1 MW; ■ PV: 75 MW over 240 ha = 3.2 ha per 1 MW.	**1**	**2**	**2**

[10] The reader will appreciate that figures presented here are of a confidential nature and consequently a relative ranking is used instead of presentation of actual numbers

Aspect	Description	Photovoltaic Technology	Concentrated Solar Power Trough Technology	Concentrated Solar Power Tower Technology
Visual Impact	The presence of the solar infrastructure and associated visual impact on the local area in terms of: ■ Scenic value; ■ Sense of place; ■ Visual character; and ■ Visually sensitive receptors currently present in the local area. The following significant infrastructural components and approximate heights thereof were considered for each solar technology: ■ PV: ▪ PV panels – estimated to be approximately 4 metres high after installation; ▪ The inverter is an 11.28 m high cube container which includes the DC distribution, the inverter, the medium voltage transformer and the medium voltage switchgear; ▪ Associated building such as the transformer substation, workshop, storage, etc. ■ CSP Trough (based on Bokpoort I project configuration): ▪ Solar collector assembly – 6m in height; ▪ Heat exchanger vessel – 20 m in height; ▪ Cooling towers – 15m in height; ▪ Generator – 6m in height; ■ CSP Tower: ▪ Power tower with central receiver located on the top of a concrete tower – 200 to 250m in height; ▪ Heliostat Solar Field – 6m in height; ▪ Heat exchanger vessel – 20m in height; ▪ Cooling towers – 15m in height;	**1**	**2**	**3**

Aspect	Description	Photovoltaic Technology	Concentrated Solar Power Trough Technology	Concentrated Solar Power Tower Technology
	▪ Generator – 6m in height.			
Noise Impact	Potential noise sources, related to the operation of the proposed solar development, are: ■ PV: ▪ The movement of the PV panels to track the sun; ▪ The cooling fans at the power block, the pumps and the power generation unit. ■ CSP Trough: ▪ The cooling fans, pumps and the power generating unit; ■ CSP Tower: ▪ The movement of the Heliostats to track the sun; ▪ The power block, the pumps and the power generation unit.	**1**	**1**	**1**
Water Requirements	The water use per year for the proposed solar technologies are: ■ PV: 25 000m^3 ■ CSP Trough: 859 000m^3 (wet cooling system - based on the Bokpoort I EIA Report); ■ CSP Tower: 250 000m^3 (air cooled condenser)	**1**	**3**	**2**
Ecology – Avifauna	The impact of the infrastructure on ecology with specific reference to avifauna: ■ PV: ▪ Potential destruction, degradation, fragmentation or otherwise displacement of fauna from large areas of habitat; ▪ Possible collision trauma and bird mortalities. ■ CSP Trough: ▪ Potential destruction, degradation, fragmentation or otherwise displacement of fauna from large areas of habitat; ▪ Possible collision trauma and bird mortalities.	**1**	**1**	**2**

Aspect	Description	Photovoltaic Technology	Concentrated Solar Power Trough Technology	Concentrated Solar Power Tower Technology
	■ CSP Tower: ▪ Potential destruction, degradation, fragmentation or otherwise displacement of fauna from large areas of habitat; ▪ Possible collision trauma and bird mortalities. ▪ Possible singeing or incineration of birds when passing through the flux beams.			
Construction Period	The construction periods for the solar technologies are approximately: ■ PV: 9 months ■ CSP Trough: 25 months ■ CSP Tower: 28 months	1	2	3
Employment opportunities for locals during construction	Employment opportunities that will be created for local residents during the construction phase will be: ■ PV: 40 employment opportunities at peak on site; ■ CSP Trough: 360 employment opportunities at peak on site; and ■ CSP Tower: 360 employment opportunities at peak on site.	2	1	1
Employment opportunities for locals during operation	Employment opportunities that will be created for local residents during the operational phase will be: ■ PV: 10 employment opportunities; ■ CSP Trough: 19 employment opportunities; and ■ CSP Tower: 21 employment opportunities.	3	2	1
Influx of contract workers during the construction phase	The approximate number of foreign workers that will be required during the construction period of the construction phase of the project: ■ PV: 10 foreign workers; ■ CSP Trough: 25 foreign workers; and ■ CSP Tower: 25 foreign workers.	1	2	2

7.0 PUBLIC PARTICIPATION PROCESS

This section provides an overview of the public participation process undertaken to date for this EIA. Figure 1-1 provides a simplified graphic overview, including the public participation process.

7.1 Objectives of Public Participation

The public consultation process is designed to provide information to and receive feedback from interested and affected parties (I&AP) for use throughout the EIA process, thus providing organisations and individuals with an opportunity to raise concerns and make comments and suggestions regarding the proposed Project.

Opportunities for Comment

Documents will be available at various stages during the EIA process to provide stakeholders with information, further opportunities to identify issues of concern and suggestions for enhanced benefits and to verify that the issues raised have been considered in the specialist studies.

The principles that determine communication with society at large are included in the principles of the National Environmental Management Act (NEMA) (Act 107 of 1998, as amended) and are elaborated upon in General Notice 657, titled *"Guideline 4: Public Participation"* (Department of Environmental Affairs and Tourism, 19 May, 2006), which states that: *"Public participation process means a process in which potential interested and affected parties (I&APs) are given an opportunity to comment on, or raise issues relevant to, specific matters."*

Public participation is an essential and regulatory requirement for an environmental authorisation process, and must be undertaken in terms of the Environmental Impact Assessment (EIA) Regulations GN R.982 (December 2014). Public participation is a process that is intended to lead to a joint effort by stakeholders, technical specialists, the authorities and the proponent/developer who work together to produce better decisions than if they had acted independently.

Internationally, the public consultation process complies with the Equator Principles (in particular Principles 5 and 6) and the IFC Performance Standards (PS) (specifically PSs 1, 2, 4, 5, 7 and 8). A Stakeholder Engagement Plan (SEP), provides a more comprehensive summary of the local regulatory requirements and international standards that were considered in the design of the public consultation process (Refer to APPENDIX D).

The public participation process is designed to provide sufficient and accessible information to Interested and Affected Parties (I&APs) in an objective manner and:

During the Scoping Phase enable them to:

- Understand the context of the EIA;
- Become informed and educated about the proposed project and its potential impacts;
- Raise issues of concern and suggestions for enhanced benefits;
- Verify that their comments, issues of concern and suggestions have been recorded;
- Assist in identifying reasonable alternatives; and
- Contribute relevant local information and traditional knowledge to the environmental assessment.

During the impact assessment phase assist them to:

- Contribute relevant information and local and traditional knowledge to the environmental assessment;
- Verify that their issues and suggestions have been evaluated and considered in the environmental investigations and feedback has been provided;
- Comment on the findings of the EIA; and
- Identify further issues of concern from the findings of the EIA.

During the decision-making phase:

- To advise I&APs of the outcome, i.e. the authority decision, and how the decision can be appealed.

7.2 Pre-Scoping Phase: Capacity Building

IFC PS 1 stipulates that stakeholder consultation should include *elements of capacity building* to ensure the process is considered "free, prior and informed". This was done by:

- Providing accessible and adequate information without creating undue fears (related to potential negative impacts) or expectations (regarding jobs);
- Using visual illustrations and verbal explanations for illiterate stakeholders; and
- Using local languages and small groups to ensure stakeholders did not feel intimidated.

The pre-scoping phase public consultation process provided vulnerable groups with equal opportunities to participate by:

- Making a special effort to identify disadvantaged or vulnerable groups; and
- Providing transportation and or subsidies for the vulnerable poor to ensure their participation does not come at the expense of their livelihoods.

7.2.1 Stakeholder Engagement Plan

The Stakeholder Engagement Plan (SEP) follows the framework provided by the International Finance Corporation (IFC, 2012). The purpose of stakeholder engagement is to establish, maintain and preserve a beneficial relationship with various stakeholders over a certain period of time. The SEP deals with both public consultation for an EIA, and following EIA, on-going engagement with stakeholders. Refer to APPENDIX D for the Stakeholder Engagement Plan.

7.2.2 Identification of I&APs

I&APs were initially identified *via* the pre-existing Bokpoort I project stakeholder database, liaison with potentially affected parties in the study area, newspaper advertisements, placement of site notices and a registration process involving completion of a registration and comment sheet. The registration sheet encouraged I&APs to indicate the names of their colleagues and friends who may also be interested in participating.

I&APs representing various sectors of society include:

- Government (national, provincial and local);
- Environmental NGOs;
- Conservation Agencies;

- Community Representatives and CBOs;
- Directly affected communities;
- Business and Commerce; and
- Other.

7.2.3 Register of I&APs

The NEMA Regulations (GN R.982) distinguish between I&APs and registered I&APs.

I&APs, as contemplated in NEMA, include: "*(a) any person, group of persons or organisation interested in or affected by an activity; and (b) any organ of state that may have jurisdiction over any aspect of the activity".*

In terms of the Regulations:

"An EAP managing an application must open and maintain a register which contains the names, contact details and addresses of:

(a) All persons who; have submitted written comments or attended meetings with the applicant or EAP;
(b) All persons who; have requested the applicant or EAP managing the application, in writing, for their names to be placed on the register; and
(c) All organs of state which have jurisdiction in respect of the activity to which the application relates.

A Register for I&APs has been opened. All stakeholders on the initial database received a letter in January 2015 inviting them to register as I&APs (APPENDIX C – Stakeholder Database and Background Information Letter).

Registered I&APs will be kept informed of environment-related project developments during the EIA process. The I&AP register have been kept up to date throughout the EIA process (APPENDIX C – Registered I&APs).

7.3 Public Participation during Scoping

This section provides a summary of the public participation process that was followed during the Scoping Phase of the EIA. ACWA Power initially applied for three different technologies, by means of six different applications, on the proposed site, namely PV solar plant technology, CSP parabolic troughs and CSP towers. ACWA Power has since performed an in depth analysis of the proposed project to include only three applications, namely for two 75 MW PV facilities and one 150 MW CSP Tower facility, as described in Section 3.0 of this report.

While the initial project configuration that was communicated to I&APs, both in writing and at the Public Meeting, has now been refined into three non-overlapping site plans, the technical content of the applications and the description of the technologies and the environment as described in the combined Scoping Report, have not changed.

All stakeholder comments received to date, on the initial documentation, have been included in the amended applications, but stakeholders will also be provided with further opportunities to comment on the revised project description during the remainder of the EIA process.

7.3.1 Initial Announcement of the Proposed Project

The initial DSR was made available for public review for 30 days from Wednesday, 28 January 2015 until Friday, 27 February 2015.

The proposed project was announced as follows:

- Distribution of the DSR and a letter of invitation to participate sent to all I&APs on the database, accompanied by a registration, comment and reply sheet that was mailed/emailed to the entire stakeholder database. Copies of these documents are attached in APPENDIX C.
- The abovementioned documents were made available at the following public places and posted to the Golder website www.golder.com/public:
  - !Kheis Local Municipal Clinic – Groblershoop;
  - !Kheis Municipal Public Library – Groblershoop;
  - Golder Associates Africa – Midrand.
- An advertisement was published in one local newspaper, Gemsbok Newspaper, on 28 January 2015 (APPENDIX C – Newspaper Advertisement); and
- Site notices were erected in Groblershoop and on the boundaries of the project area on 28 January 2015 at the following locations (APPENDIX C – Site Notices):
  - *Entrance to site near substation*

    28˚44'22.47''S

    21˚59'50.80''E
  - *Further along the road across from service road for railway line*

    28˚42'23.94''S

    22˚01'43.11''E
  - *At the south western corner of the site*

    28˚43'02.36''S

    21˚58'16.10''E

7.3.2 Open House

An Open House was held on Wednesday, 18 February 2015 at the Orange River Wine Cellars, Groblershoop from 12:00 to 18:00. Information on the proposed project was shared with the attendees.

Stakeholders from all sectors of society attended the Open House. An attendance register for the Open House is appended in APPENDIX C.

7.3.3 Comments from Interested and Affected Parties

The comments received and issues raised, both in writing and at the Open House, have been captured in a Comment and Response Report, appended to this report as APPENDIX C.

7.3.4 Project Progress and Feedback Letter

A project progress and feedback letter, dated 5 June 2015, communicated the new project configuration and technology layouts and explained the reduction in the number of environmental authorisation (three instead of six) applications that will be submitted. Refer to APPENDIX C for a copy of the letter.

Stakeholders were invited to submit any additional comments on the proposed new layout. The comments received are included in the Comments and Response Report in APPENDIX C.

7.3.5 Additional Opportunity to Comment

The amended draft Scoping Report (dated 6 January 2016), detailing the updated project configuration, was made available for additional public comment for a period of 30 days simultaneously with the Authority comment period. Refer to APPENDIX C for a copy of the letter, dated 6 January 2016, informing the stakeholders of the additional comment period from 6 January 2016 to 5 February 2016.

All comments received from I&APs during this comment period were included in the Comments and Response Report, which was attached to the final Scoping Report submitted to the DEA APPENDIX C.

7.4 Public participation during the Impact Assessment Phase

Public participation during the impact assessment phase of the EIA entails providing stakeholders with the opportunity to review the findings of the EIA, presented in the Draft EIA and EMPr Report. The draft EIA/EMPr report is available for public comment for a period of 30 days from 27 May 2016 to 27 June 2016. All stakeholders are encouraged to comment either in writing (mail or email), on the Golder website or by telephone. Stakeholders are notified of the availability of the draft EIA report via the following:

- Letter to Registered I&APs

A letter was sent to all registered I&APs informing them of the availability of the draft EIA reports, public places where copies of the document can be viewed, the date and time of the public meeting as well as the method by which they can submit their comments. Refer to APPENDIX C for a copy of the letter.

- Advertisement

An advert has been placed in the Die Gemsbok (regional) and Volksblad (provincial) newspapers informing all stakeholders of the availability of the draft EIA reports, public places where copies of the document can be viewed, the date and time of the public meeting as well as the method by which they can submit their comments. Refer to APPENDIX C for a copy of the advertisement.

- Site Notices

Updated site notices have been placed at the project site informing all stakeholders of the availability of the draft EIA reports, public places where copies of the document can be viewed, the date and time of the public meeting as well as the method by which they can submit their comments. Refer to APPENDIX C for a copy of the site notice.

- Public Meeting

A stakeholder meeting will be held on Tuesday 14 June 2016 at the Orange River Wine Cellars, near Groblershoop, from 10:00 to 12:00.

All the issues, comments and suggestions raised during the comment period on the Draft EIA Report/EMPr will be added to the Comment and Response Report (CRR) that will accompany the Final EIA Report/EMPr. The Final EIA Report/EMPr will be submitted to the DEA for a decision about the proposed project.

7.4.1 Summary of Issues Raised by Interested and Affected Parties

The following key issues have been raised to date:

- Visual impact of height of CSP tower (alternative technology) and bright glare reflected from it will degrade the wilderness and hunting experience currently marketed to affluent individuals by commercial hunting farms in the area and lead to unacceptable loss of revenue. PV and CSP Trough installations would be more acceptable;

- Dust caused by increased traffic at higher speeds along unpaved roads during construction of Bokpoort I have already affected quality of grapes produced along the Orange River and resulted in revenue losses. The Bokpoort II project will exacerbate the situation;
- Why were foreign truck drivers used on the Bokpoort I project? They disregarded traffic rules, travelled at high speeds, raised a lot of dust and endangered other road users;
- The local dirt roads were not built to carry heavy vehicles; and
- Why use imported solar technology and components? There are not enough benefits for South Africans;

7.5 Next steps in the EIA process

This Draft EIA/EMPr Report will be finalised by incorporating any additional comments received from I&APs and the Final EIA Report and EMPr will be presented to the authorities for decision-making. See **Table 7-1**.

Table 7-1: Bokpoort II EIA process timeframes

Key Milestone	Proposed timeframe
Draft Scoping public and authority review period: 30 days	6 January 2016 to 5 February 2016
Review of Final Scoping Report (FSR) by DEA – decision on the FSR within 43 days	19 February 2016 to 5 April 2016
Public review period for Draft EIA report: 30 days	27 May 2016 to 27 June 2016
Submission of EIA Report to DEA for review and decision-making	7 July 2016

7.6 Lead Authority's Decision

Once the DEA have issued a decision regarding the proposed project, Golder's Public Participation Office will notify I&APs of this decision and of the opportunity to appeal. A letter will be sent, personally addressed to all registered I&APs, summarising the authority's decision and explaining how to lodge an appeal should they wish to.

A grievance mechanism will be established by ACWA Power to record grievances during the construction, operation and decommissioning phases of the proposed development. A responsible person from the Project Company will ensure that this grievance mechanism is maintained and that grievances are attended to in a timeous manner.

8.0 DESCRIPTION OF THE ENVIRONMENT THAT MAY BE AFFECTED AND THE BASELINE CONDITIONS

The following section describes the biophysical and socio-economic environment that may be affected by the proposed solar development. The baseline studies for the authorised EIA for the Bokpoort I solar development, for a concentrated solar thermal power plant project[11], and more detailed studies focussing on significant environmental aspects of the proposed development, referenced in Section 14.0 of this report, were consulted to describe the baseline conditions.

A detailed site selection and sensitivity analysis process was conducted for the Bokpoort I EIA and it was indicated that the project area for the Bokpoort II development is in a preferred and acceptable developable

[11] Environmental Impact Assessment for a Proposed 75 MW Concentrating Solar Thermal Power Plant and Associated Infrastructure in the Siyanda District, Northern Cape. 2011. DEA Reference number: 12/12/20/1920.

area. A comprehensive Environmental Management Programme (EMPr) has been developed to mitigate and minimise the impacts during the construction and operational phases.

8.1 Physical Environment

8.1.1 Geology

The geology of the area is generally characterised by metamorphosed sediments and volcanics intruded by granites and is known as the Namaqualand Metamorphic Province.

Groblershoop is located on the Kalahari Group. The Kalahari Group is divided into four formations. At the base is a soft, clay gravel of fluvial origin (the Wessels Formation). Upon this follows calcareous claystone with interlayered gravel (the Budin Formation). This is in turn overlain by clay-containing, calcareous sandstone (the Eden Formation). Upon the Eden Formation follows the aeolian surface which is characteristic of the group (the Gordonia Formation) (Council for Geoscience , 2016). The proposed solar development project site is situated on red-brown windblown sands of the Gordonia Formation, Kalahari Group.

GCS (Pty) Ltd (2010) describes the general geology of the site as comprising mainly red-brown, coarse grained granite gneis and quartz-muscovite schist, quartzite, quartz-amphibole schist and greenstone of the Groblershoop formation, Brulpan group. Calcrete is also present, especially in the south-eastern part of the area.

Dune ridges occur in the northern portions of the site and are characterised by NNW-SSE orientation. Calcrete outcrops occur approximately 2km west and southwest from the Garona Substation (Figure 8-1). An anticlinal structure (upward pointing fold) causes the Groblersdal formation to be elevated in the area to the east of the site where it forms a range of hills known as the Skurweberge (Benedek, F; Roods, M;, February 2011).

8.1.2 Climate

The baseline characteristics of the climate, wind field and air quality in the project area were determined from literature sources.

The project area is situated in the subtropical high-pressure belt. The mean circulation of the atmosphere over the subcontinent is anti-cyclonic throughout the year (except for near the surface) (Preston-Whyte & Tyson , 1997). The synoptic patterns affecting the typical weather experienced in the region owe their origins to the subtropical, tropical and temperature features of the general atmospheric circulation over Southern Africa.

The subtropical control is brought via the semi-permanent presence of the South Indian Anticyclone (HP cell), Continental High (HP cell) and the South Atlantic Anticyclone (LP cell) in the high pressure belt located approximately 30°S of the equator (Preston-Whyte & Tyson , 1997). The tropical controls are brought via tropical easterly flows (LP cells) (from the equator to the southern mid-latitudes) and the occurrence of the easterly wave and lows (Preston-Whyte & Tyson , 1997). The temperature control is brought about by perturbations in the westerly wave, leading the development of westerly waves and lows (LP cells) (i.e. cold front from the polar region, moving into the mid-latitudes) (Preston-Whyte & Tyson , 1997).

Seasonal variations in the positioning and intensity of the HP cells determine the extent to which the westerly waves and lows impact the atmosphere over the region. In winter, the high pressure belt intensifies and moves northward while the westerly waves in the form of a succession of cyclones or ridging anticyclones moves eastwards around the South African coast or across the country. The positioning and intensity of these systems are thus able to significantly impact the region. In summer, the anti-cyclonic HP belt weakens and shifts southwards and the influence of the westerly wave and lows weakens.

Anticyclones (HP cells) are associated with convergence in the upper levels of the troposphere, strong subsidence throughout the troposphere, and divergence near the surface of the earth. Air parcel subsidence, inversions, fine conditions and little to no rainfall occur as a result of such airflow circulation patterns (i.e. relatively stable atmospheric conditions).

Westerly waves and lows (LP cells) are characterised by surface convergence and upper-level divergence that produce sustained uplift, cloud formation and the potential for precipitation. Cold fronts, which are associated with the westerly waves, occur predominantly during winter. The passage of a cold front is characterised by pronounced variations in wind direction and speed, temperature, humidity, pressure and distinctive cloud bands (i.e. unstable atmospheric conditions).

The tropical easterlies and the occurrence of easterly waves and lows affect Southern Africa mainly during the summer months. These systems are largely responsible for the summer rainfall pattern and the north easterly wind component that occurs over the region (Preston-Whyte & Tyson , 1997).

The regional climate associated with the project area is typical of most semi-desert areas. The ZF Mgcawu District Municipal area is known for its extreme climate conditions. The Northern Cape is characterised by a harsh climate that experiences minimal rainfall and prolonged droughts. This situation is exacerbated by high evaporation due to the intense heat experienced during the dry summer months (ZF MGCAWU District Municipality, 2014).

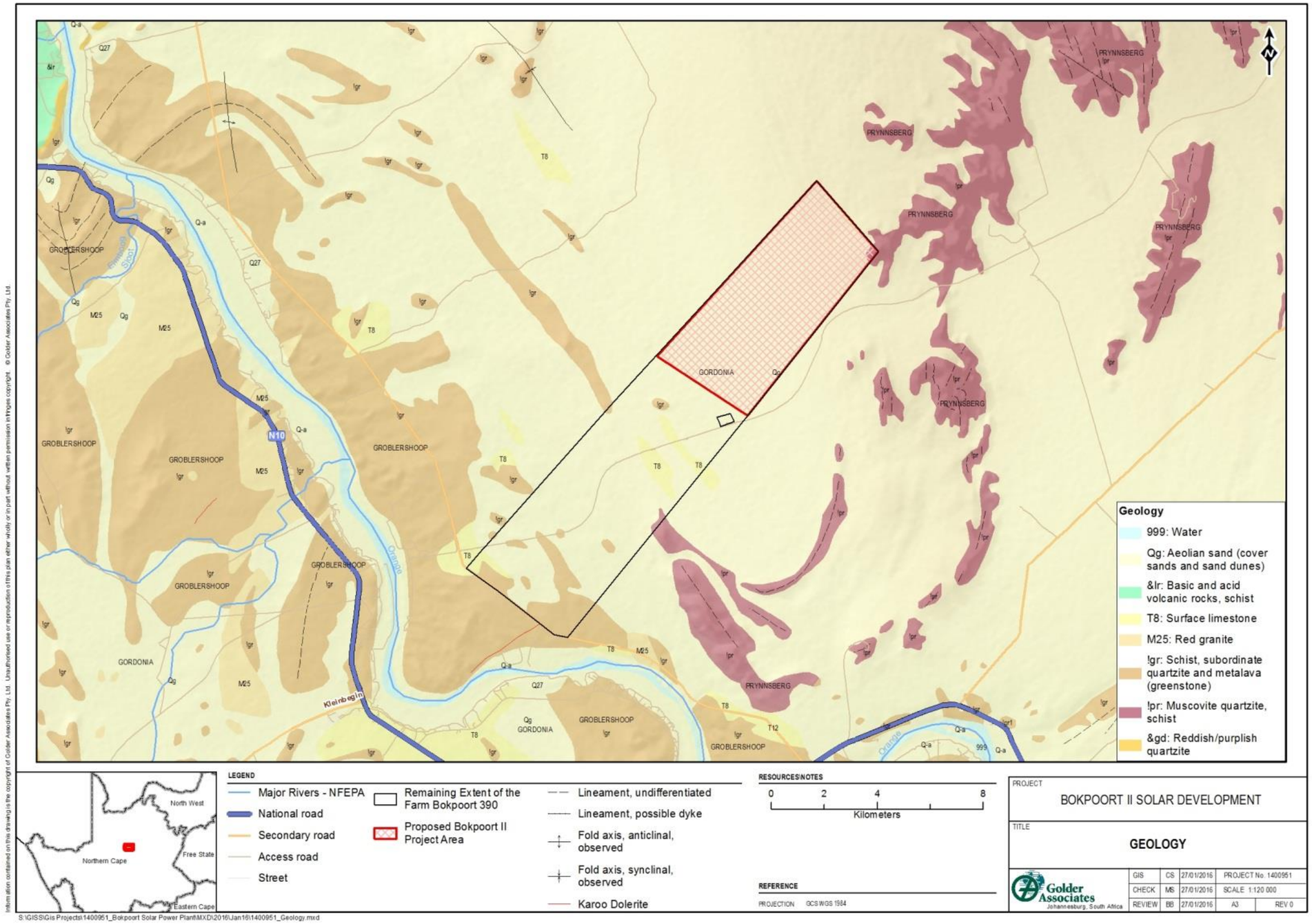


Figure 8-1: Geological Map of the project and surrounding area

8.1.2.1 Assessment of Climate Data

Climate data in the area around the project site was sourced from the Daily Rainfall Extraction Utility (Kunz, 2004) and the Department of Water and Sanitation's website (Department of Water Affairs, 2008). The rainfall stations are presented in Table 8-1 and the graphical representation of their locations are presented in Figure 8-2.

Table 8-1: Rainfall Stations

Station	Name	Altitude (masl)	From	To	No of Years	MAP (mm)
0284658 A	Opwag	939	1972	1999	29 (0% patched)	197
0284832 A	Groblershoop (pol)	880	1900	1999	99 (49.5% patched)	171
D7E001	Boegoeberg Res @ Boegoeberg Dam	980	1930	2014	84	231
D7E003	P V Ryneveld Airport @ Upington	830	1902	2004	102	179

The D7E001 station (Boegoeberg Res @ Boegoeberg Dam) was chosen as the station used to represent the general climatic conditions of the study area for the following reasons:

- The rainfall record is of a long duration;
- The station is seen to be still active, such that recent rainfall data is available;
- The patched data applied to the station's records is minimal, thus providing a reliable set of data; and
- The station's MAP falls within a suitable range of nearby stations.

8.1.2.2 Rainfall

Rainfall in the project area is scarce and generally occurs in late summer and early autumn between January and April (Figure 8-3). Average rainfall in the area varies between 170 and 240mm per annum (Figure 8-4), while evaporation is extremely high, due to the high temperatures, which can reach 35º - 40º C in summer.

The 5, 50 and 95 percentiles of the annual rainfall totals for the D7E001rainfall station are presented in Table 8-2.

Table 8-2: 5, 50, and 95 percentiles of the annual rainfall totals

Station Number	Station name	5th percentile	50th percentile	95th percentile
0284681 W	D7E001	81	208	412

The 24-Hour rainfall depths for the 1 in 2, 1 in 5, 1 in 10, 1 in 50, 1 in 100 and 1 in 200 recurrence intervals at the D7E001 station were abstracted from the Design Rainfall Estimation Program (Smithers & Schulze, 2002) are given in Table 8-3.

Table 8-3: 24 Hour rainfall depths for different recurrence intervals (mm/day)

Recurrence Interval (years)	1 in 2	1 in 5	1 in 10	1 in 20	1 in 50	1 in 100	1 in 200
24 Hour Rainfall Depth (mm)	35	41.5	62	72	84	92	101

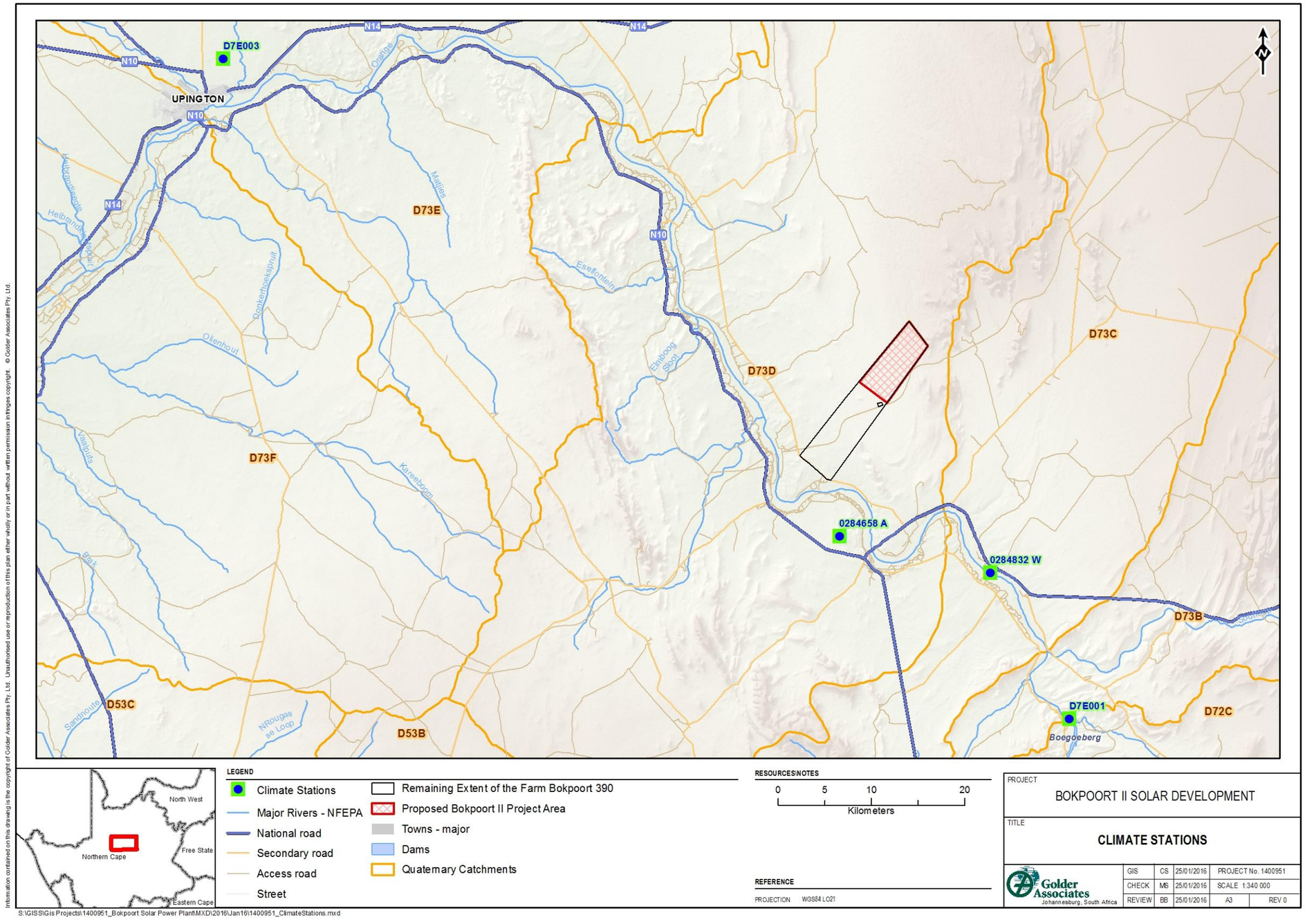
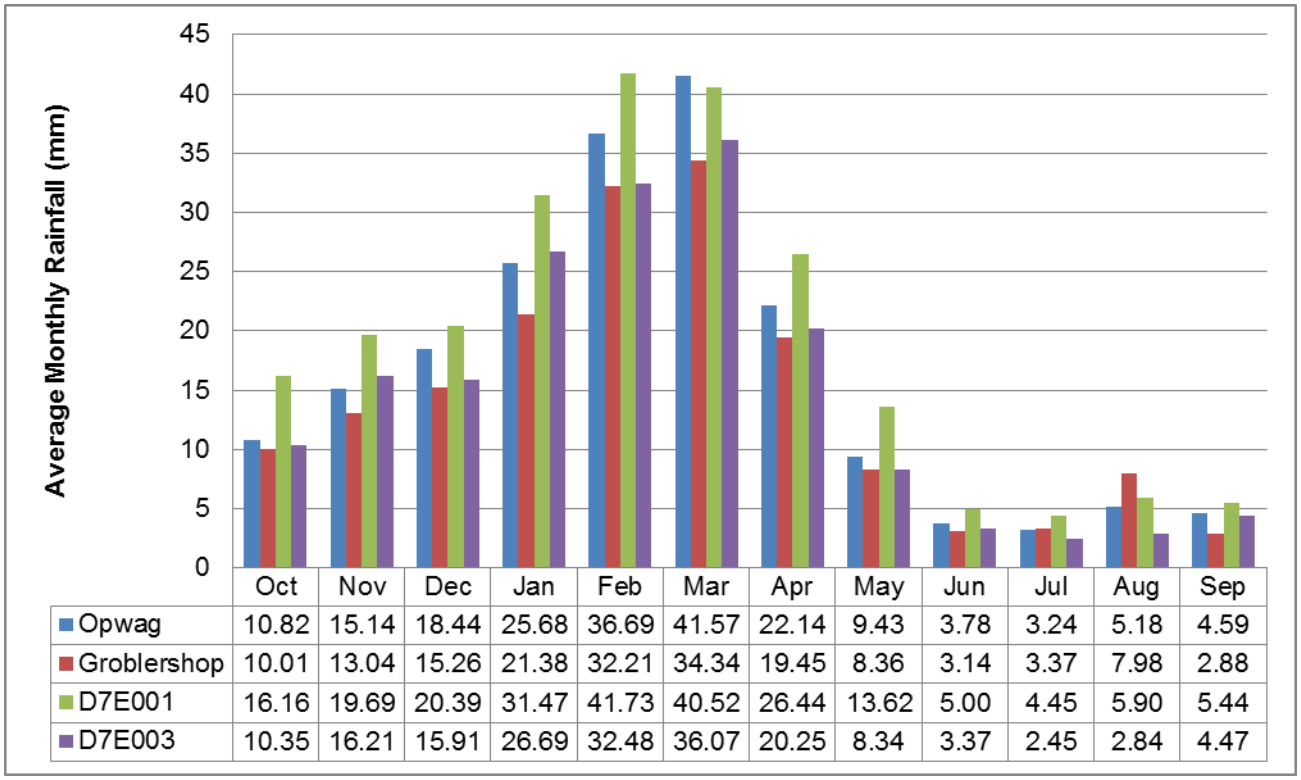


Figure 8-2: Locality Map of the Rainfall Stations in the vicinity of the Bokpoort II project site



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Opwag	10.82	15.14	18.44	25.68	36.69	41.57	22.14	9.43	3.78	3.24	5.18	4.59
Groblershop	10.01	13.04	15.26	21.38	32.21	34.34	19.45	8.36	3.14	3.37	7.98	2.88
D7E001	16.16	19.69	20.39	31.47	41.73	40.52	26.44	13.62	5.00	4.45	5.90	5.44
D7E003	10.35	16.21	15.91	26.69	32.48	36.07	20.25	8.34	3.37	2.45	2.84	4.47

Figure 8-3: Monthly rainfall distribution for rainfall stations in the surrounding area.

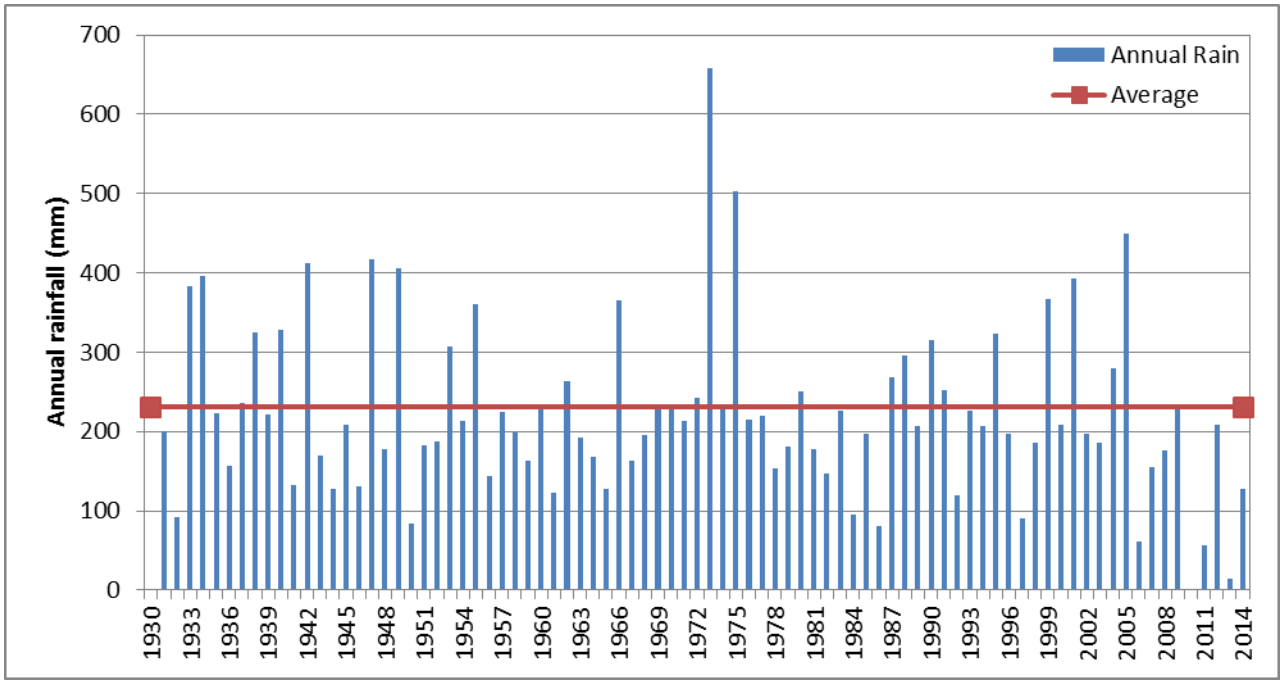


Figure 8-4: Annual Rainfall recorded at the D7E001 (Boegoeberg Dam) station

8.1.2.3 Temperature

Daily average summer temperatures range between 23^0 C and 37^0 C with winter temperatures ranging between 4^0 C and 20^0 C.

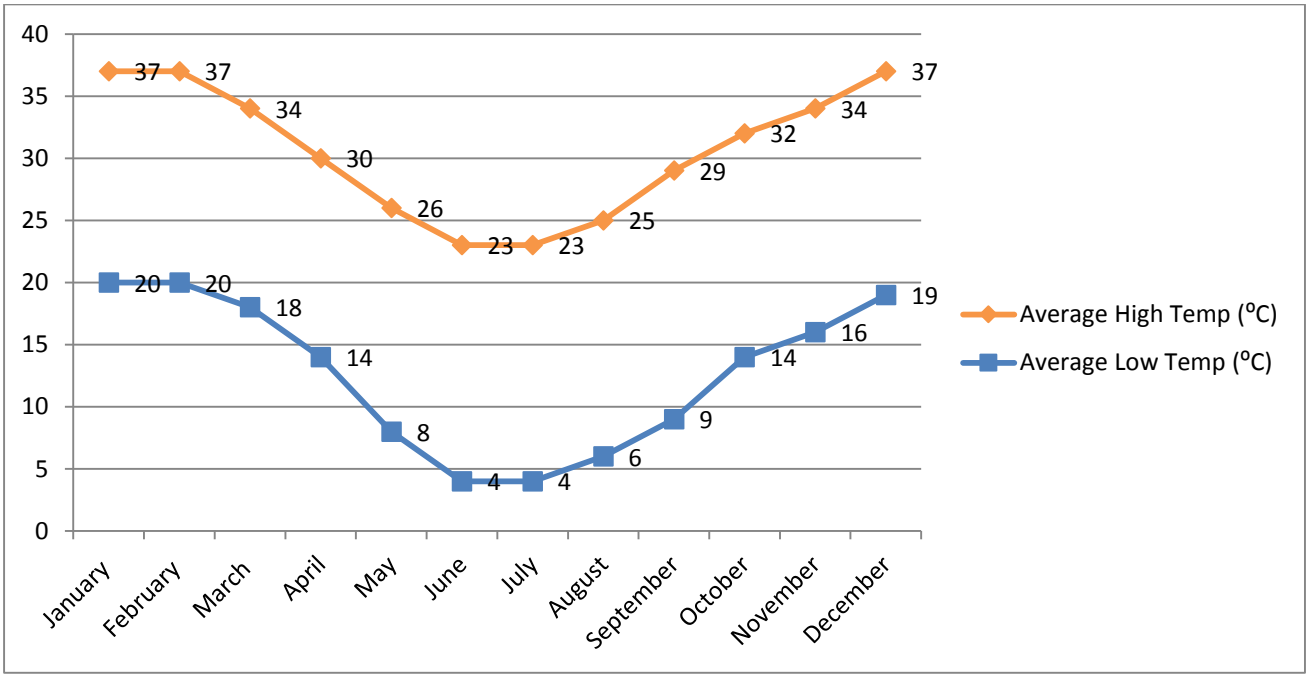


Figure 8-5: Average Temperature (ºC) Graph for Groblershoop (World Weather Online , 2016).

8.1.2.4 Evaporation

Monthly evaporation data was available for the Department of Water and Sanitation station D7E001, located approximately 40km south east of the project site. The station has an approximate Mean Annual Evaporation (MAE) of 2 166.3mm calculated over a period of 1931-2008. Monthly mean, minimum and maximum evaporation depths are shown in Figure 8-6.

As illustrated in Figure 8-6, the highest evaporation occurs in the summer months of September to March. The average monthly evaporation values are shown in Table 8-4.

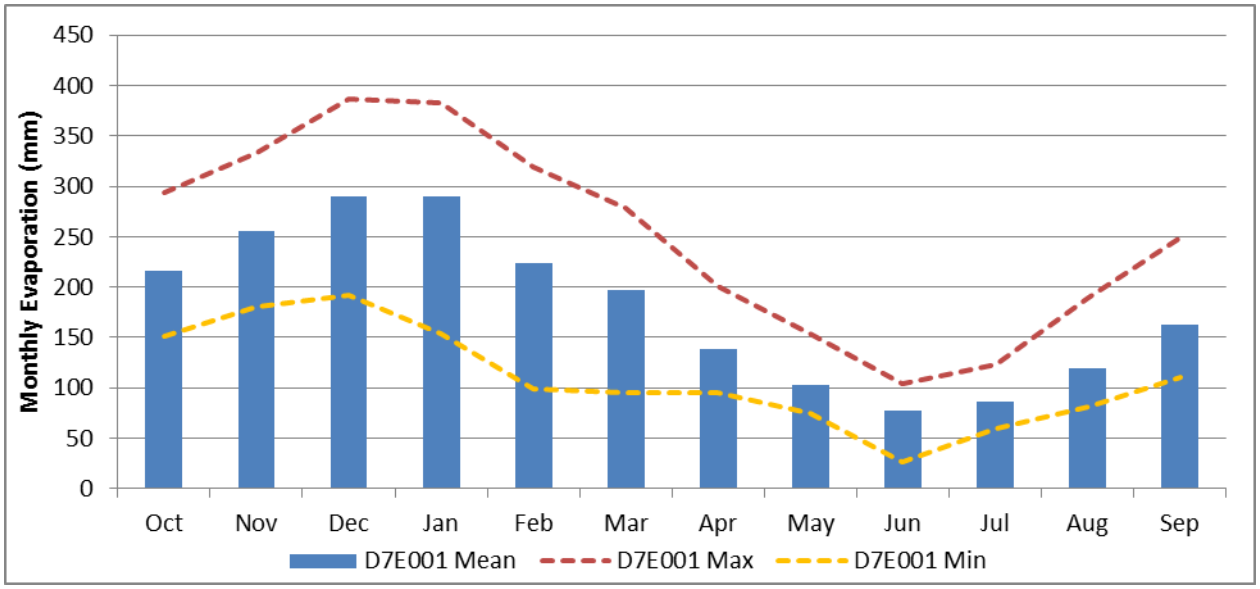


Figure 8-6: Monthly mean, minimum and maximum evaporation for station D7E001 (Boegoeberg Dam)

Table 8-4: Average monthly evaporation values for station D7E001

Month	Monthly Evaporation
October	216
November	255
December	290
January	290
February	223
March	197
June	139
July	103
August	77
September	87
Year	1 877

8.1.2.5 Wind Field

Based on the evaluation of the meteorological data, done by (Walton & Thompson, November 2010) for the Bokpoort I EIA, winds originate predominantly from the north-north-east (10% of the time) and north (9% of the time) (Figure 8-7). The monitoring data recorded from January 2005 to December 2009 indicated that moderate to fast winds was generally recorded over the monitoring period. Calm winds, which are classified as wind speeds less than 0.5 m/s occur infrequently (4% of the time).

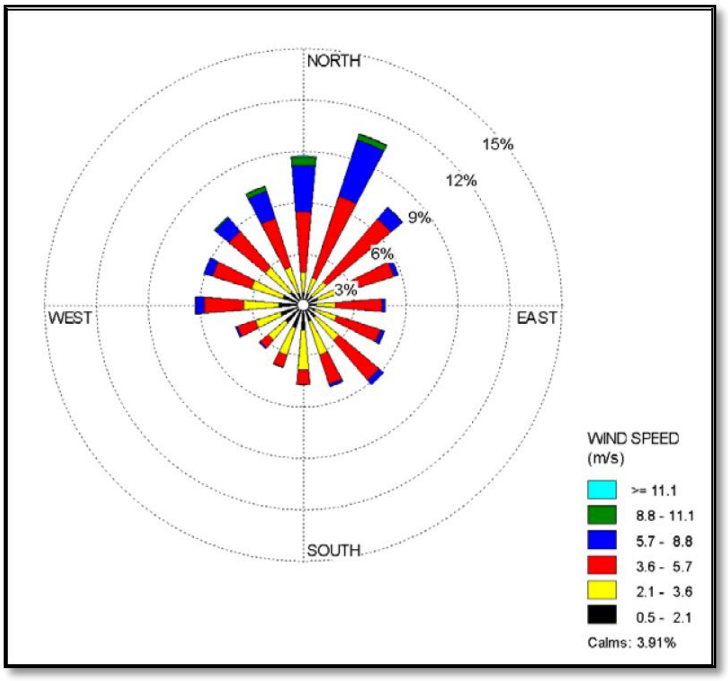


Figure 8-7: Period wind rose for the project area for the period January 2005 to December 2009 (Walton & Thompson, November 2010)

The diurnal trend in the wind field is illustrated in Figure 8-8. Moderate to fast winds originate predominantly from the westerly and northerly sectors during the day-time (06:00 – 18:00). During the night-time, winds originate from all sectors with a shift observed to the north-north-east and north-east between 00:00 – 06:00. Faster winds were recorded during the day-time period compared to the night-time (Walton & Thompson, November 2010).

Figure 8-9 illustrates the seasonal variability in the wind field at the project site. Winds originate predominantly from the west during the summer months (December, January and February). During autumn (March, April and May), a shift is observed with winds originating predominantly from the north-north-east and north-east. A similar pattern is observed during the winter months (June, July and August). During spring (September, October and November), winds originate from all sectors, with the highest frequency recorded form the westerly sector (Walton & Thompson, November 2010).

It can be expected from the prevailing meteorological conditions of the project area that emissions released from the proposed site will be transported predominantly in a south-south-westerly and southerly direction from the project site towards the Orange River. The prevalence of moderate to fast winds will transport emissions several kilometres from the project site (Walton & Thompson, November 2010).

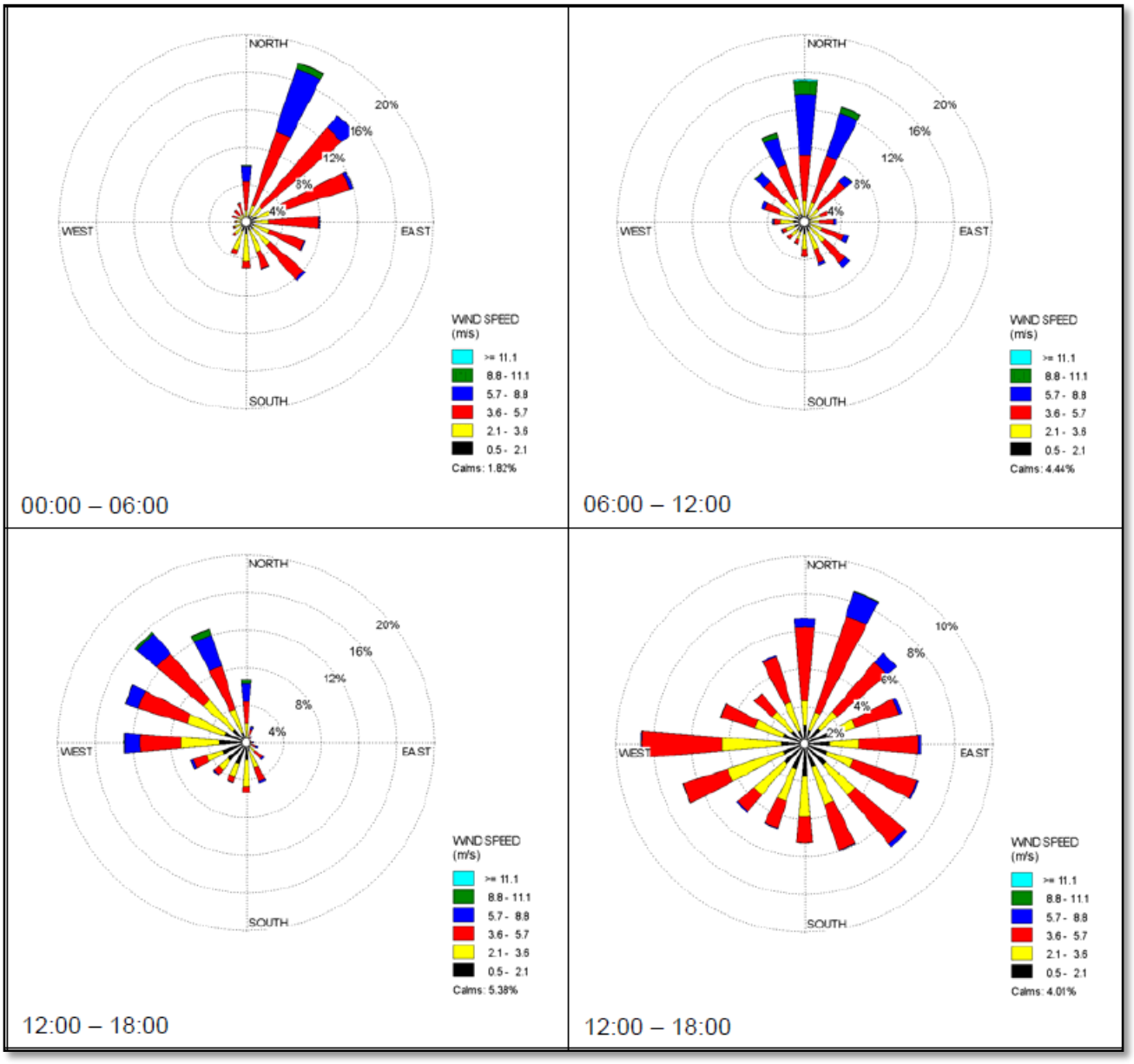


Figure 8-8: Diurnal wind roses for the project site for the period January 2005 to December 2009 (Walton & Thompson, November 2010)

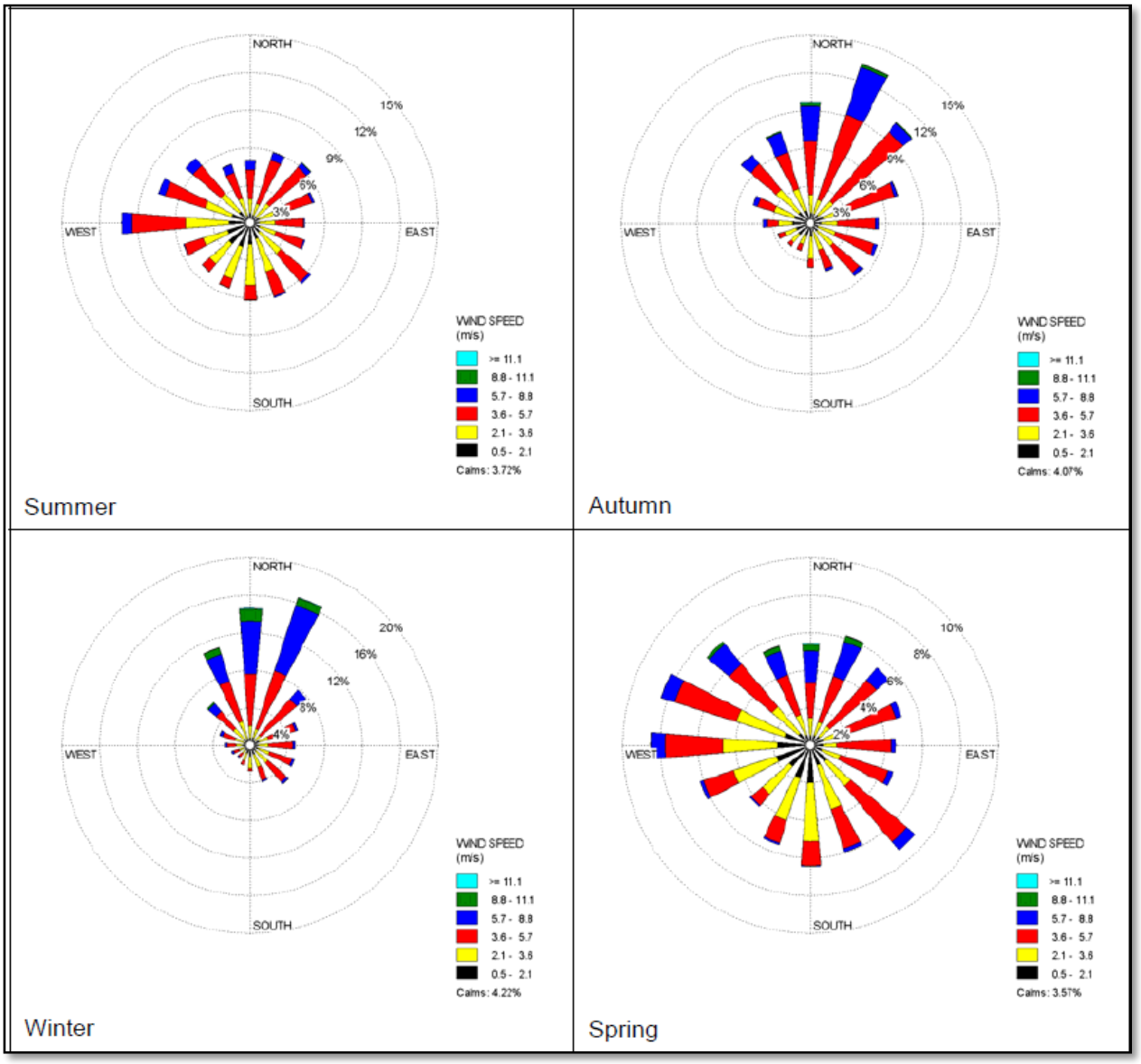


Figure 8-9: Seasonal wind roses for the project site from the period January 2005 to December 2009 (Walton & Thompson, November 2010)

8.1.3 Air Quality

Spatial imagery was used to identify sensitive receptors to potential air pollutant emissions. A sensitive receptor is a person or place where involuntary exposure to pollutants by the proposed development could occur. The main sensitive receptors identified are residential areas and their respective proximity to the centre point of the project site include:

- Wegdraai (~21km south-west);
- Groblershoop (~22km south;,
- Boegoeberg (~40km south-southeast); and
- Upington (~77km west-north-west).

These areas are highlighted because of the aggregation of households at these areas. There are also a number of individual households between the site and these highlighted areas. Additionally, the Bokpoort I solar development has recently been completed and is located in the southern portion of the Remaining Extent of Bokpoort 390.

The air quality baseline[12] within the proposed project area was based on MM5[13] meteorological data from January 2005 to December 2009. The data was modelled to determine the atmospheric dispersion potential of the area. Existing sources of air pollution surrounding the site include the operation of the Bokpoort I site which is limited to vehicles travelling along the gravel access road to the site. Other air pollution sources are from agricultural activities, domestic fuel burning and occasional veld fires. Due to the sparsely populated nature of the area and the short duration times of emissions of air pollutants, the baseline air quality is generally better than the national standards.

In general, the Bokpoort II site experiences neutral (Class D) to stable (Class E) atmospheric conditions (Table 8-5, Figure 8-10). This is expected, given the predominance of a high-pressure anticyclone over South Africa that produces stable, clear conditions.

Table 8-5: Atmospheric Stability Classes (Walton & Thompson, November 2010)

Stability Class	Definition	Description
A	Very unstable	Clam wind, clear skies, hot daytime conditions
B	Moderately unstable	Clear skies, daytime conditions
C	Unstable	Moderate wind, slightly overcast daytime conditions
D	Neutral	High winds or cloudy days and nights
E	Stable	Moderate wind, slightly overcast night-time conditions
F	Very stable	Low winds, clear skies, cold night-time conditions

[12] Air Quality Impact Assessment. Air Quality Unit at SSI Engineers and Environmental Consultants for the Environmental Impact Assessment for a Proposed 75 MW Concentrating Solar Thermal Power Plant and Associated Infrastructure in the Siyanda District, Northern Cape. 2011. DEA Reference number: 12/12/20/1920.

[13] MM5 stands for Fifth-Generation Penn State/ NCAR Mesoscale Model) and is a regional mesoscale model used for creating weather forecasts and climate projections.

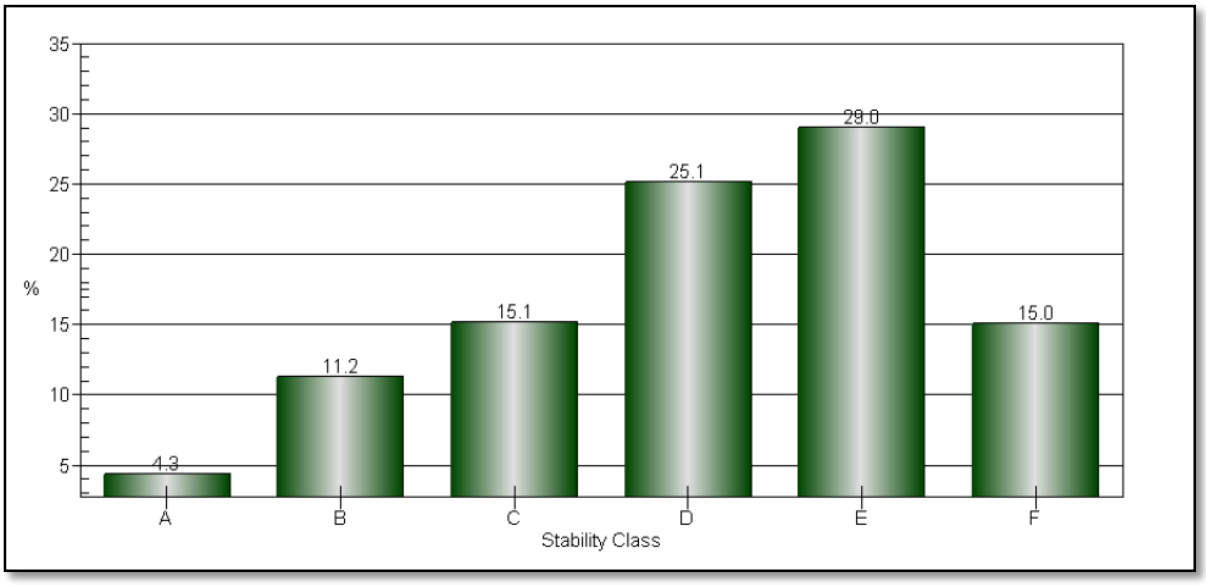


Figure 8-10: Stability class frequency distribution for the project site for the period January 2005 - December 2009 (Walton & Thompson, November 2010)

The analysis of the meteorological data showed that winds originate predominately from the north-north east (10% of the time) and north (9% of the time). Over the monitoring period moderate to fast winds are generally recorded. Winds speeds less than 0.5m/s or calm winds occur infrequently (4% of the time). Diurnal trends in the wind field show that during the day-time (06:00 – 18:00) moderate to fast winds originate predominately from the westerly and northerly directions. During the night calmer winds were reported. Emissions released from the proposed site will likely travel predominately in a south-south-westerly and southerly direction.

8.1.4 Topography

The terrain on the Remaining Extent of the Farm Bokpoort 390 is relatively flat, sloping from 1 110 mamsl in the south-eastern corner to 950 mamsl in the south-western corner over a distance of 5 466 m and from 1030 mamsl in the northern corner to 955 mamsl in the southern corner over a distance of 6 522 m (Figure 8-11).

The larger surrounding area is characterised by elevated areas, ranging between 1 140 and 1 080 mamsl to the north of the site due to the Korannaberg foothills being located in the extreme northern section of the area.

The land slopes gently from the study area towards the Orange River (elevation 860 mamsl) to the south-west over a distance of 12 522 m.

8.1.5 Soil, Land Capability and Land Use

8.1.5.1 Soils

The terrain of the proposed project site is characterised by plains with open low hills or ridges, changing to rolling or irregular plains with low hills or ridges in the extreme north of the site (Lanz, 2016). The slope across the site is less than 2%.

The agricultural and soil assessment conducted by Lanz (2016) identified one predominant land type across most of the site, namely Ae4. The soils of the land type Ae4 are shallow to moderately deep, red, sandy soils overlying hard pan carbonate and sometimes rock. These soils fall into the Calcic and Lithic soil groups according to the classification of Fey (2010). The soils are classified as having low to moderate susceptibility to water erosion and is highly susceptible to wind erosion (Lanz, 2016).

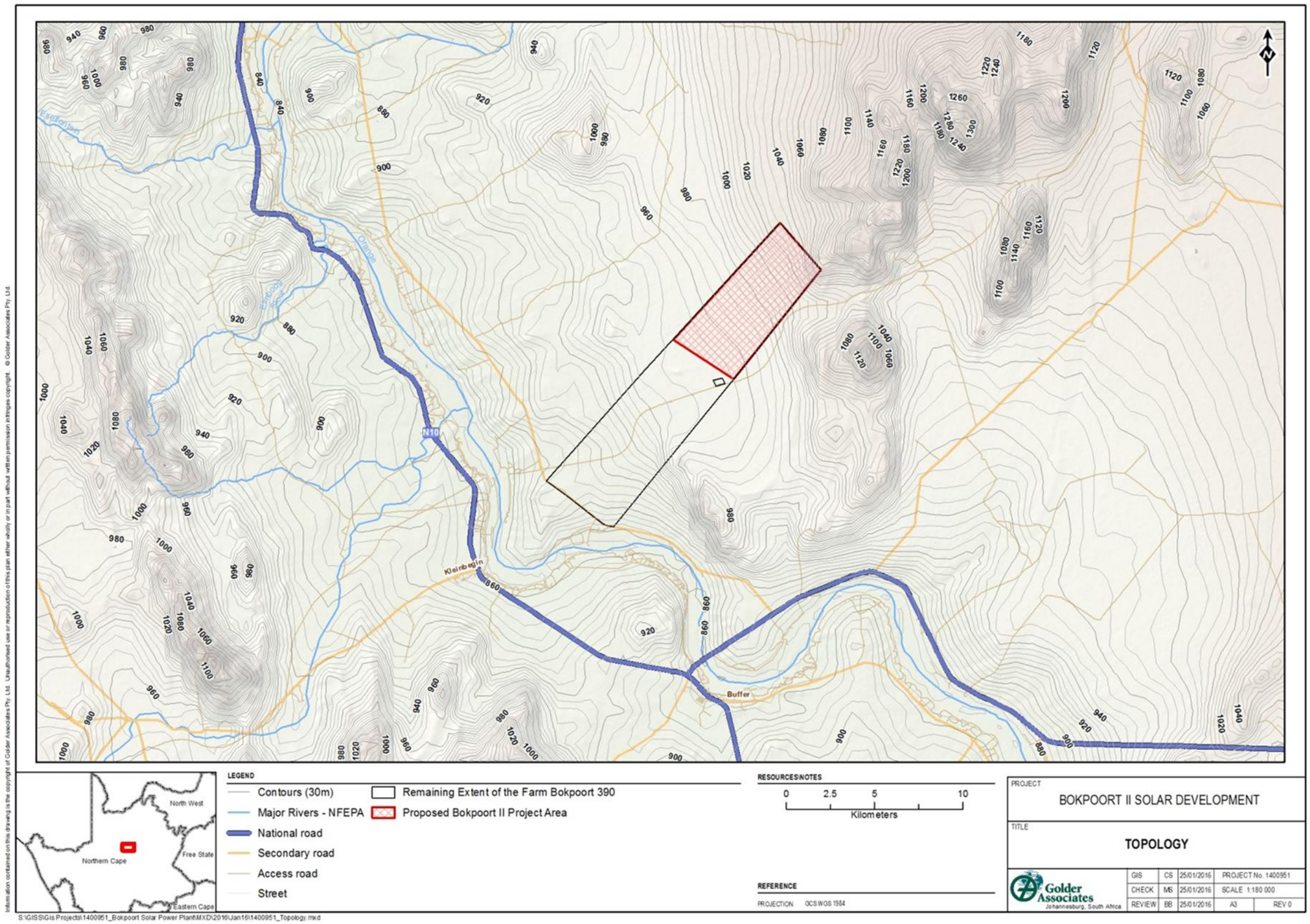


Figure 8-11: Topography of the Project Area

The geotechnical investigation conducted by Moore Spence Jones (2011) states that the project site is underlain by a mantle of transported soils of Quaternary age, of the Gordonia Formation, Kalahari Group. These soils comprise windblown or aeolian sands that are fine grained and generally orange in colour. The sands are known to be very loose to loose to depths of at least 1.5 metres, below which depth they gradually become medium dense to dense. The dune sands are well known for their high collapse potential and the soils frequently contain calcrete boulders, cobbles and gravels, which are formed by the weathering and breakdown of hardpan calcrete (Moore Spence Jones, 2011).

The main characteristics of each of the land types occurring in the project area are given in Table 8-6 and Figure 8-12 (Benedek, F; Roods, M;, February 2011).

Table 8-6: Land types and soil properties

Land type	Dominant Soils	Sub-dominant Soils	Slopes	Agricultural Potential (%)
Af7	**Hu30/33/34** (600-1200 mm), Sa, 58%	***Hu30/31*** (>1200 mm), Sa (dunes), 40% 1-2%	1-2%	H: 0.0 M: 58.0 L: 42.0
Ae4	**Hu33/34** (450-1000 mm), Sa, 42%	***Ms10/22*** (100-250 mm), Sa, 41%	1-2%	H: 0.0 M: 47.0 L: 53.0
Ic4	**Rock, 80%**	***Hu30/Ms10*** (50-250 mm), Sa-LmSa, 11%	4-60%	H: 0.0 M: 8.0 L: 91.0

From the above table and the related map (refer to Figure 8-12), it can be seen that the soils on the Remaining Extent of the Farm Bokpoort 390 consist of mainly red and yellow sands, mostly of the Hutton (Hu) form, with occasional dunes, especially at the Bokpoort I and II sites. There are also smaller areas of shallow lithosols of the Mispah (Ms) and Hutton (Hu) forms, along with rocky areas.

The only areas of high potential land within the project area are the alluvial zones close to the Orange River, where irrigation is practiced.

The land within the project area supports locally indigenous fauna and flora that are adapted to the prevailing conditions. The land is not well suited for agriculture, but is currently used for grazing by sheep and goats (see section 8.1.6).

8.1.5.2 Land Capability

The land capability of the project site has been categorised as non-arable, low potential grazing land ((Lanz, 2016). The limitations on the agricultural capability of the site are mainly climate related. The high variability in rainfall is a very severe limitation to agriculture, which makes any cultivation without irrigation non-viable. The sandy soils present at the project site has very limited water holding capacity. The Agricultural Geo-Referenced Information System (AGIS) indicates the site to have a low grazing capacity rated as 26-30 hectares per large stock unit.

8.1.5.3 Land use and Agricultural Potential

The project site is located within a sheep farming agricultural region and is currently used for grazing (Lanz, 2016).The infrastructure on the site id limited to wind pumps, stock watering points and the fencing around the grazing camps.

The neighbouring property to the south of the project site has been developed for solar power generation. A private game reserve is located to the north of the site.

The land use assessment conducted by Lanz (2016) concluded that, due to the climatic limitations of the area, the site is totally unsuitable for cultivated crops and the viable agricultural land use is limited to grazing only.

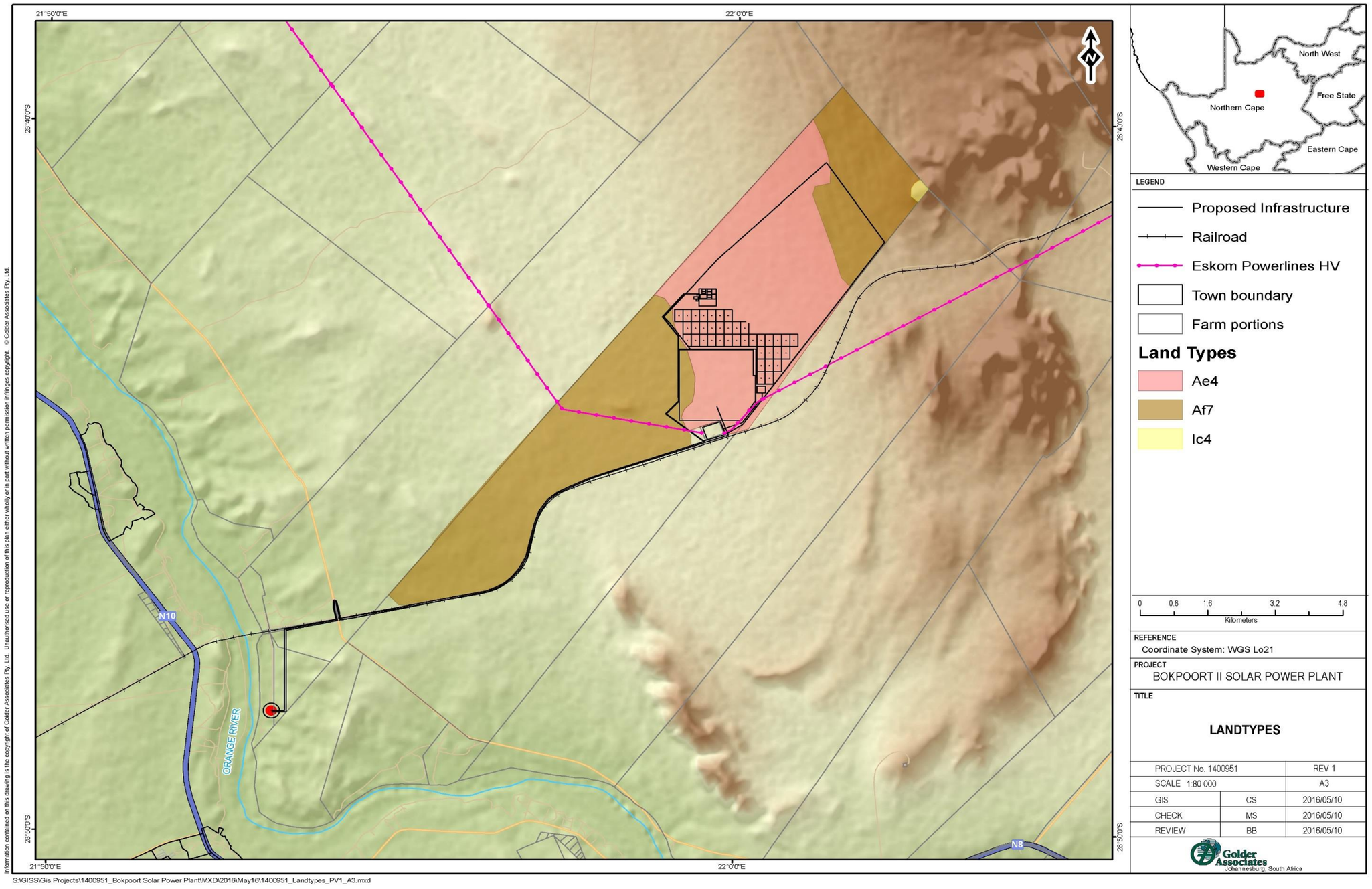


Figure 8-12: Land types identified at the project site

8.1.6 Ecology

An ecological biodiversity baseline and impact assessment study was undertaken between September 2015 and February 2016 (Dower, A; Aken, W, 2016). This section provides a concise summary of the most salient information. Detailed information is presented in the specialist report, which is included in APPENDIX G.

8.1.6.1 Flora

The proposed project site is located in a transitional area that includes elements of both the Savanna Biome and the Nama Karoo Biome. The Savanna Biome is the largest biome in South Africa, covering approximately 35% of the country's land surface. Savannas occur as patch-mosaic landscapes, comprising patches of grassland and scattered trees or closed woodlands. Composition, structure and functioning include fire, a distinct seasonal climate, soil types and browsing/grazing by large herbivores. The Nama Karoo Biome, the second largest biome in Southern Africa, is characterised by plains of dwarf shrubs and grasses, dotted with characteristic rocky outcrops ('koppies'). It is essentially a grassy, dwarf shrubland; the ratio of grasses to shrubs increases progressively until the Nama Karoo merges with the Savanna Biome.

The two main natural vegetation types the area of the Bokpoort II site are Kalahari Karroid Shrubland and Gordonia Duneveld. The pipeline route traverses Bushmanland Arid Grassland and Lower Gariep Alluvial Vegetation.

As shown on (Figure 8-13, Koranna-Langeberg Mountain Bushveld occurs near the north-eastern corner of the site. This area was found to be in pristine condition and, due to the association with steep slopes, it is generally regarded as sensitive.

The project site area is largely untransformed and is currently grazed by sheep and goats. Some areas of over-grazing are evident, most likely as a result of the dry end-of-winter conditions prevailing during the September 2015 field survey. The present ecological status was classified as moderate.

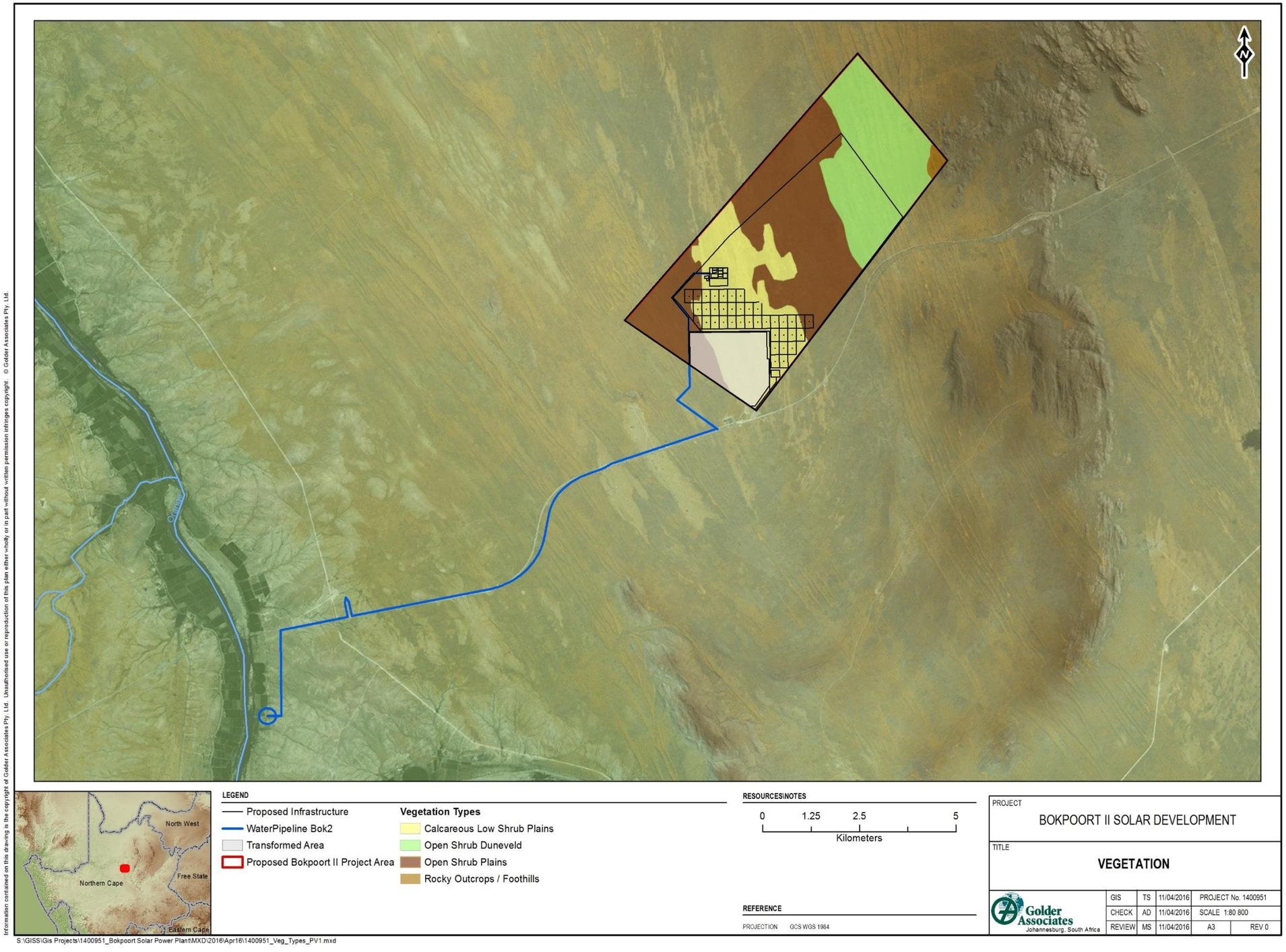


Figure 8-13: Vegetation Classification (Mucina & Rutherford, 2006)

The servitude cleared for the existing pipeline will be used for the proposed additional pipeline and no further vegetation clearing within the servitude is anticipated. The baseline survey included the riparian vegetation of the Endangered (NEMBA) Lower Gariep Alluvial Vegetation type, which may need to be cleared at the new abstraction point. The riparian vegetation adjacent to the abstraction point consists of dense thickets of trees and shrubs with a dense understorey (*Vachellia (Acacia) karroo, Ziziphus mucronata, Rhus lancea, Diospyros ramulosa* and *Lycium cinereum*), as well as stands of reeds (*Phragmites australis)* at the edge of the Orange River. The invasive species *Prosopis glandulosa* was recorded throughout the *Phragmites* reed bed.

The invasive plant species recorded in the project area are listed in Table 8-7 below.

Table 8-7: Declared invasive, exotic flora species recorded in the project area

Species	Family	Threat Status
Prosopis glandulosa	Fabaceae	Category 2 Invader
Rhigozum trichotomum	Bignoniaceae	Declared indicator of encroachment
Acacia mellifera	Fabaceae	Declared indicator of encroachment

8.1.6.2 Fauna

A summary of the fauna species in the project area is presented in the following sections.

Please note that birds are addressed in a separate specialist study report (ARCUS, 2016).

8.1.6.2.1 Mammals

Three bat species were confirmed via active monitoring conducted in 2015 and some unidentified species were also detected (APPENDIX H). The confirmed species and those expected to occur within the region are listed in Table 8-8.

Table 8-8: Bat species confirmed and potentially occurring within the project area

Species	Common Name	Likelihood of occurrence	Conservation Status	Possible roosting habitat on site
Sauromys petrophilus	Roberts's flat-headed bat	**Confirmed**	Least Concern	Roosts in narrow cracks and under slabs of exfoliating rock. Closely associated with rocky habitats. May be roosting in the Koranna-Langeberg Mountain Bushveld
Tadarida aegyptiaca	Egyptian free-tailed bat	**Confirmed**	Least Concern	Roosts during the day in rock crevices, under exfoliating rocks. May be roosting in the Koranna-Langeberg Mountain Bushveld
Cistugo seabrae	Angolan wing-gland bat	Possible	Near Threatened	It is restricted to the arid western parts of southern Africa, typically in desert and semi-desert conditions. Not a common bat
Eptesicus hottentotus	Long-tailed serotine	Possible	Least Concern	It is a crevice dweller roosting in rock crevices, expansion joints in bridges and road culverts
Neoromicia capensis	Cape serotine	**Confirmed**	Least Concern	Roosts under the bark of trees, and inside the roofs of buildings. The Olifantshoek Plains Thornveld may offer such roosting space.

Specific regions were mapped based on the presence of natural habitat features capable of providing bat roosts as well as foraging habitat. Such features include rocky outcrops in the northern region of the project area, certain vegetation types, the presence of riparian/water drainage habitat and the presence of several water tanks at the southern extent of the area, which provide drinking water and habitat for insects. The areas identified as most sensitive to development that could impact on important bat foraging and roosting habitats, plus a 1 km development buffer, are shown on Figure 8-14.

Fifty-one other mammal species potentially occur in the project area. Fourteen of these have been confirmed during several field studies and they are listed in Table 8-9.

Table 8-9: Mammal species recorded within the project area

Scientific Name	Common Name	Conservation Status		
		IUCN – regional Status	NEMBA TOPS List	Northern Cape NCA
Canis mesomelas	Black-backed Jackal	-	-	-
Otocyon megalotis	Bat-eared Fox	-	Protected	Specially Protected
Caracal caracal	Caracal	-	-	-
Atilax paludinosus	Water Mongoose	-	-	Protected
Cynictis penicillata	Yellow Mongoose	-	-	Protected
Galerella sanguinea	Slender Mongoose	-	-	Protected
Hystrix africaeaustralis	Porcupine	-	-	-
Lepus capensis	Cape Hare	-	-	Protected
Lepus saxatilis	Scrub Hare	-	-	Protected
Aonyx capensis	Cape Clawless Otter	-	Protected	Protected
Ictonyx striatus	Striped Polecat	Data Deficient	-	Specially Protected
Mellivora capensis	Honey Badger	Near Threatened	-	Specially Protected
Orycteropus afer	Aardvark	-	Protected	Specially Protected
Pedetes capensis	Springhare	-	-	-

Source: Distributions = Stuart & Stuart (2007);Conservation Status = Friedmann & Daly (2004), NEMBA ToPS List (2013) & (Northern Cape Nature Conservation Act 2009)

8.1.6.2.1 Invertebrates

Invertebrate species previously recorded within the Study Area (BEC, 2010) were restricted to butterflies only, all of them common and ubiquitous species in the region, due to the largely untransformed and non-fragmented nature of the project area.

Two species of conservation concern that were not observed, namely *Alfredectes browni* and *Lepidochrysops penningtoni* could potentially occur within the project area.

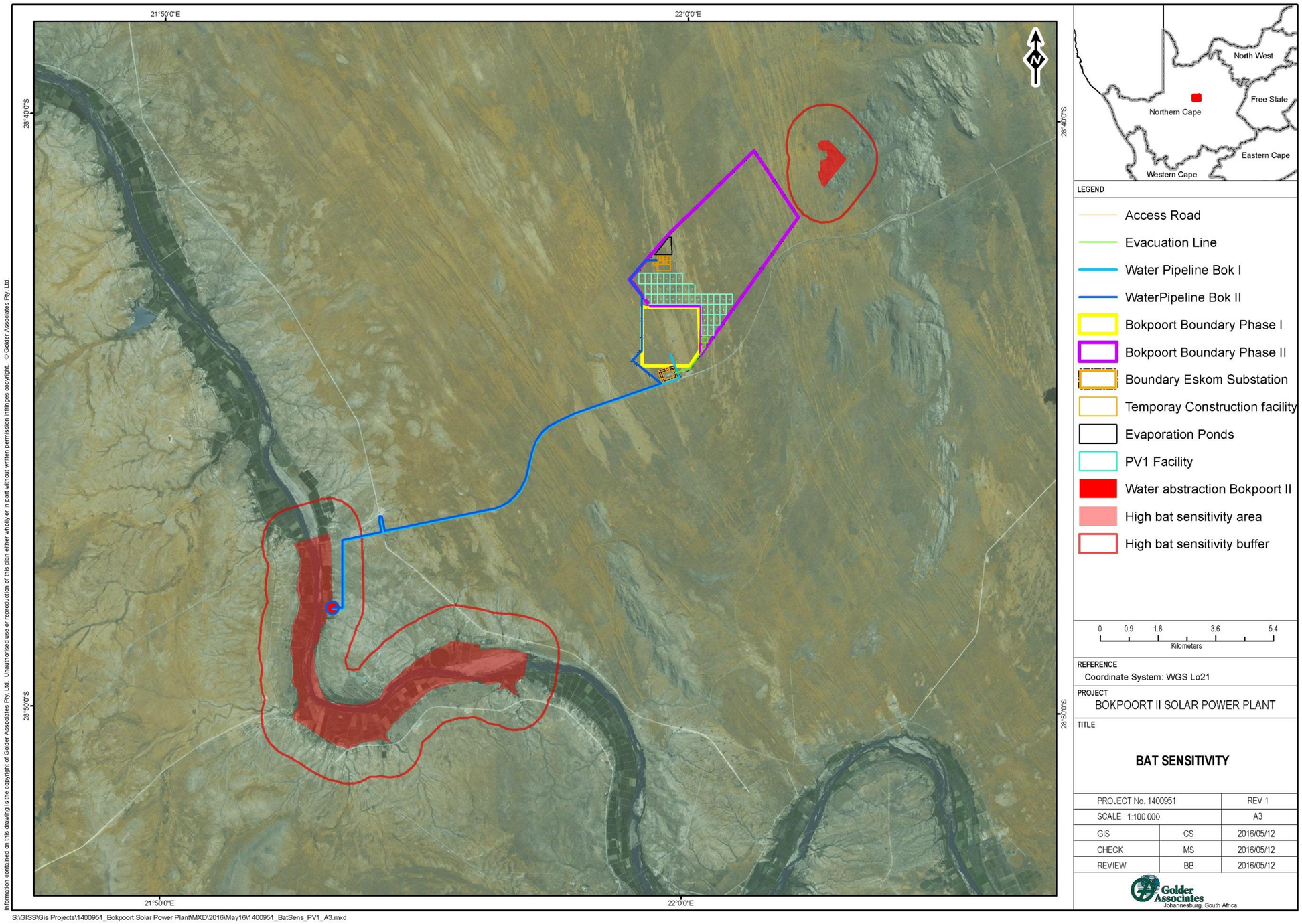


Figure 8-14: Sensitive bat foraging and roosting habitat within the project area

8.1.6.2.2 Herpetofauna – Amphibians and Reptiles

No amphibian species were recorded or reported within the project area to date, but eleven frog species, all of them on the Northern Cape protected species list, are expected to occur in the vicinity of the abstraction point in the Orange River.

Reptiles

About 60 reptile species could potentially occur in the project area. The eight that were observed during previous fieldwork (BEC, 2010) are listed in Table 8-10.

Table 8-10: Reptile species recorded within the project area, and conservation status

Scientific Name	Common Name	Conservation Status		
		NEMBA TOPS List (2013)	Northern Cape-Protected Species (2009)	Endemic Status
Agama atra	Southern Rock Agama	-	-	Near Endemic
Naja nivea	Cape Cobra	-	-	-
Ptenopus garrulus garrulus	Common Barking Gecko	-	-	-
Pedioplanis lineoocellata	Spotted Sand Lizard	-	Protected	-
Trachylepis striata	Striped Skink			
Psammobates oculifer	Serrated tent Tortoise		Protected	-
Varanus albigularis albigularis	Rock Monitor	-	Protected	-
Bitis arietans arietans	Puff Adder	-	-	-

8.1.6.3 Avifauna

An avifaunal baseline assessment was done over a 12 month period and included four seasonal surveys (Pearson, A, May 2016). The initial survey was conducted in the winter between 3 and 11 June 2015, the spring survey between 14 and 21 September 2015 and the summer survey between 7 and 14 December 2015. The final survey was conducted in the autumn during April 2016. This section provides a concise summary of the most salient information. Detailed information is presented in the seasonal progress reports as well as the final impact assessment report, which are included in APPENDIX I.

8.1.6.3.1 Survey Methodology and Survey Design

In order to obtain comparative data, the surveys were undertaken within the broader project area (within the project site and at variable distances from the project site), as well as at a control site (Figure 8-15). The control site is located approximately 6 km to the south-west of the project site. Accessibility and similarity in the predominant habitats to the project site contributed to the selection of the control site.

The survey methodology employed during the site assessment included walked transects, vantage points, driven transects, focal sites and incidental records. The survey methodology was employed on both the project site and the control site.

8.1.6.3.1.1 Walked Transects

Walked transects of 1km in length were undertaken twice during each seasonal survey. This resulted in eight replications of each transect (three on the project site and two on the control site) during the monitoring period. Walked transects provide valuable information on bird populations and densities across the site, with a particular focus on small terrestrial species and passerines.

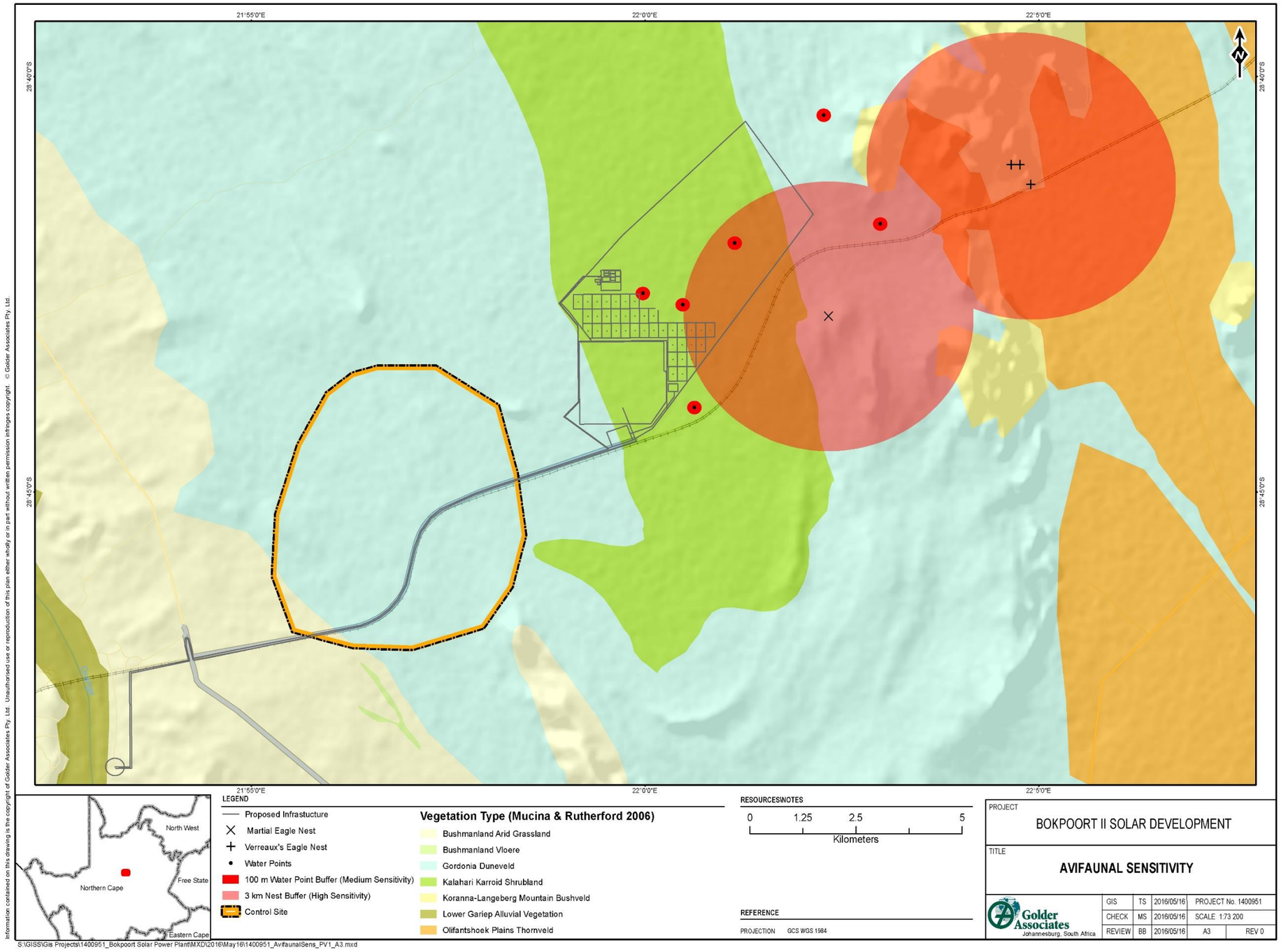


Figure 8-15: Avifauna Sensitivity Zones (Pearson, A, May 2016)

8.1.6.3.1.2 Vantage Points

The season survey included observations from two vantage points on the project site and one on the control site. Observations from the vantage points were conducted by two observers monitoring a viewshed of 360 degrees with a radius of 2.25 km.

8.1.6.3.1.3 Driven Transects

Five driven transect, three in the broader project area and two on the control site, were used to observe target species. Each driven transect was undertaken twice during each seasonal survey, resulting in replications of each transect during the 12 month monitoring period.

8.1.6.3.1.4 Focal Sites

Five focal sites were surveyed in the broader project area and one on the control site. The focal sites were selected on the basis that they had identifiable features within the landscape that are likely to support notable avifauna (e.g. roosting or nesting site) or have the potential to support breeding pairs or large densities of avifauna.

8.1.6.3.1.5 Incidental Records

Incidental observations of target species were made during commuting to or from, or within the broader project area and control site. These survey were made outside the survey protocols and time described in Sections 8.1.6.3.1.1 to 8.1.6.3.1.4.

8.1.6.3.2 Survey Results

During the four seasonal surveys a total of 103 positively identified species were recorded in the broader project area of which 89 were recorded in the project site. Seventy species were identified on the control site, the majority corresponded with the project site. Ninety-one species were identified during incidental observations in close proximity to the Orange River Valley. A total of 145 species, of which 19 are priority species and 8 are South African endemic or near endemic species, were identified over the four seasonal surveys on the project site, the broader project area, control site and the Orange River Valley.

Large seasonal variations in the composition of the bird community often occur in an arid environment. However, this was not evident for this area, possibly due to the relatively dry conditions that prevailed during the monitoring period. Therefore some species may not have been present during the monitoring period (or were present in lower numbers). Open artificial water sources attracted large numbers of doves and sandgrouse, particularly in the morning and early evening.

Refer to the seasonal survey reports and the final impact assessment report (APPENDIX I) for the detail of the species observed as well as the detailed results of the various methods employed.

8.1.6.3.2.1 South African Endemic or Near-endemic Species

Of the eight South African endemic or near endemic species[14], six were recorded on the project site and two were only recorded in the Orange River Valley.

Table 8-11: South African Endemic or Near-endemic Species

Species	Broader Project Area	Project Site	Control Site	Orange River Valley
Buzzard, Jackal	x	x		
Canary, Black-throated	x	x	x	
Chat, Sickle-winged	x	x		
Flycatcher, Fiscal	x	x	x	x
Lark, Black –eared Sparrow-	x	x		
Thrush, Karoo	x	x		
Warbler, Namaqua				x

[14] Endemic or Near-endemic (i.e. ~70% or more of population in RSA) to South Africa according to the BirdLife South Africa Checklist of Birds in South Africa, 2014.

Species	Broader Project Area	Project Site	Control Site	Orange River Valley
Weaver, Cape				x

8.1.6.3.2.2 Red Data Species

Nine regionally red data species were confirmed during the four seasonal surveys in the broader project area (Table 8-12).

Table 8-12: Regionally Red Listed Species Identified in the Broader Project Area and the Control Site.

Species	Red Data Status (Taylor, 2015)	Broader Project Ara	Project Site	Control Site
Martial Eagle	Endangered	x	x	x
Lappet-faced Vulture	Endangered	x	x	
Ludwig's Bustard	Endangered	x	x	
Verreaux's Eagle	Vulnerable	x	x	
Lanner Falcon	Vulnerable	x	x	x
Burchell's Courser	Vulnerable	x	x	
Double-banded Courser	Near-threatened	x	x	
Karoo Korhaan	Near-threatened	x		x
Kori Bustard	Near-threatened	x	x	x

8.1.6.3.2.3 Avifaunal Sensitivity Zones

Three avifaunal sensitivity zones have been identified in the broader project area from the data obtained during the four seasonal surveys.

High Sensitivity Zones

The nesting sites of the Martial Eagles and Verreaux's Eagles identified in the broader study area are classified as high sensitivity zones (Figure 8-15). The nesting sites include two inactive Verreaux's Eagle nests, one active Verreaux's Eagle nest and one active Martial Eagle nest. The high sensitivity zone is determined as a 3 km radius around each of these nests.

Medium Sensitivity Zones

Medium sensitivity zones have been identified in the broader study area which are currently important for avifauna either by supporting important species and/or that support a high abundance of birds at certain times. Two types of medium sensitivity zones identified are related to gravel plains which support important species such as coursers and bustards and a 100 m radius around artificial water points.

Undetermined Sensitivity Zones

The undetermined sensitivity zones encompass the remaining areas of the project site that don't show any obvious avifaunal features, patterns or sensitivities and are preferred for infrastructure placement. However, taking into consideration the general avifauna of the area and broader project area, as observed during the four seasonal surveys, these zones could likely be considered as being of moderate sensitivity (Pearson, A, May 2016)

8.1.6.4 Aquatic Ecosystems

The Orange River has been prioritised as a National Freshwater Ecosystem Priority Area (NFEPA). The baseline description of aquatic ecosystems focuses on the point in the Orange River where the abstraction point for this project will be located.

Both the flow regime and the water quality along the entire Orange River system have been severely impacted upon by extensive upstream infrastructural developments and agricultural practices. Eutrophic conditions are evident along the Lower Orange River.

Systems with a large diversity of habitat, good water quality and varying flow velocities often support a great diversity and abundance of aquatic macro-invertebrates. The lower Orange River is characterised by low numbers of aquatic macro-invertebrate species, which is in part attributed to its biogeographic isolation and vulnerability to change, it is classified as representing a moderately modified state (Class C).

During a baseline aquatic assessment previously conducted (Enviross, 2010) at the abstraction point for this project the Integrated Habitat Assessment System (IHAS) indicated good habitat availability. This was attributed to a diversity of habitat biotopes for macro-invertebrates, namely Stones-In-Current (SIC), Vegetation (Veg) and sand, gravel and mud (GSM) being available at the proposed site. The aquatic macro-invertebrate community structures were considered to be representative of natural conditions.

A total of 13 indigenous fish species are expected to occur within the study area, which includes the Near Threatened *Labeobarbus kimberleyensis* (Vaal-Orange Largemouth Yellow fish) (IUCN, 2016).

The numerous migratory barriers (weirs) that have been constructed at water abstraction points have a severe impact on the abundance and diversity of fish species in the river. Flow volumes, velocities and water quality are being compromised by infrastructural developments along the river banks, namely abstraction points and hydro-electrical plants, affecting the spawning habitats of the fish.

8.1.6.5 Ecosystems of Conservation Concern

Ecosystems of conservation concern include those identified by NEMBA as endangered, those considered to be ecologically pristine, and those that support species of conservation concern.

The ecosystems of conservation associated with the Bokpoort II project include the following:

- The **rocky outcrop** in the northern corner of the project area associated with the Koranna-Langeberg Mountain Bushveld Vegetation type – as well as having an intact ecological integrity in terms of vegetation community composition, it supports roosting bat species; and
- The **riparian habitat** along the Orange River – this area supports the endangered vegetation type Lower Gariep Alluvial Vegetation, and is an important ecological corridor in the landscape.

8.1.7 Ecosystem Services

A healthy, balanced ecosystem provides essential, interdependent life-sustaining services to all organisms on Earth, including humans, who also have the capacity to derive personal aesthetic enjoyment from nature. Such services are experienced at a local, regional and global scale.

The International Finance Corporation's (IFC) Performance Standard 6 - Biodiversity Conservation and Sustainable Management of Living Natural Resources (PS6) (IFC, 2012a), and its Guidance Notes (IFC, 2012b) - defines ecosystem services as **the benefits that people, including businesses, derive from ecosystems**. The IFC define two types of ecosystem services:

- **Type I Ecosystem Services**: Ecosystem Services on which the Project operations are most likely to have an impact and, therefore, which result in adverse impacts to ***affected communities*** (beneficiaries); and
- **Type II Ecosystem Services**: Ecosystem Services on which ***the Project*** is directly dependent for its operations, for example, water.

An analysis of the ecosystem services relevant to the PV1 solar facility project was undertaken (Dower, A; Aken, W, 2016) and is summarised in this section.

Construction of the project infrastructure on the footprint area of 250 ha will cause land cover changes and associated loss of supply of ecosystem services for the life of the project, which could be in excess of 30 years. It will also have a visual impact, from distances of 10 km and further away.

One priority Type I ecosystem service that could be adversely affected by the project was identified:

- Soil stability & erosion control: Droughts and future effects of climate change could increase the likelihood of desertification encroachment in this region. Vegetation removal for site clearance could create a 'nick point' for erosion to take hold.

Two priority Type II ecosystem services in terms of project dependence were identified:

- Fresh water supply: The project is dependent on a constant supply of 0.025 million m^3 of fresh water throughout its lifetime. Climate change and the cumulative impact of abstraction by other projects could affect water availability in future;
- Soil stability & erosion control: Climate change modelling indicates that rainfall will become more variable and the western parts of South Africa are likely to become drier and hotter. (http://media.csag.uct.ac.za/faq/qa_3impacts.html). More frequent and/or more prolonged periods of drought could increase the likelihood of desertification encroachment in this region. Dealing with increased soil erosion within the project footprint and higher ambient temperatures could have cost implications for the project.

8.1.8 Surface Water

A surface hydrology study was undertaken during 2015 (Dateling, J; Boyd, L;, 2016).

8.1.8.1 Regional surface water

The proposed Bokpoort II Solar Development project is situated in the in the D73D quaternary catchment in the Lower Orange Main Stem Catchment (116539) within the Orange Water Management Area (WMA). The catchment is still largely undeveloped, with limited water resources and water uses. The area of quaternary is 4291 km^2 (gross area). The area of the development is 24 km^2, or 0.56% of the catchment.

Figure 8-16 shows the catchment area and the localities map of the local weather stations.

8.1.8.2 Water Quality

The Department of Water and Sanitation (DWS) has not undertaken Water Resource Classification in the Orange River yet, but the water quality at monitoring points D7H8, upstream of the site and D7H5, downstream of the site at Upington, has been compared against the Resource Water Quality Objectives (RWQO) that were developed as part of the Water Resources Planning project for the Upper and Lower Orange River in 2009 (DWAF, 2009). The water quality at both points is generally good, but slightly alkaline and the nitrate and orthophosphate concentrations exceed the limits that could lead to eutrophication.

Table 8-13: Water quality in Orange River at DWS monitoring points compared against interim RWQOs

Parameter	Units	Interim RWQO*	Upstream (D7H8)			Downstream (D7H5)		
			5	50	95	5	50	95
pH		7.1-8.4	7.26	8.13	8.55	7.19	8.14	8.45
Electrical Conductivity	mS/m	70	18.47	26.40	47.64	21.10	32.30	55.83
Total Dissolved Solids	mg/L	400	145.00	197.22	317.46	151.95	228.00	374.19
Calcium	mg/L	80	18.50	23.70	33.75	19.24	25.71	35.69
Chloride	mg/L	100	5.00	13.49	40.93	7.68	17.85	48.09
Fluoride	mg/L	0.7	0.12	0.20	0.34	0.16	0.23	0.41
Potassium	mg/L	15	1.26	1.92	4.26	1.40	2.24	4.29
Magnesium	mg/L	30	6.87	9.70	16.89	7.26	11.40	20.67
Sodium	mg/L	70	7.20	13.50	33.44	9.44	18.10	44.14
Ammonia	mg/L	0.015	0.02	0.04	0.12	0.02	0.03	0.11
Nitrate	mg/L	0.2	0.02	0.24	0.67	0.02	0.18	0.81
Orthophosphate	mg/L	0.02	0.01	0.02	0.06	0.01	0.02	0.08
Silica	mg/L	20	3.22	6.80	8.55	2.60	6.71	8.63

Parameter	Units	Interim RWQO*	Upstream (D7H8)			Downstream (D7H5)		
			5	50	95	5	50	95
Sulphate	mg/L	80	7.21	20.10	59.61	8.60	23.90	64.65
Total Alkalinity	mg/L	300	73.70	92.20	113.76	70.47	104.70	139.27

*the stricter of the RWQOs set at the two points has been chosen

The Orange River's water quality is categorised as Moderately Transformed (Class C) due to existing agricultural activities along the river banks. The Orange River's major inflow of water is from the Vaal River which has high nutrient levels which sometimes result in algal blooms. Slow water flow rates also cause siltation and turbidity of the water which leads to water quality degradation within the river.

8.1.8.1 Surface water in project area

The Orange River is the predominant perennial surface water feature in the vicinity of the proposed development. This section of the river falls in the Lower Orange Water Management Area (LOWMA). The banks of the Orange River are used extensively for irrigated agriculture.

There are no areas of permanent surface water present on the proposed Bokpoort II site. Satellite imagery indicates some ephemeral drainage lines in the southern part of the site, which are only expected to flow after high rainfall. The ground falls very gently towards the south-west, with the slope on the site ranging from 0.3/100 to/100.

There are no significant wetlands, estuaries, Ramsar Sites or major dams present within the immediate vicinity of the proposed site. One seasonal pan occurs approximately 3km north of the Garona Substation and the Bokpoort I EIA indicated a 200m 'no development area' buffer demarcated around the pan. The smaller riparian systems in the region are impacted by livestock where natural habitats are grazed intensively.

A water pump will be installed in the Orange River to extract water for the proposed Bokpoort II development.

8.1.9 Groundwater

The geology of the project area consists of unconsolidated sediments (sand, clay and minor gravel beds) of the Kalahari Group, overlying muscovite quartzite and schist of the Prynnsberg Formation (Brulpan Group).

The thickness of the overlying Kalahari Group is probably <65 m. The area is covered by secondary limestone (Mokalanen Formation) and younger aeolian sand (Gordonia Formation).

The average water level in the Bokpoort area is ~60 mbgl, thus it is expected that the Kalahari Group Aquifer is not present in the area (no Kalahari saturation).

The average borehole yields (as per the national Borehole Yield Classification) fall in the 0.1 to 0.5 l/s range. The aquifer system is mapped as a fractured system with an insignificant yield. The water quality is reported as Class 1 and 2 (mapped electrical conductance: 70 to 300 mS/m (salinity range from ~450 to ~1950 mg/l); although the borehole hydrochemistry data indicates that even higher salinities occur in the area.

The aquifer vulnerability in the Bokpoort area is expected to be "low" to "insignificant" due to the low yields, naturally poor water quality and depth of the water levels (>50 mbgl).

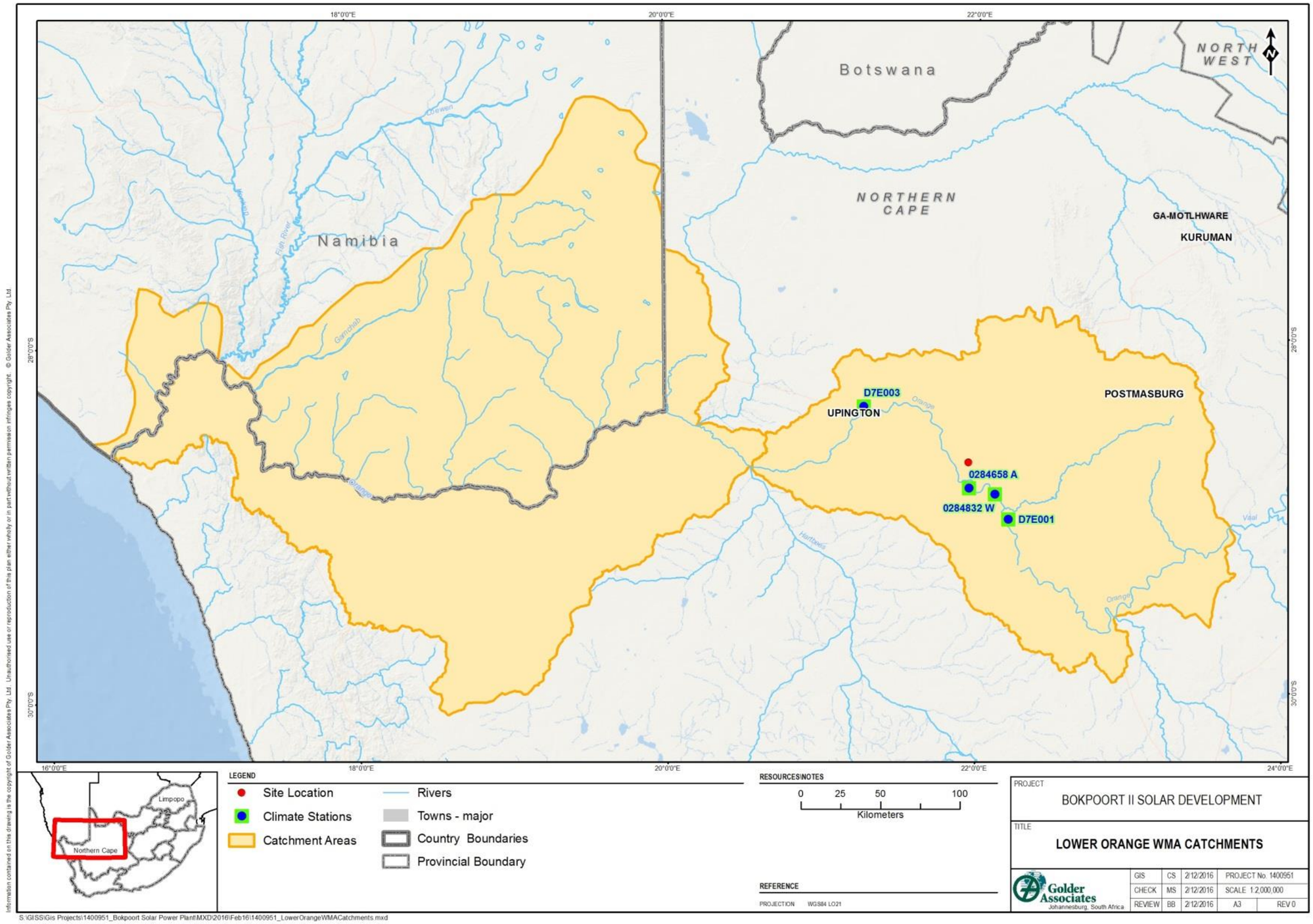


Figure 8-16: Lower Orange Main Stem catchment area

8.1.9.1 Background information sourced from literature

Groundwater Consulting Services (Pty) Ltd (GCS) was appointed by Bohlweki-SSI to undertake a geo-hydrological impact assessment for the proposed Bokpoort I CSP plant on the Farm Bokpoort 390 during May 2010 (APPENDIX L). The aim of the assessment was to assess the baseline groundwater conditions for the local aquifer system and to determine the likely risks to the groundwater environment (Benedek, F; Roods, M;, February 2011).

During the compilation of the 2010 geo-hydrological impact assessment, a desk study was conducted which involved the review of available geological and hydrogeological literature, which included aerial photos, topographical sheets, geological and hydrogeological maps. Information on existing boreholes and groundwater use in the area was sourced from the National Department of Water and Sanitation.

8.1.9.2 General Geology and Aquifer Type

As discussed in Section 8.1.1, the general geology of the site comprises mainly red-brown, coarse-grained granite gneiss and quartz-muscovite schists, quartzite, quartz-amphibole schists and greenstones of the Groblershoop formation, Brulpan group. Calcrete is also present, especially in the south-eastern part of the area (Dindi & Troskie, 2010).

The hydrogeological map of the area indicates that the fractured aquifer type occurs in the area. The yield from the local aquifers ranges from 0.1 to 0.5 l/s (Dindi & Troskie, 2010).

8.1.9.3 Hydrocensus

A hydrocensus survey was done to establish the extent of groundwater use in the project area. GCS (2010) visited the farmers and the villages to locate any production boreholes that might be used for water supply. The results of the hydrocensus indicated that the communities living on the farms in the vicinity of the project area rely on municipal water for domestic water supply. The farms located on the southern side of the area get water from the Orange River. The river water requires some treatment before it is ready for domestic use. Groundwater use increases on the farms located further away from the river. Groundwater abstraction on the farms is mainly used for domestic purposes and animal (cattle and sheep) farming. Most of the boreholes are equipped with hand pumps. Table 8-14 provides a summary of the data collected during the survey. Figure 8-17 illustrates the location of the boreholes assessed during the hydrocensus survey. Water level measurements could not be taken at the farm boreholes. However, the use of windpumps in the boreholes indicates that the water level is not very deep. The pH levels ranged from 7.36 to 8.06 and the Total Dissolved Solids (TDS) ranged from 420 to 490 mg/l (Dindi & Troskie, 2010).

8.1.9.4 National Groundwater Database

GCS (2010) obtained borehole and groundwater data from the Department of Water Affairs and Sanitation's (DWS) National Groundwater Database (NGDB). Six boreholes from the data obtained plotted within a 2 km radius around the boundaries of the farm Bokpoort 390. The NGDB data indicated that the average water level in the existing boreholes is 41.88m below ground level. It was established during the hydrocensus survey that the boreholes on the surrounding farms are also equipped with windpumps and are used for stock watering. Groundwater is the sole source of water on these farms, but use is at a small scale in general (Dindi & Troskie, 2010). Figure 8-17 illustrates the location of the NGDB boreholes in the project area.

8.1.9.5 Groundwater Quality

GCS (2010) collected three groundwater samples from the boreholes and submitted them to M&L Laboratory in Johannesburg for chemical analysis. The certificates of analysis are appended to the Hydrogeological Baseline Assessment in 0. A database was established, by GCS (Pty) Ltd, in AQUABASE (database system for the storage and retrieval of surface water and groundwater related data developed by VSA Earth Resources Consultants (Pty) Ltd) and Microsoft Excel in which data was captured for storage and analysis.

Results of the chemical analysis were compared with the DWS (formerly DWAF) South African Water Quality Guidelines for Domestic Water Use and the SABS Standards. The results of the analysis and comparison with the DWS Guideline limits are summarised in Table 8-15. Values that exceeded the DWS limits are highlighted in colour as assigned to water quality classes by the DWS.

The results from the groundwater analysis indicate that the groundwater in the area contains elevated levels of electrical conductivity. The dominant cations in two of the sampled boreholes (Borehole 2 and Borehole 5) were sodium and calcium and the dominant anions were chloride and sulphate. The samples also contained a high concentration of nitrate. Borehole 3 had water of good quality with all the determinants falling in class 0 of the DWS standards. The groundwater was concluded to be of the $Ca/MgHCO_3$ to $CaMg/SO_4$ type (Dindi & Troskie, 2010).

8.1.9.6 Aquifer Classification

GCS (2010) states that the local aquifers can be classified as minor, according to Parsons' Aquifer Classification system, due to the limited use of groundwater in the area as well as the quality of the groundwater (Dindi & Troskie, 2010).

Table 8-14: Data obtained from hydrocensus survey (Dindi & Troskie, 2010)

Site ID	Farm Name	S Coordinates	E Coordinates	Equipment	pH	TDS (mg/l)	Use	Comments
BH1	Sand Draai 391	28.78569	21.89017				Unused	Borehole located next to a farm worker's house. The windpump is broken. The hole is blocked with stones.
BH2	Rooilyf 389	28.81411	21.94856	Wind pump	8.06	490	Domestic	Borehole located next to a farm dwellers' village along the Loop 16 gravel road.
BH3	Bokpoort 390	28.73536	21.97234	Submersible pump	7.36	420	Domestic	Borehole located west of the farm house. Water is used in two farm owners' houses and in the farm workers' village.
BH4	Bokpoort 390	28.72458	21.9926	Wind pump			Stock watering	Borehole located on a flat area within the game farm.
BH5	Bokpoort 390	28.71084	21.9999	Wind pump			Stock watering	Borehole located on a flat area on a goat and sheep farm. Water is pumped into two concrete tanks for stock watering.
BH6	Bokpoort 390	28.7692	21.93741	Wind pump			Stock watering	Borehole located on a flat area on a goat and sheep farm. Water is pumped into two concrete tanks for stock watering.
BH7	Rooilyf 389	28.79907	21.96237	Wind pum			Stock watering	Borehole located on a sheep farm. Currently unused because there are no sheep on the farm.

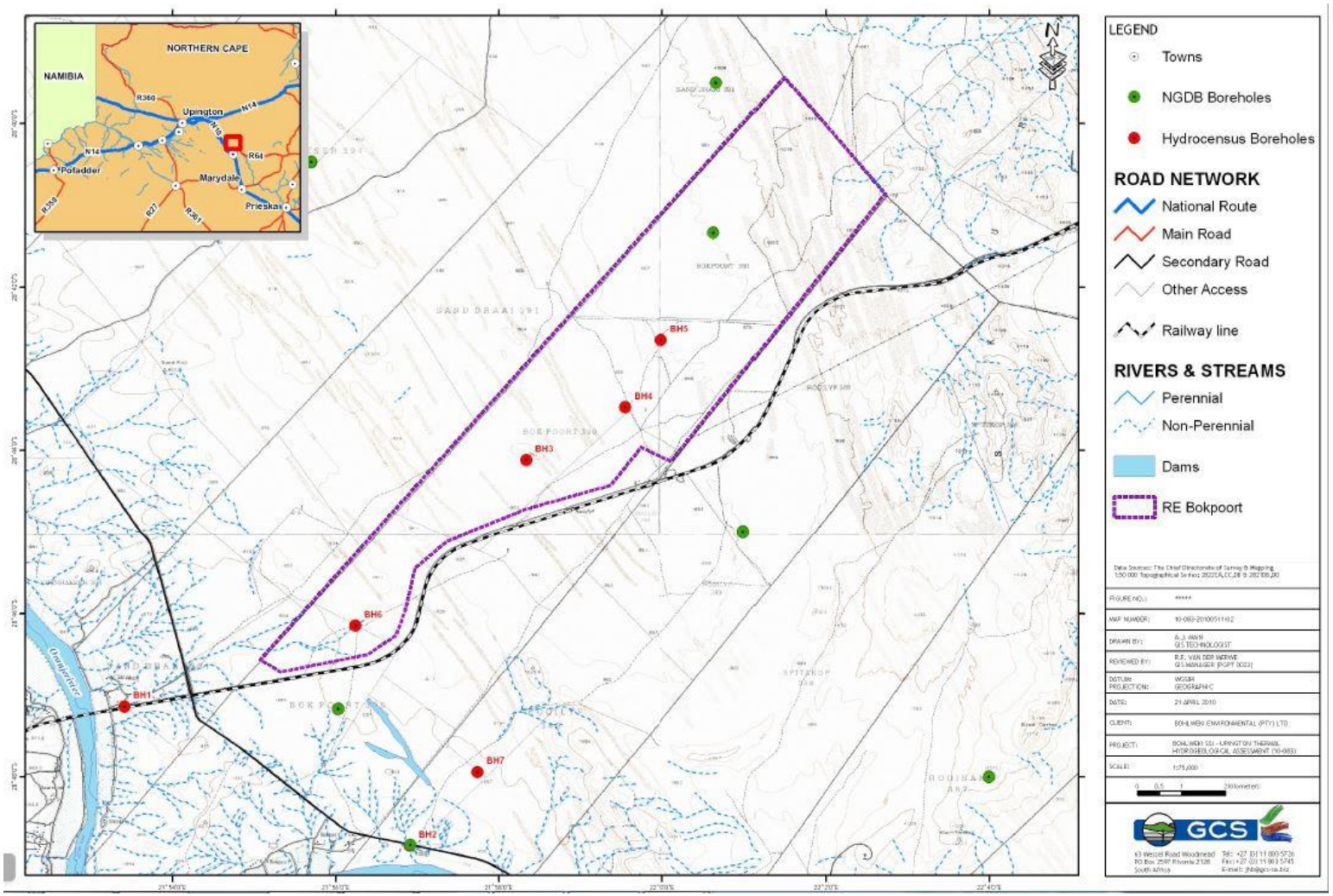


Figure 8-17: Location of Hydrocensus Survey Boreholes (Dindi & Troskie, 2010)

Table 8-15: Groundwater Analyses

Sample ID	Sample Date	pH	EC	Na	K	Mg	Ca	Mn	Fe	Cl	SO_4	NO_3 as N	NO_3	T-Alk	HCO_3
BH2	13/04/2010	7.8	243	259	3.1	82	175	<0.001	0.001	314	266	26	113	501	611
BH3	13/04/2010	8.1	37.9	28	4	11.9	30	<0.001	<0.001	28	46	0.3	1.4	101	123
BH5	13/04/2010	7.9	153	104	12.3	68	123	<0.001	<0.001	155	69	22	96	482	588

ID	pH	EC	Na	K	Mg	Ca	Mn	Fe	Cl	SO_4	NO_3 as N
Class 0 Limits	5 - 9.5	70	100	25	70	80	0.1	0.5	100	200	6
Class 1 Limits	4.5 - 10	150	200	50	100	150	0.4	1	200	400	10
Class 2 Limits	4 – 10.5	370	400	100	200	300	4	5	600	600	20
Class 3 Limits	3 - 11	520	1000	500	400	>300	10	10	1200	1000	40
Class 4 Limits	3 - 11	>520	>1000	>500	>400		>10.0	>10.0	>1200	>1000	>40

Quality of Domestic Water Supplies, DWA&F, Second Edition 1998	
Class 0	**- Ideal water quality** – Suitable for lifetime use.
Class 1	**- Good water quality** – Suitable for use, rare instances of negative effects.
Class 2	**- Marginal water quality** – Conditionally acceptable. Negative effects may occur in some sensitive groups.
Class 3	**- Poor water quality** – Unsuitable for use without treatment. Chronic effects may occur.
Class 4	**- Dangerous water quality** – Totally unsuitable for use. Acute effects may occur.

South African Water Quality Guidelines, Volume 1: Domestic Use, DWA&F, First Edition 1993 & Second Edition 1996	
NR	**- Target water quality range** – No Risk.
IR	**- Good water quality** – Insignificant risk. Suitable for use, rare instances of negative effects.
LR	**- Marginal water quality** – Allowable low risk. Negative effects may occur in some sensitive groups.
HR	**- Poor water quality** – Unsuitable for use without treatment. Chronic effects may occur.

8.1.10 Noise

The existing baseline noise sources[15] at the project area include:

- Commissioning and operational activities at the Bokpoort I solar development (e.g. vehicular traffic, workers at work);
- Traffic on the access roads to the Remaining Extent of the Farm Bokpoort 390 (Transnet service road);
- Railroad traffic on the Saldanha-Sishen line which runs through the centre of the Farm Bokpoort 390;
- Eskom Garona Substation;
- Noise from general farming operations; and
- Fans from refrigeration units at various wineries.

Sensitive receptors are located primarily in residential areas as indicated in section 8.1.3.

The project area is remote and sparsely populated. It is located away from the main roads and other farms along the banks of the Orange River and so the baseline noise levels are low, typical of a rural/agricultural noise environment. Noise climates are degraded in areas close to the National Road N10 and National Road N8/Road R64 as well as near the Sishen railway line. The nearest settlements are Groblershoop and Wegdraai which experience noise levels typical of urban areas. The existing residual noise climate throughout the study area is typical of a rural/agricultural environment as defined in SANS 10103:2008, that is, an area where ambient noise levels generally do not exceed 45dBA during the day and generally do not exceed 35dBA during the night-time.

8.1.11 Visual Aspects

A specialist study on the visual aspects of the study area and the visual impact of the project within the context of the study area was undertaken (Ramsaroop, P; Bothma, J, 2016).

8.1.11.1 Visual Resource Value

The project area is located within the Kalahari variation of the Savanna Biome and is densely covered by grass, shrubs and trees. The area slopes toward the Orange River in a south-eastern direction. The project area is relatively flat, with parallel dunes and lowlands in the northern part and irregular plains in the southern part. A portion of the Korannaberg foothills occurs on a small section of the extreme northern part of the site, which is characterized by boulders, high slopes and mountainous topography. The elevation of the project site ranges from the highest point of 1 110 m located at the southeast corner of the Remaining Extent of the Farm Bokpoort 390, to the lowest point of around 950 m on the northern end of the Bokpoort farm.

The surrounding area is dotted with farm houses. There is an informal settlement about 14 km to the south-west and the nearest town is Groblershoop, approximately 20 km to the south-east of the site. The Kalahari Oryx game farm and lodge, which offers a high end wilderness and hunting experience, is located on Portion 4 of the Farm Bokpoort 390 to the north-west of the proposed Bokpoort II PV1 site. There are a number of farmsteads alongside the Orange River to the west, south and south-east of the site.

The Korannaberg foothills in the extreme northern section of the study area forms part of the Koranna Mountain Range extending into the eastern Free State and leading up to Lesotho. This range consists of sandstone ravines and rolling grasslands and it is frequented by tourists due to its high scenic appeal.

[15] Noise Impact Assessment. Jongens Keet Associates using specialists Mr Derek Cosijn and Dr Erica Cosijn. 2010. For the Environmental Impact Assessment for a Proposed 75 MW Concentrating Solar Thermal Power Plant and Associated Infrastructure in the Siyanda District, Northern Cape. 2011. DEA Reference number: 12/12/20/1920.

Several small towns occur intermittently along the N10 national road between Groblershoop and Upington to the north of proposed the project site.

The visual resource value of the area was determined in accordance with the criteria listed in Table 8-16 and within the context of the current land use of nearby properties that serve the tourism industry.

Table 8-16: Criteria for determining visual resource value

Visual resource value	Criteria
High (3)	Pristine or near-pristine condition, little to no visible human intervention visible, characterised by highly scenic or attractive natural features or cultural heritage sites with high historical or social value and visual appeal. Contains areas that exhibit a strong positive character with valued features that combine to give the experience of unity, richness and harmony. These are landscapes that may be considered to be of particular importance to conserve and which may be sensitive to change.
Moderate (2)	Partially transformed or disturbed landscape, human intervention visible but does not dominate view, or is characterized by elements that have some socio-cultural or historic interest but that are not considered to be visually unique. Scenic appeal of landscape partially compromised by noticeable presence of incongruous elements or areas that exhibit positive character but which show evidence of degradation/erosion of some features resulting in areas of more mixed character. These landscapes are less important to conserve, but may include certain areas or features worthy of conservation.
Low (1)	Extensively transformed or disturbed landscape, human intervention is visually intrusive and dominates available views. Scenic appeal of landscape greatly compromised by visual prominence of widely disparate or incongruous land uses and activities/. Areas generally negative in character with few, if any, valued features. Scope for positive enhancement frequently occurs.

The visual resource value of the study area can be summarised as follows:

- Topography: The more prominent landforms (dunes, rocky areas, valleys, foothills, Orange River floodplains) are visually distinctive and likely to have a relatively high visual resource value;
- Hydrology: The Orange River, about 12 km away, is the predominant perennial surface water feature in the area. There are some ephemeral drainage lines in the southern part of the proposed site that contain flowing water only during periods of exceptionally high rainfall. There are no significant wetlands, estuaries, Ramsar Sites or major dams present within the immediate vicinity of the proposed site. One seasonal pan occurs approximately 3 km north of the Garona Substation. The visual resource value of the hydrological features in the study area is therefore relatively low;
- Vegetation cover: The area of the proposed site is covered in grass, dense shrubs and small trees. Few visually distinct groupings of vegetation occur. Construction of the Bokpoort I solar facility has removed vegetation from that site on the adjacent farm. The visual resource value of vegetation cover in the study area is rated as moderate; and

- Land use: Current land use on the Remaining Extent of the Farm Bokpoort 390 consists of domestic livestock grazing (cattle, sheep and game) and the Bokpoort I Solar facility.

  Land use in the wider study area includes agricultural activities within the Orange River floodplain and surrounding areas as well as game farming and tourism facilities. The agrarian landscape character has a specific sense of place which is expected to appeal to most viewers, and is therefore considered to be of high resource value.

The overall visual resource value of the study area (8) is rated as ***moderate***, but containing elements of high resource value, most notably the neighbouring property, which is part of the Kalahari Oryx game farm which operates as a high-end game viewing and hunting farm and lodge.

Areas of high visual resource value occur to the north of the study area at a distance greater than 40 km along the Korannaberg foothills and mountain range, where the pronounced topography, greater occurrence of indigenous vegetation and lower levels of landscape transformation create greater visual variety and interest.

8.1.12 Sites of archaeological and Cultural Significance

The Northern Cape Province has a rich and diverse archaeology due to its long history of human occupation. The area around Kathu, which is almost 150km from the project site, is exceptionally rich in terms of Stone Age material. Excavations have shown that an unusual conjunction of geological circumstances has led to the stratified preservation of an exceptional human record, representing three phases of the Early Stone Age, two phases of the Middle Stone Age and almost the entire Later Stone Age.

The nomination of the Kathu Archaeological Complex as a National Heritage Site has been mooted. The pan covers about 30ha and is the only permanent natural water body in the area.

Archaeological material is widespread throughout the Kuruman and Kathu areas and down along the Sishen-Saldanha railway line. These occurrences generally comprise a background scatter of Middle Stone Age hand axes and Later Stone Age core flakes and flaked cores. The density of the scatters is very low over large areas.

There are a number of Anglo-Boer War (1900-1902) camping and skirmish sites in the Northern Cape, containing distinctive heavily soldered tin food cans and specific types and calibres of spent cartridge cases. Planted and self-sown trees and other types of vegetation determine a major part of the historical landscape of human settlements in the Kalahari and in villages and towns, on farmyards or even deserted places in the open veld, show evidence of human activity.

With the exception of the Richtersveld and the Middle Orange River areas, little is known about the archaeology of the part along the Orange River where the project will be located.

A Phase I heritage impact assessment (HIA) that included a field survey was undertaken in September 2015 by means of an off-road vehicle and on foot (Dreyer, September 2015). The HIA was done in terms of the National Heritage Resources Act (NHRA), (25 of 1999).

The site is characterised by a repeated pattern of alternating red sand dunes, calcrete scatters and quartzite outcrops. The nature of the site varies from aeolian (Kalahari) dune veld, visible spreads of calcrete and scatters of quartzite sills. Archaeological material tends to be associated with the calcrete and stone deposits.

Quartz and calcrete outcrops were investigated on foot, finds were plotted by GPS and photographs were taken. The site was examined for possible archaeological and historical material and to establish the potential impact on any cultural material that might be found. The survey showed that Middle Stone Age artefact scatters could be found across the study area.

Ironstone, quartz and meta-quartzite artefacts were found in association with a calcrete outcrop near the Garona substation – see Figure 8-18. The collection was spread out and there was no dense concentration of artefacts. No other cultural or historical remains or graves were found at the proposed site.

Figure 8-18: Stone flakes of chalcedony, banded ironstone, quartz and meta-quartzite found near Garona substation (Pocketknife = 84mm)

8.1.13 Traffic

A specialist study to assess the traffic impact of the project within the context of the study area as well as the surrounding roads was undertaken (Van Wyk, L; Reutener, I, 2016).

8.1.13.1 Surrounding Road Network

A number of major roads and relevant secondary roads service the project area (Figure 8-22). These roads include:

- The N10 (National Highway), which links Upington and Groblershoop. This major road is aligned in a north-west to south-east direction through the south-western sector of the study area. The road essentially follows the course of the Orange River along its southern bank;
- The N8, which links Groblershoop to Griekwastad, is aligned in a southern to north-eastern direction and then turns in a northern to south-eastern direction through the south-eastern sector of the project area;
- The Gariep Road / Loop 16 along the northern bank of the Orange River, which links from the N8 (near Groblershoop) to the N14 (near Upington). The road is aligned through the southern section of the Farm Bokpoort 390. The Gariep Road / Loop 16 road is unpaved;
- The Opwag Road serving the farms on the southern bank of the Orange River. It links from the N8 (near Groblershoop) to the N10 (approximately 10km west of Groblershoop). The Opwag Road is unpaved;
- The Transnet Service Road. This is the service road for the Saldanha-Sishen railway line, which is aligned in a south-north direction from the Gariep Road through Bokpoort. The Transnet Service Road is unpaved.

Table 8-17 provides an overview of the road network in the vicinity of the project area.

Table 8-17: Overview of the road network in the vicinity of the project area

Road	Ownership	Geometry	Discussion	Layout
N14	South African National Roads Agency (SANRAL)	Paved Single carriageway 2 lanes (one per direction) 3.7m wide paved lanes with 2m wide gravel shoulders Speed limit 120km/hr Longitudinal profile: Flat	Major east west link between Gauteng and Namibia via Upington. Used as haul route for equipment and materials from Gauteng to site. Condition: Good	
N10	South African National Roads Agency (SANRAL)	Paved Single carriageway 2 lanes (one per direction) 3.7m wide paved lanes with 2m wide gravel shoulders Speed limit 120km/hr Longitudinal profile: Flat	Major east west link between east coast (Port Elizabeth) to Namibia via Groblershoop and tying in with the N14 at Upington. It intersects the N1 and the N12.	

Road	Ownership	Geometry	Discussion	Layout
			Use as haul route for equipment and materials from Cape Town and PE harbours. The road essentially follows the Orange River alignment. Condition: Fair to good	
N8 (R64)	South African National Roads Agency (SANRAL)	Paved Single carriageway 2 lanes (one per direction) 3.7m wide paved lanes with 2m wide gravel shoulders Speed limit 120km/hr Longitudinal profile: Flat	Major link between Bloemfontein and Kimberley and Groblershoop linking with the N10 at Groblershoop. Condition: Fair to good	
Gariep Road (MR874)	Northern Cape Department of Transport	Gravel road 2 lanes (one per direction) 10 wide Speed limit 60km/hr Longitudinal profile: Flat	The road runs parallel and to the east of the Orange River serving as access to the farms along the Orange River. The road links the N14 with the N8. Major dust issues due to construction vehicles have been noted by farmers. The road is aligned through the southern sections of the farm Bokpoort.	

Road	Ownership	Geometry	Discussion	Layout
			Condition: Fair	
Transnet Road (Loop 16 Access Road)	Transnet	Gravel road 2 lanes (one per direction) 10 wide Speed limit 60km/hr Longitudinal profile: Flat	Private Transnet Road to serve the Sishen-Saldanha Railway line. Road is main access to Bokpoort Farm Condition: Fair	

The hierarchy of the roads in the vicinity of the project area is listed in Table 8-18.

Table 8-18: Road Hierarchy of roads in the vicinity of the project area

Road	Class	Speed Limit
N14, N10, N8	Class 1, National Road	120 km/hr
Gariep Road	Class 3, Minor Arterial Road	80 km/hr
Transnet Railway Road	Class 5, Local Access Road	60 km/hr

8.1.13.1.1 Accident Hotspots

It is stated in the traffic assessment report (APPENDIX O) that a number of fatal accidents have occurred on the Gariep Road (a gravel road) due to speeding, overtaking and poor visibility (Figure 8-19). A number of stakeholders raised this issue during the scoping phase and attributed the increase in accidents to the rapid deterioration of the Gariep Road as well as speeding by contractors during the construction of the Bokpoort I solar development.

ACWA Power SolAfrica initiated a study and submitted a Basic Assessment application to investigate a feasible solution to address the road concerns of stakeholders in the area. The extent of the road network included in the Basic Assessment process is the Gariep Road from the N8 to the Transnet bridge over the Transnet railway line. The Basic Assessment process is currently in progress.

Figure 8-19: Recent motor accidents on the Gariep Road (Van Wyk, L; Reutener, I, 2016)

8.1.13.1.2 Dust on the Gariep Road

The Gariep Road is surfaced with calcrete. Driving at high speed on this road generates dust that can impact on farming in close vicinity to the road. Complaints were received during the scoping phase about dust raised during the construction activities at the Bokpoort I solar development.

Figure 8-20: Dust generated by heavy vehicle turning from the Gariep Road onto the private Transnet Road (Van Wyk, L; Reutener, I, 2016).

Figure 8-21: Vehicle driving on the Gariep Road (Van Wyk, L; Reutener, I, 2016)

8.1.13.2 Intersections and levels of service

In traffic analysis:

- The capacity of a road (C) is the maximum hourly number of vehicles that can reasonably be expected to traverse the road under prevailing traffic and control conditions;
- The volume (V) is the number of vehicles that arrive at an intersection per hour; and
- The level of service (LOS) is expressed as the average delay (D) in seconds that a driver experiences at an intersection.

The levels of service for signalised and un-signalised intersections as defined in the Highway Capacity Manual (2010) are shown in Table 8-19.

Table 8-19: Level of service as a function of volume and capacity

Level of Service for V/C≤1.0	**Rating**	**Average delay per vehicle in seconds (D)**			**Level of Service for V/C>1.0**
		Signals	**SIDRA Roundabout LOS option**	**Priority Control *(HCM2010 default for roundabouts)***	**All Intersection Types**
A	Excellent	d ≤ 10	d ≤ 10	d ≤ 10	**F**
B	Very Good	10 < d ≤ 20	10 < d ≤ 20	10 < d ≤ 15	**F**
C	Good	20 < d ≤ 35	20 < d ≤ 35	15 < d ≤ 25	**F**
D	Acceptable	35 < d ≤ **55**	35 < d ≤ **50**	25 < d ≤ **35**	**F**
E	Poor	**55** < d ≤ 80	**50** < d ≤ 70	**35** < d ≤ 50	**F**
F	Very Poor	80 < d	70 < d	50 < d	**F**

Note: V/C (demand volume/capacity) ratio, or degree of saturation: V/C > 1.0 represents oversaturated conditions

An intersection is deemed to be operating acceptably at levels of service A to D. If an intersection operates at a level of service E or F or has a volume to capacity ratio higher than 0.95 the intersection is considered to be operating at capacity.

A traffic count was conducted at the major intersections during March 2016. The traffic volumes for the intersections in the vicinity of the project area are summarised in Table 8-20.

Table 8-20: Traffic volumes at the intersections in the vicinity of the project area

Intersection	Morning peak hour volumes	Afternoon peak hour volumes	Daily volumes
N14/Gariep	168	157	16 800
Gariep/Transnet	36	46	265
N8/Gariep	257	274	1 340

The intersections in the vicinity of the project area are all un-signalised and are listed in Table 8-21.

Table 8-21: Overview of the intersections in the vicinity of the project area

Intersection	Level of Service	Discussion	Layout
N14/Gariep Road	Existing: A During construction: A During Operations: A	Sight distance: Good Dedicated right turning lanes: None Safety: Poor N14 is a high speed (120km/hr) road. There is no dedicated turning lane for vehicles having to turn from the N14 onto the Gariep Road. The use of the Gariep Road, even though shorter when travelling from Gauteng, is not recommended as a haul route due to safety on the N14 and dust issues along the Gariep Road.	

Intersection	Level of Service	Discussion	Layout
N8/Gariep Road	Existing: A During construction: B During Operations: A	Sight distance: Good Dedicated right turning lanes: None Safety: Poor N8 is a high speed (120km/hr) road. There is no dedicated turning lanes for vehicles having to turn from the N8 onto the Gariep Road.	
Gariep Road/Transnet Road	Existing: B During construction: B During Operations: B	Sight distance: Fair, after bridge over rail Dedicated right turning lanes: None Safety: Poor Very little traffic currently on road. The approach to the intersection is poor, with poor visibility and geometry.	

8.1.13.1 Non-motorised Transport

No pedestrians or cyclists were observed during the site assessment on the roads in the vicinity of the project area (Van Wyk, L; Reutener, I, 2016). No dedicated non-motorised transport facilities are provided on the Gariep Road or the Transnet Road. It is assumed that most of the farm workers reside on the farms. No cyclists or pedestrians are allowed on the national roads (N14, N10, N8).

8.1.13.2 Public Transport Infrastructure

No dedicated public transport loading/pick up bays have been provided for along the Gariep Road or the private Transnet Road. Commuters are mostly picked up from the residential areas and transported to their places of work. Minibus taxis transported construction staff to the Bokpoort I project site from the adjacent residential areas.

8.1.13.3 Railway Lines

The Sishen-Saldanha railway line runs adjacent the project site from the north-east to the south-west. A cross-over siding, Rooilyf, for the iron-ore trains is located in the central sector of the Farm Bokpoort (Loop 16).

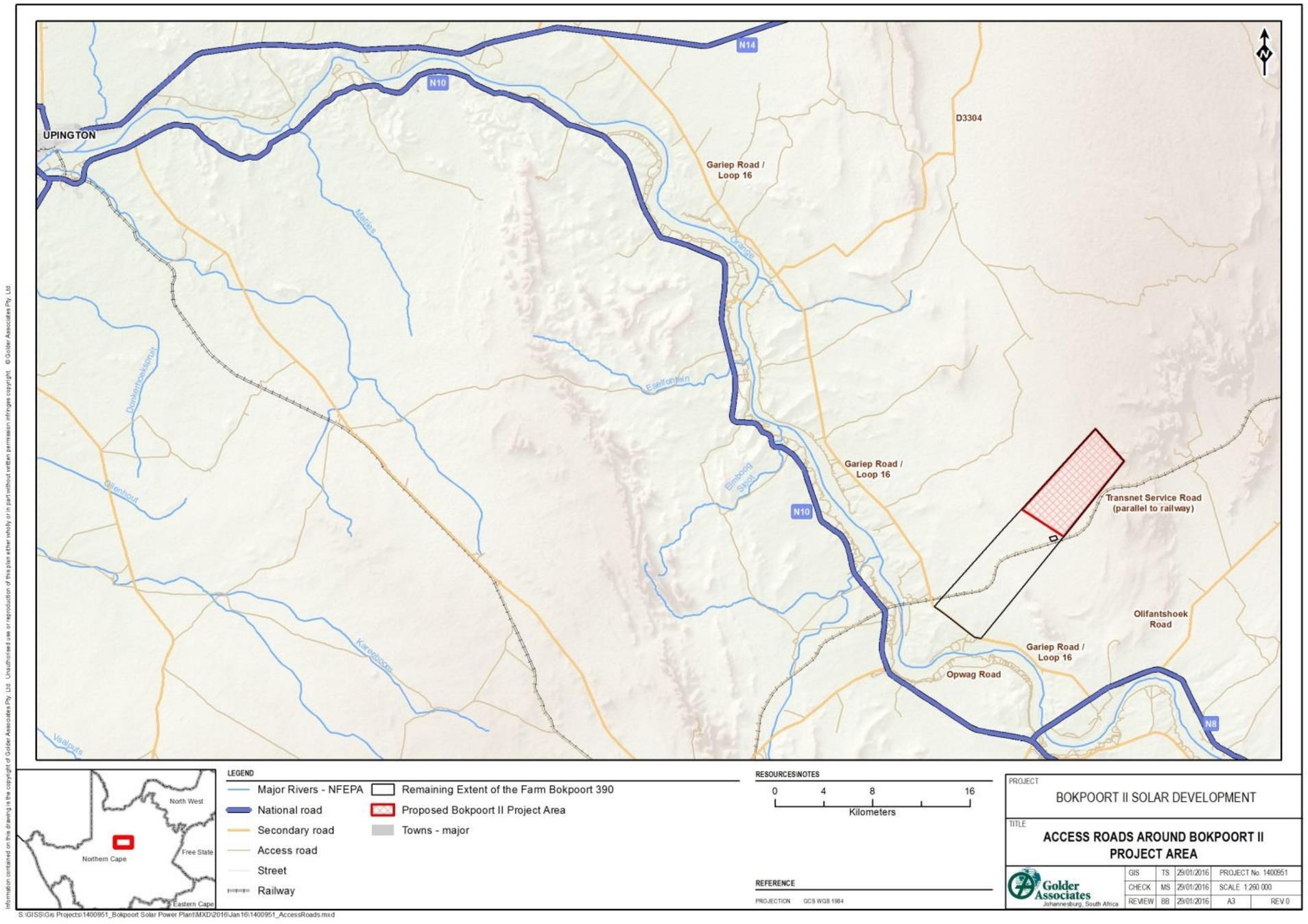


Figure 8-22: Access Roads around the Bokpoort II project area

8.1.14 Socio-economic

A socio-economic impact assessment was undertaken during November 2015 to February 2016 (Smith, T; de Waal, D, 2016).

8.1.14.1 Administrative Setting

The proposed project area is located in Ward 3 of the !Kheis Local Municipality (LM), ZF Mgcawu District Municipality (DM), Northern Cape Province – see Figure 2-2.

The ZF Mgcawu DM, which is classified as a category C municipality forms the mid-northern section of the province on the frontier with Botswana. It covers an area of more than 100,000 square kilometres (almost 30% of the entire province). The DM comprises six local municipalities namely: Mire; Kai! Garb; Kara Hails; Tsantsabane, !Kheis and Kgatelopele. Upington is the district municipal capital.

The !Kheis Municipal Area was initially inhabited by the Khoisan people, first permanent inhabitants of South Africa. The San, who lived a nomadic life, migrated through the area. The Korannas (Khoi group) arrived in the area during the 18th century. They were widely distributed over the “Benede Oranje” area and comprised several tribes.

The !Kheis Local Municipality, formerly the Groblershoop Municipality, includes the settlements of Boegoeberg, Gariep, Grootdrink, Kleinbegin, Opwag, Topline and Wegdraai, was established from the. These settlements were previously part of the Siyanda and Karoo District Municipalities, who administrated these settlements and provided them with services up until the demarcation in November 2000. From December 2000, the !Kheis Municipality took over services and personnel and total service provision commenced on 1 July 2001 (!Kheis LM IDP 2012-2017).

The IFCs Performance Standard 7 provides criteria for the identification of indigenous people and requires that project proponents implement culturally appropriate measures to mitigate the impacts of a project on indigenous people.

The South African government has acknowledged the Khoi and San as the original indigenous people of South Africa. The presence of Khoisan people in the municipality triggered further investigation into the presence of an indigenous population in the Bokpoort II project area. At this stage of the social impact assessment, there is no evidence of the presence of any indigenous people residing or utilising the project area and immediate surrounds.

8.1.14.2 Population Demographics

According to available socio-economic baseline information, the total population of the !Kheis LM increased from 14 950 in 1996 to 16 539 in 2001 and 16 637 in 2011. The Census of 2011 indicated 60.3% of the population to be of working age, 4.7% to be older than 65 and 35% to be younger than 16. The average population density in the municipality is one person per square kilometre.

In 2011 Ward 3 of the !Kheis LM had a population of 2 510 and the population of ZF Mgcawu DM was 157 318. Groblershoop, 22 km to the south, is the closest town to the proposed project area and it had a total population of 4 938 in 2011.

There were 4,146 households in the LM of which 1,209 were defined as agricultural households in the 2011 Census. The average household size was nearly four people per household and 33% of the households were headed by females.

Formal dwellings (66.3%) dominated the types of dwellings found in the municipality, but only 16.7% had piped water inside their dwellings, 64% used electricity for lighting and 27% had flush toilets connected to a reticulated sewerage system. The next most available sanitation system was flush toilets with a septic tank. A quarter (25%) of the population of the LM and 7% of Ward 3 did not have access to any sanitation system. The sanitation and sewerage systems in Ward 3 and the !Kheis LM are still inadequate.

There is a strong reliance on wood for cooking fuel, which is not sustainable and can lead to the overexploitation of especially camel thorn (*Acacia Erioloba*) trees in the area.

There was an influx of people and heavy equipment during the construction of the Bokpoort I facility on the Remaining Extent of the Farm Bokpoort 390 to the south of the Bokpoort II project area. Construction has been completed and the Bokpoort I facility is currently being commissioned.

8.1.14.3 Levels of Education

There is a school in Groblershoop and several farm schools in the regional area. Education levels are relatively low - 13.5% of the municipal population above the age of 20 has no formal schooling. Only 4.5% of the population over the age of 20 received a high school education and only 14% of this group achieved Matric qualifications. The dominant language spoken in the municipality is Afrikaans (93%).

8.1.14.4 Economic Activities

The Northern Cape contributed about 2.3% or R 61.175 billion to the South African GDP of R 2 607.14 billion in 2010 (Wikipedia: List of South African provinces by gross domestic product per capita , 2012) .

Information about the Gross Regional Value (GRV) contributions of the ZF Mgcawu DM and the !Kheis LM is not available, but the contribution of various economic sectors to the regional Gross Value Added (GVA) for 2010 is shown in Table 8-22.

Table 8-22: Contribution to Gross Value Added (2010)

Industry	Northern Cape	ZF Mgcawu DM	!Kheis LM
Agriculture, forestry and fishing	7%	15%	33%
Mining and quarrying	24%	18%	0%
Manufacturing	4%	6%	5%
Electricity, gas and water	2%	3%	3%
Construction	2%	2%	1%
Wholesale and retail trade, catering and accommodation	11%	13%	19%
Transport, storage and communication	10%	12%	7%
Finance, insurance, real estate and business services	15%	11%	12%
Community, social and personal services	10%	8%	10%
General government	15%	12%	11%

Source: Quantec data (2010)

The major established economic growth centres are located in the Kimberley and Upington sub-regions.

The Orange River plays a crucial role in the economy of the ZF Mgcawu DM, with most of the economic activities linked to or located along the river. The area is responsible for a major portion of South Africa's table grape production and exports more than 20 million cartons per annum to Europe (!Kheis LM IDP, 2012-2017).

More than 90% of Africa's total dried vine fruit production comes from 1 250 sultana grape growers in the Northern Cape who produced more than 50 000 tons in 2010, most of which is exported to Europe and the Far East (ZF Mgcawu DM IDP, 2016-2017).

The Orange River Wine Cellars Co-Op, also based in Upington, is the second largest winemaking cooperative in the world and has wine cellars at Groblershoop, Grootdrink, Upington, Keimoes and Kakamas. This Co-Op has more than 740 members who produce wine grapes and 445 farmers who produce grape juice (ZF Mgcawu DM IDP, 2016-2017).

The Northern Cape receives the lowest number of tourists, both foreign and domestic, of all the provinces, but there is potential for growth. Currently, the Boegoeberg Dam is the most popular tourist attraction in the area, drawing fishermen and water sport enthusiasts. Other popular attractions include Ezelsklaauw, Centenary Monument, Oranjerivier Wine Cellars, the water turbine at Winstead Farm, private game farms and hunting concessions.

The central part of the region consists largely of semi-desert areas which are mainly suitable for extensive livestock farming.

Renewable energy is recognised as a key developing sector in the area. In addition to at least six other solar developments in the Northern Cape, application has been made to construct a hydropower project at the Boegoeberg Dam in the Orange River.

The agricultural sector is the main economic sector within the !Kheis LM - see Figure 8-23.

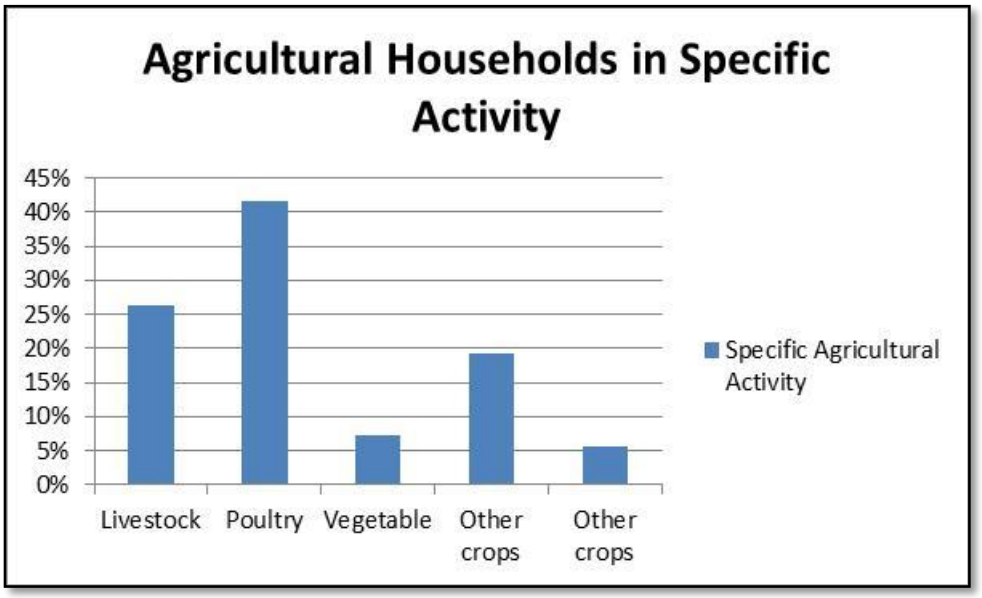


Figure 8-23: Percentage of Agricultural Households in each particular activity within the !Kheis LM (Stats SA,2011).

8.1.14.5 Employment Levels

The local municipality unemployment rate is high at 28% in the 2011 Census indicating that there are limited formal job opportunities in the municipality. Youth, or persons 35 years or younger, comprise 34.3% of the municipal unemployment rate.

9.0 ENVIRONMENTAL IMPACT ASSESSMENT

9.1 Methodology for Assessing Impacts

The identified impacts were assessed in accordance with the approach outlined below (terminology from the Department of Environmental Affairs and Tourism Guideline document on EIA Regulations, April 1998). This approach incorporates two aspects for assessing the potential significance of impacts, namely occurrence and severity, which are further sub-divided as follows:

Occurrence		**Severity**	
Probability of occurrence	Duration of occurrence	Scale / extent of impact	Magnitude (severity) of impact

To assess each of these factors for each impact, the following four ranking scales are used:

Probability	**Duration**
5 - Definite/don't know	5 - Permanent
4 - Highly probable	4 - Long-term
3 - Medium probability	3 - Medium-term (8-15 years)
2 - Low probability	2 - Short-term (0-7 years) (impact ceases after the operational life of the activity)
1 - Improbable	1 – Immediate
0 - None	
Scale	**Magnitude**
5 - International	10 - Very high/don't know
4 - National	8 - High
3 - Regional	6 - Moderate
2 - Local	4 - Low
1 - Site only	2 - Minor
0 - None	

Once these factors have been ranked for each impact, the significance of the two aspects, occurrence and severity, was assessed using the following formula:

SP (significance points) = (magnitude + duration + scale) x probability

The maximum value is 100 significance points (SP). The impact significance was then rated as follows:

SP >75	Indicates high environmental significance	An impact which could influence the decision about whether or not to proceed with the project regardless of any possible mitigation.
SP 30 – 75	Indicates moderate environmental significance	An impact or benefit which is sufficiently important to require management and which could have an influence on the decision unless it is mitigated.
SP <30	Indicates low environmental significance	Impacts with little real effect and which should not have an influence on or require modification of the project design.
+	Positive impact	An impact that constitutes an improvement over pre-project conditions

9.2 Project Phases and Activities

The environmental impacts of the project were assessed for the:

- Pre-construction phase;
- Construction phase;
- Operational phase; and
- Closure and rehabilitation phase.

Potential cumulative impacts were also identified and assessed for each component, where applicable.

9.2.1 Pre-construction

The **Pre-construction Phase** will entail the finalisation of the facility design and layout taking into consideration the conditions of the environmental authorisation.

The Engineering, Procurement and Construction (EPC) Contractor will be appointed. It will be the EPC's responsibility, in conjunction with the project company, to ensure compliance to the requirements of the EMPr by all sub-contractors, during the entire construction phase.

The ECO will initiate pre-construction fauna and flora surveys as stipulated in Section 11.8.

9.2.2 Construction

The **Construction Phase** marks the beginning of physical changes to the site. During this phase, the following activities will take place:

- Surveying and pegging out of the construction areas for the surface infrastructure shown in Figure 2-4. An area of about 250 hectares will be affected;
- Excavation of the foundations for the PV panels, transformer substation, workshops, hazardous substance storage, water and waste water management facilities and administrative buildings;
- Construction of the access road, internal roads, power transmission lines and storm water management system;
- Construction of the ± 20 km water underground pipeline within the existing 50m wide water pipeline servitude that runs across the Farm Sand Draai 391 Portion 0 and 5 to the Remaining Extent of the Farm Bokpoort 390;
- Installation of the water abstraction pumps and pump platform in the Orange River as well as the associated rock and cement foundation to stabilise the steep river bank;
- Installation, testing and cold commissioning of equipment; and
- Landscaping and re-vegetation of bare areas on the site.

It is anticipated that the construction phase will commence in 2017 and take approximately 9 months to complete. The construction phase will end with the cold commissioning of the installed equipment and systems.

9.2.3 Operation

The **Operational Phase** will commence when all systems have been tested and begin to generate power. The operational phase is expected to last for about 30 years. Various equipment and system upgrades, in addition to normal maintenance, are expected to be done during the operational life of the installation, which will continue until it can no longer compete technologically and economically with newer technologies.

9.2.4 Closure and rehabilitation

The activities during the **Closure and rehabilitation Phase** will include:

- Dismantling of the PV panels, power line and water pipeline and removal of all metal structures;
- Demolition of buildings and disposal of the rubble;
- Re-vegetation of all bare areas on the project footprint with locally indigenous species; and
- Post-closure monitoring of environmental performance against the EMPr and other permitting conditions for at least three years.

9.3 Impact Assessment and Mitigation Measures

9.3.1 Geology

9.3.1.1 Construction

Excavations for foundations for the PV panel support structures, plinths for the overhead power lines and associated structures as well as the underground pipeline will permanently disturb the near-surface geology over parts of the site, resulting in an impact of ***moderate (SP = 40)*** significance, which cannot be mitigated, with regard to the project area only. Within the context of the land falling within the jurisdiction of the !Kheis Local Municipality, the impact will be negligible.

9.3.1.2 Operation

The operational phase will have no impact ***(SP = 0)*** on the geology of the project area.

9.3.1.3 Closure and rehabilitation

The closure and rehabilitation phase will have no impact ***(SP = 0)*** on the geology of the project area.

9.3.2 Air Quality

The South African ambient air quality standards for common pollutants prescribe the allowable ambient concentrations of pollutants which are not to be exceeded during a specified time period in a defined area (**Table 9-1**). If the standards are exceeded, the ambient air quality is defined as poor and potential adverse health impacts may occur over time.

Table 9-1: South African Ambient Air Quality Standards for Criteria Pollutants

Pollutant	Averaging Period	Limit Value (µg/m^3)	Limit Value (ppb)	Frequency of Exceedance	Compliance Date
SO_2 (a)	10 minute	500	191	526	Immediate
	1 hour	350	134	88	
	24 hours	125	48	4	
	1 year	50	19	0	
NO_2 (b)	1 hour	200	106	88	
	1 year	40	21	0	
PM_{10} (c)	24 hour	75	-	4	
	1 year	40	-	0	
$PM_{2.5}$ (d)	24 hours	40	-	4	01/01/2016 – 31/12/2029
	24 hours	25	-	4	01/01/2030
	1 year	20	-	0	01/01/2016 – 31/12/2029
	1 year	15	-	0	01/01/2030
O_3 (e)	8 hours (running)	120	61	11	Immediate

Pollutant	Averaging Period	Limit Value (µg/m^3)	Limit Value (ppb)	Frequency of Exceedance	Compliance Date
Lead (Pb) (f)	1 year	0.5	-	0	
CO (g)	1 hour	30,000	26,000	88	
	8 hour (calculated on 1 hourly averages)	10,000	8,700	11	
Benzene (C_6H_6) (h)	1 year	5	1.6	0	

a. The reference method for the analysis of SO_2 shall be ISO 6767
b. The reference method for the analysis of NO_2 shall be ISO 7996
c. The reference method for the determination of the particulate matter fraction of suspended particulate matter shall be EN 12341
d. The reference method for the analysis of $PM_{2.5}$ shall be EN14907
e. The reference method for the analysis of ozone shall be the UV photometric method as described in ISO 13964
f. The reference method for the analysis of lead shall be ISO 9855
g. The reference method for analysis of CO shall be ISO 4224
h. The reference methods for benzene sampling and analysis shall be either EPA compendium method TO-14 A or method TO-17

9.3.2.1 National Dust Control Regulations

On 1 November, 2013, the National Dust Control Regulations were promulgated under the NEM: AQA and published in the Government Gazette No. 36974. The dust fall standard defines acceptable dust fall rates in terms of the presence of residential areas (Table 9-2).

Table 9-2: Acceptable dust fall rates

Restriction areas	Dust fall rate (mg/m^2/day over a 30 day average)	Permitted frequency of exceedance
Residential areas	Dust fall < 600	Two per annum (not in sequential months)
Non-residential areas	600 < Dust fall < 1200	Two per annum (not in sequential months)

The Bokpoort II PV1 Solar facility will not require an atmospheric emission licence for its proposed operations, but it will have to operate within the NAAQS and the National Dust Control Regulations.

It is important to note that, unlike PM_{10} and $PM_{2.5}$ particles, dust fall constitutes an nuisance and not a health risk, as the coarser particles are trapped by the mucous membranes in the respiratory system and do not reach the lungs. They also settle within a few metres of the emission source under calm atmospheric conditions, whereas the finer particles can remain airborne for long periods and travel long distances.

9.3.2.2 Construction

Site clearing, excavations for foundations, vehicular movements and the construction of access roads and the runoff management contours can result in the mobilisation of particulates that can be transported off-site for various distances, which depend on the wind speed and the particle size. Transport along unpaved roads, such as the Loop 16 Gariep Road, can raise dust that will settle on grazing and on the crops grown along the Orange River. During the scoping phase of this EIA a number of farmers commented that dust settling on their produce due to transport along the Gariep Road during the construction of the Bokpoort I project had reduced the market value of their crops.

The potential impact was assessed as being of ***moderate (SP = 50)*** significance. The following mitigation measures are recommended to reduce the impact to one of ***low (SP = 24)*** significance:

- As long as the Loop 16 Gariep Road remains unpaved, the section from the N14 to the project site should not be used for transport by the Bokpoort II Project, and a speed limit of 30 km/hour must enforced on the section from the N8 to the site (see Figure 9-2);

- ACWA Power should engage with the road authorities to encourage paving of the Gariep Road;
- Dust fall monitoring on the properties of landowners who lodge complains about dust fall. The collected dust should be analysed to determine whether it originated from the site or the Gariep Road between the N8 and the site;
- Wet suppression on unpaved surfaces and during earthmovings or excavation activities;
- Appropriate speed limits on unpaved surfaces to reduce dust entrainment by vehicle wheels;
- Disturbed areas where construction work has been completed should be re-vegetated with a locally indigenous grass species as soon as possible;
- Dust fall monitoring by dust collection buckets installed downwind of the construction area. Monitoring must be done in accordance with SANS 2004;
- All construction vehicles and other diesel-powered equipment should be maintained and serviced regularly to ensure that exhaust particulate emissions are kept to a minimum; and
- Implementation of a system to receive, record and respond to complaints.

9.3.2.3 Operation

Vehicles travelling over unpaved surfaces will continue to mobilise particulates.

The impact on air quality during the operational phase was assessed as being of ***moderate (SP = 60)*** significance. The following mitigation measures are recommended to reduce the impact to one of ***moderate (SP = 30)*** significance:

- Wet suppression on unpaved access roads with water and a suitable dust palliative or with commercial binders such as Dustex or Dust-a-Side to achieve 95 % control efficiency. Water alone will only achieve 75 % control efficiency;
- Maintain dust fall monitoring;
- Appropriate speed limits on unpaved surfaces to reduce dust entrainment by vehicle wheels;
- Paving areas on site where vehicles travel or covering them with crushed rock;
- Engaging with the road authorities to pave local roads used by ACWA Power traffic;
- All vehicles and other equipment should be maintained and serviced regularly to ensure that exhaust particulate emissions are kept to a minimum;
- Dust fall and fine PM_{10} monitoring at site boundaries and nearby receptors to determine compliance with NAAQS;
- All vehicles and other diesel-powered equipment should be maintained and serviced regularly to ensure that exhaust particulate emissions are kept to a minimum;
- Maintain the complaints procedure and complaints register; and
- Follow up, resolve and close out each complaint.

9.3.2.4 Closure and rehabilitation

Air quality impacts similar to those of the construction phase are likely to occur, but over a shorter period of time, probably about 6 months and the number of trips generated would probably be about 40% lower than during the construction phase. Fugitive dust emissions are likely to continue until the site has been successfully re-vegetated.

The impact has been assessed as being of ***moderate (SP = 50)*** significance, which can be mitigated to one of ***moderate (SP = 24)*** significance by implementing the following recommended mitigation measures:

- Undertaking the most dusty operations (ripping, landscaping an spreading of topsoil) during mid-summer, autumn and up to mid-winter, when calm conditions are more likely to prevail;
- Wet suppression to ensure the absence of visible dust;
- Enforcement of low vehicle speeds on unpaved areas;
- Vegetation of the disturbed areas with a locally indigenous grass species as soon as possible;
- Dust fall and PM_{10} monitoring at the site boundaries and nearby receptors until vegetation cover is well established;
- All vehicles and other diesel-powered equipment should be maintained and serviced regularly to ensure that exhaust particulate emissions are kept to a minimum;
- Maintain the complaints procedure and complaints register; and
- Follow up, resolve and close out each complaint.

9.3.2.5 Peer review

In a letter dated 17 March 2016, the DEA stipulated that in-house specialist studies must be peer reviewed by external specialists – see APPENDIX C. The air quality report for the Bokpoort I project (Walton, N; Thompson, S, November 2010) and Golder's professional opinion as reflected in section 9.3.2.2 to 9.3.2.4 of this EIA report were peer reviewed by Dr Lucian Burger of Airshed Planning Professionals (Burger, L;, May 2016). The report is included in APPENDIX E and his main findings can be summarised as follows:

- *The baseline description is most likely an adequate reflection of the climatic conditions in the study area, but the baseline wind field extracted from simulated data contained in the Bohlweki-SSI Report is significantly different from observations made at Upington (77 km north-west of site) and Prieska (130 km south-east of site). The differences may be due to the Skurweberg and Prynnsberg to the north-east of the site;*
- *Although wetting of unpaved roads could be an effective manner to control fugitive dust emissions, the high evaporation rates and the relatively limited water resources in this arid region may not be the most optimal solution. More permanent measures may have to be considered; and*
- *Overall, the Golder Report is considered to be acceptable, provided the limitations of using the information from the Bohlweki-SSI Report are included*.

The use of commercial binders such as Dustex or Dust-a-side had already been recommended in sections 9.3.10, 9.3.12, 10.9.2, and 11.6.

9.3.3 Topography

9.3.3.1 Construction

Excavating for building foundations and landscaping to position the PV panels and create runoff management berms (see sections 9.3.6.1 and 9.3.7.1) will result in minor changes to the existing topography of the site. The changes will be reversible during closure and rehabilitation.

The impact is assessed as being of ***low (SP = 21)*** significance. No mitigation is necessary.

9.3.3.2 Operation

The activities undertaken during the operational phase will not have any effect on the topography of the site ***(SP = 0)***.

9.3.3.3 Closure and rehabilitation

Due to the low rainfall and the sandy soils, the site is naturally not very prone to erosion, but inappropriate closure and rehabilitation could increase the erosion potential, leading to a topographical impact of ***low (SP =***

22) significance. The site will be largely restored to its original topography. If it is shaped to be free draining, but resistant to erosion, it will result in a positive impact of ***low (SP = +21)*** significance.

9.3.4 Agricultural Potential, Soil, Land Capability and Land Use

9.3.4.1 Construction

Construction of the project infrastructure as described in section 9.2.1 will affect an area of about 250 ha on the Remaining Extent of the Farm Bokpoort 390 (PV1 site), approximately 20 km's within an already disturbed 5 metre wide servitude (water abstraction pipeline) as well as 300 square metres on the farm Sand Draai 391 (water abstraction point). The different soil types and land capabilities occurring over the entire affected area are described in section 8.1.5. Where it is necessary to strip topsoil, the different soil types must be stripped and stockpiled separately and topsoil must be stockpiled separately from subsoil.

Removal of vegetation will increase the probability of soil loss through erosion.

Potential impacts on the stored topsoil could be:

- Degradation of quality due to mixing with subsoil;
- Loss of topsoil due to water and wind erosion;
- Contamination with hydrocarbons and hydraulic fluids; and
- Colonisation of the stockpile by weeds.

The impact is rated as being potentially of ***moderate (SP = 56)*** significance and can be mitigated to ***low (SP = 30)*** significance by:

- Stripping soil only where unavoidable, e.g. on footprints of excavations for foundations;
- Careful stripping and stockpiling to avoid mixing topsoil and subsoil;
- Limiting the stockpile height to 3 m and the slope to 1 in 5, and rounding the top edges;
- Placing a runoff containment berm down-gradient of the stockpile to capture runoff, letting the transported soil settle and recovering it;
- Vegetating the stockpile with locally indigenous grass species;
- Regular weeding of the stockpile; and
- Constructing berms 200 metres apart across the slope of the site to capture runoff and allow silt to settle.

9.3.4.2 Operation

The current land (natural veld and grazing) use on the footprint of the PV1 solar installation will be replaced by an industrial land use for the life of the project, which is estimated at 30 years. Soil compaction will occur on areas used for roads, erecting structures and parking vehicles. The use of lubricants, hydraulic fluids, solvents and cleaning chemicals could result in soil contamination. Areas without vegetation cover could experience loss of soil by erosion.

The potential impact has been assessed as being of ***high (SP = 70)*** significance. It can be reduced to one of ***moderate (SP = 60)*** significance by implementing the following recommended mitigation measures:

- Remove silt from runoff containment berms regularly and blend with topsoil stockpile or store separately for later use during rehabilitation;
- Re-vegetate open areas with locally indigenous grass species where practicable;
- Maintain a trained clean-up team and a spill kit on site at all times; and
- Clean up spillages of contaminants immediately.

9.3.4.3 Closure and rehabilitation

Inappropriate rehabilitation could leave the soil on the site in a damaged state that could endure for decades or even centuries in the semi-arid climate experienced in the area, resulting in an impact of ***high (SP = 70)*** significance. Implementation of the following mitigation measures is recommended with the objective of restoring the soil and land use capability to essentially their original condition, thereby reducing the impact to one of ***moderate (SP = 30)*** significance:

- Demolition of containment systems and bunded areas should take place last, after all other structures have been removed.
- Sample and analyse areas of potential soil contamination and map contaminated areas, if any;
- Where screening levels of criteria contaminants are exceeded, remove the contaminated soil and either remediate *in situ* or dispose at an appropriately licence disposal site;
- Shape profile of site to be free draining, but not prone to erosion – leave runoff containment berms in place;
- Rip compacted areas, using light agricultural machinery to minimise compaction;
- Have soil sampled and analysed by a suitably qualified and experienced agronomist. Fertilise soil as recommended;
- Vegetate with locally indigenous species under guidance of a rehabilitation specialist;
- Monitor progress for at least 3 years after closure.

9.3.5 Ecology

9.3.5.1 Construction

The construction activities described in section 9.2.1 will result in a temporary disturbance of the soil and vegetation along the 20 km water pipeline route, which will be rehabilitated after completion of the pipeline construction.

Vegetation will be largely removed from the approximately 250 ha footprint of the PV1 site and the area will only be rehabilitated after decommissioning of the plant and removal of all infrastructure. The avifaunal assessment (Pearson, A, May 2016) concluded that the habitat loss may effect, and be more significant for important terrestrial species such as coursers, korhaans and bustards. The raptors identified in the broader study area (i.e. Martial Eagle, Black-chested Snake-Eagle and Pale Chanting Goshawk) could potential also be affected due to the loss of potential hunting habitat.

Riparian vegetation will be removed for the construction of the rock and cement foundation to stabilise the steep river bank for the installation of the pipelines and water abstraction pumps.

The area will only be rehabilitated after the decommissioning of the plant and removal of the water abstraction infrastructure. If required, the dredging of substrate underneath the abstraction point, may have a limited effect on habitat disturbance for invertebrates in the immediate area of the abstraction point. The destruction of habitat will also result in the migration of most of the fauna on the site, to similar available habitat. Due to their greater mobility, avifauna will find it easier than terrestrial fauna to relocate. Some animals may be injured or killed by vehicular movement, earthmoving activities, trapping and poaching. Some disturbance of bat foraging and roosting areas at the abstraction point in the Orange River and to the north-east of the PV 1 solar facility construction site could occur.

Taking into consideration the size of the area relative to that of the surrounding land with similar ecological characteristics, the current ecological state of the site and the relatively small amount of water to be abstracted from the Orange River, the ecological impact is assessed as being of ***high (SP = 70)*** significance on the undisturbed areas.

Specific project impacts that are anticipated include:

- Loss/disturbance of flora and fauna species of conservation concern;
- Loss/disturbance of other fauna species;
- Reduction in extent of ecosystems of conservation concern;
- Reduction in extent of Critical Habitat;
- Soil erosion and sediment loading of surface water runoff; and
- Expansion of abstraction area at Orange River and effects on riparian and aquatic ecosystems.

The following mitigation measures will be implemented to reduce the impact to one of ***moderate (SP = 55)*** significance:

- Prior to construction, an ecologist should check whether any protected species occur on the areas that will be impacted and, if such occurrence is verified, the necessary permits for the destruction or relocation of such species should be applied for;
- An environmental control officer (ECO) should be on site during vegetation clearing to ensure continuous, day-to-day compliance with the EMPr;
- All construction personnel should receive training in environmental awareness and the recognition of Red Data species and should be prohibited from causing damage to any plants other than those that have to be removed. In the event that any Red Data species are found, the services of a suitable specialist should be sourced to advise on their relocation;
- Clear demarcation of all construction and laydown areas, which should be chosen to minimise the disturbance footprint;
- Designation of no-go areas;
- Confining activities to the infrastructure site only and prohibiting access to and activities on adjacent land;
- Monitoring for and control of declared weeds and invasive flora on the site. The re-occurrence or spread of declared weeds and invasive plants must be controlled by the land user as per the legal requirements of the CARA;
- Re-vegetating disturbed and exposed areas with locally indigenous species where practicable;
- Stripped vegetation should not be burned. Leafy parts should be composted and woody parts chipped to serve as mulch during rehabilitation;
- Breeding and foraging areas for exotic faunal species (e.g. rubbish dumps) should be kept to a minimum;
- The destruction, harvesting, handling, poisoning and killing of fauna and flora on land under ACWA Power's control should be strictly prohibited;
- Prohibiting the cutting down of trees for firewood, building material or any other unauthorised use;
- Restriction of vehicle movement to existing roads and tracks;
- Employees and contractors should be made aware of the presence of, and rules regarding, flora and fauna through suitable induction training and on-site signage; and
- Monitoring and auditing of the construction activities for compliance with the project-specific Environmental Management Programme (EMPr).

9.3.5.2 Operation

The 250 ha footprint of the Bokpoort II PV1 solar installation will remain unavailable as habitat for locally indigenous fauna, with the exception of insects, birds and rodents that are adapted to living in, or even attracted to, areas transformed by human activity.

The possibility of birds and bats colliding with the solar panels due to mistaking them for a water source are moderate to low due to the availability of more obvious water sources such as the Orange River and artificial water points (e.g. livestock water points). However, artificial water sources such as leaking pipelines and open water storage facilities on site can attract birds and bats increasing the risk of collision.

The risk of birds colliding with the new over-head 132 kV power line is significant especially for the low flying species such as the Kori Bustard and Ludwig's Bustard, two species that were frequently observed during the 12 month monitoring survey. Crows and owls may be electrocuted when trying to nest in electricity infrastructure such as substations. Large raptor species such as the Martial Eagle, Verreaux's Eagle and Lappet-faced Vulture may be susceptible to electrocution by the 132 kV over-head powerline due to their large wingspan potentially bridging the gap between the lines.

Resident bird species such as the Martial Eagle breeding in the broader study area, may be disturbed by operational and maintenance activities associated with the solar farm and grid connection.

The amount of water (25 000 m^3/year) to be abstracted from the Orange River for the PV1 solar facility is not expected to significantly contribute to any negative effects on water quality with in the Orange River during the operational phase. However, some changes in the river flow patterns such as scour and, if required, dredging of substrate around the abstraction point, may have a limited effect on habitat availability for invertebrates in the immediate area of the abstraction point.

The operational activities associated with PV solar facility has been assessed to have a ***moderate (SP = 60)*** significance on biodiversity. The following measures are recommended to reduce the potential impacts further to a ***moderate (SP = 33)*** significance:

- Site lighting options such as directional shading to prevent excessive light spillage and the use of light bulbs that are not as attractive to insects (e.g. LED bulbs) will be investigated and applied where feasible;
- There should not be any open water sources on or near the site that could attract large numbers of sandgrouse and doves;
- On-going multi-seasonal monitoring of bat and insect activity will be undertaken at the Project to better understand any changes in bat and/or insect activity that may be induced by the Project. In addition, ground surveys will be undertaken at the same frequency to quantify the level of mortality (if any) as a result of potential collisions with the solar panels. This data will be made available to the relevant statutory department to facilitate assessment of future solar developments in the region;
- Ensure effective diversion of storm water and maintenance of the storm water management system throughout the lifespan of the Project.
- Annual monitoring of the Orange River upstream and downstream of the abstraction point will be on-going throughout the lifespan of the Project;
- Commence with native species planting around the site boundary and in any areas which have exposed soils to aid in the reduction of soil erosion and additional loss of vegetation beyond the footprint of cleared areas.

9.3.5.3 Closure and rehabilitation

Rehabilitation of a semi-arid or near-desert area is a slow process that seldom achieves a state close to the original pristine state during a human lifetime. The soil conditions found on ecologically pristine land in the higher latitudes generally developed over millennia and can take hundreds or even thousands of years to return to a state resembling the original.

If closure and rehabilitation is not done with proper care, the vegetation will not re-establish well and the residual impact, relative to the pre-project state of the ecology, will be of ***high (SP = 75)*** significance on the originally undisturbed areas. The following mitigation measures will be implemented to reduce it to one of ***moderate (SP = 39)*** significance:

- Profiling the surface to ensure good drainage by sheet flow and avoid soil erosion during rare high rainfall events;
- Re-vegetating with a mix of locally indigenous species designed to re-establish a self-sustaining vegetation community suitable for grazing. A specialist in rehabilitation will be engaged to provide appropriate advice. If re-vegetation does not take place satisfactorily, topsoil sampling and analysis will be undertaken, followed by appropriate fertilisation and soil conditioning;
- To avoid compaction, light farming equipment will be used rather than heavy earthmoving equipment;
- The re-vegetated areas will be monitored quarterly until the vegetation has become self-sustaining and clear signs of succession have manifested. If any bare patches exceeding 10 m^2 in area develop, the reasons will be investigated, appropriate remediation measures will be taken and the affected areas will be re-vegetated; and
- Weeds, alien species and invasive species will be eradicated before they can establish and spread. An appropriate vegetation community will be provided to attract small animals, birds and insects and facilitate the establishment of a functioning ecosystem over time. Once good progress towards such a state is evident, larger species will be introduced to encourage the development of a balanced ecosystem.

9.3.5.4 Peer Review

In a letter dated 17 March 2016, the DEA stipulated that in-house specialist studies must be peer reviewed by external specialists – see APPENDIX C.

The biodiversity specialist report (Dower, A; Aken, W, 2016) was peer reviewed by Dr Rob Palmer of Nepid Consultants. The review findings and Golder's response are included in APPENDIX G. The main findings can be summarised as follows:

- *Recommendations were made on the inclusion of additional information / points of discussion relating to the baseline and identification of key issues, approach and methodology and the impact assessment and mitigation;*
- *Overall, the Golder report is considered to be impartial, well-written, error-free and easy to read, and provides a comprehensive review of relevant literature.*

The bat specialist report (Dower, A; Aken, W, 2016) was peer reviewed by Jonathan Aronson of ARCUS Consulting Services. The review findings and Golder's response are included in APPENDIX G. The main findings can be summarised as follows:

- *Recommendations were made on the inclusion of additional cave / cavity roosting species that might use the site for foreging, to clarify the extent of the buffer around the rocky outcrop, potential impacts due to lighting and monitoring requirements;*
- *Overall, the Golder report is considered to be sufficient for a solar power facility in South Africa where the impacts of these facilties are currently unknown/unclear.*

9.3.6 Ecosystems Goods and Services

The ecosystem services assessment (Dower, A; Aken, W, 2016) identified and assessed Type 1 Priority Ecosystem Services and Type 2 Priority Ecosystem Services that will potentially be impacted on by the proposed PV1 solar development.

One priority Type I ecosystem service that could be adversely affected by the project was identified:

- Soil stability & erosion control: Droughts and future effects of climate change could increase the likelihood of desertification encroachment in this region. Vegetation removal for site clearance could create a 'nick point' for erosion to take hold.

Two priority Type II ecosystem services in terms of project dependence were identified:

- Fresh water supply: The project is dependent on a constant supply of 0.025 million m^3 of fresh water throughout its lifetime. Climate change and the cumulative impact of abstraction by other projects could affect water availability in future;
- Soil stability & erosion control: Climate change modelling indicates that rainfall will become more variable and the western parts of South Africa are likely to become drier and hotter. (http://media.csag.uct.ac.za/faq/qa_3impacts.html). More frequent and/or more prolonged periods of drought could increase the likelihood of desertification encroachment in this region. Dealing with increased soil erosion within the project footprint and higher ambient temperatures could have cost implications for the project.

It is crucial that the mitigation hierarchy is followed and all efforts to avoid and minimise impacts on Orange River water quantity and soil stability. In particular, implementation of the recommended biodiversity action planning, to manage and prevent soil erosion, and reductions in the amount of process water being abstracted are key mitigation measures in maintaining both the Project's social license to operate in the area, and assisting the Project in maintaining operational performance.

9.3.6.1 Construction

The removal of vegetation from the 250 ha footprint of the Bokpoort II PV1 solar facility will result in the destruction of the ability of such vegetation to provide:

- Food and habitat for locally indigenous fauna adapted to living in that area;
- Grazing currently utilised by local owners of sheep and goats;
- Protection against soil erosion by water and wind.

Although the impact in the footprint area itself will be very high, the affected area is not large within the context of the surrounding landscape and the impact is assessed as being of ***moderate (SP = 65)*** significance. It can be mitigated to one of ***moderate (SP = 36)*** significance by implementing the following mitigation measures:

- Clearly demarcate the areas where vegetation must of necessity be removed;
- Leave a 250 m buffer zone, within which the existing vegetation is retained, between the edge of the proposed infrastructure footprint and the outer boundary of the facility;
- Build berms 200 metres apart across the slope of the site to capture runoff and allow silt to settle;

9.3.6.2 Operation

The proposed PV 1 solar development will rely on the provision of ecosystem services in the form of soil stability and erosion control. Should this not be provided, the project will have to budget for additional site and equipment maintenance as a result of implementation of ongoing erosion-resistance measures.

The project will be dependent on the supply of water from the Orange River. Potential impacts on the quantity of this ecosystem service may arise as a result of climate change, as well as the cumulative impact of abstraction by other solar and other development projects in the area that could limit the availability of water in the future.

Although the amount of water (25 000m^3/year) required by the PV1 solar development in terms of the available water resource is low, the cost of future water shortages of unknown duration to the development could be prohibitive to operation performance. This potential impact to project water supply is considered of ***high (SP =80)*** significance.

Reducing volumes of water intake through treatment and recycling, as well as participation in water catchment management activities in the Orange River management area can reduce the significance of impacts on freshwater demand to ***moderate (SP =40)*** post-mitigation. The following mitigation measures will assist with soil stability and erosion control:

- Plant non-invasive vegetation with low water requirements wherever practicable to stabilise the soil and reduce the potential for erosion; and
- Regularly remove silt trapped by the berms and use it as growth medium for vegetating.

9.3.6.3 Closure and Rehabilitation

Disturbance of vegetation during the closure and rehabilitation phase could similarly contribute in the creation of a "nick point" for erosion that could lead to the increase of desertification encroachment in the region.

The significance of the potential effect on the supply of this ecosystem services are considered to be ***moderate (SP = 65)***. With the implementation of the following mitigation measures, the impact can be reduced to ***low (SP =28)***:

- Areas of surface disturbance and associated vegetation clearance must be minimised wherever possible. Areas proposed for vegetation clearance must be clearly marked and no heavy vehicles should be allowed to travel beyond the marked works zone.

9.3.6.4 Peer Review

In a letter dated 17 March 2016, the DEA stipulated that in-house specialist studies must be peer reviewed by external specialists – see APPENDIX C.

The ecosystems goods and services specialist report (Dower, A; Aken, W, 2016) was peer reviewed by Myles Mander of Future Works Sustainability Consulting. His review findings and Golder's response are included in APPENDIX J. The main findings can be summarised as follows:

- *Recommendations were made on the current consideration of water quality needs and water cycling as well as the mitigation measures presented in the report;*
- *Overall, the Golder Report is considered to be acceptable, given the level of land use and settlement density in the affected area.*

9.3.7 Surface Water

The specialist study on surface hydrology (Dateling, J; Boyd, L;, 2016) identified and assessed potential impacts on the Orange River, which is the predominant perennial surface water feature in the vicinity of the proposed development. A Storm Water Management Plan has been developed for the site and is included in Section 11.13.

9.3.7.1 Construction

The construction activities described in section 9.2.1 could lead to erosion from de-vegetated areas and runoff carrying a high silt load and contaminants such as fuel, hydraulic fluids, degreasing and other chemicals and cement. Due to the very gentle slope (see section 8.1.8.1), the sandy nature of the soil (see section 8.1.5), and the low rainfall (see section 8.1.2.2) in the area, only limited runoff is likely to occur under all but exceptionally high rainfall conditions.

The potential surface water impacts during the construction phase have been assessed as being of ***moderate (SP = 40)*** significance. The following measures are recommended to reduce the potential impacts further to a ***low (SP = 21)*** significance:

- Construct pollution control systems such as bunded areas, and runoff control systems such as diversion berms and water collection areas such as the process water/evaporation dam first, before undertaking any other activities;

- Construct berms down-gradient of construction areas to collect dirty runoff. Allow silt to settle, examine for contamination with oil and/or hydraulic fluids. Remove contaminated material monthly for remediation or appropriate disposal in accordance with prevailing legislation. Clean silt can be used during re-vegetation of bare areas;
- Place drip trays under vehicles when parked;
- Service vehicles in a workshop, not in the field;
- If in-field refuelling is done from a tanker, it should be done in a designated dirty area and a spill kit and clean-up team must be available on site;
- Spillages should be cleaned up immediately and contaminated soil must either be remediated *in situ* or disposed of at an appropriately licensed landfill site;
- Potentially contaminating wastes (empty containers for paint, solvents, chemicals, etc.) and cement should be stored in bunded areas until removed by a reputable contractor for disposal at an appropriately licensed site;
- Provision of adequate sanitation facilities in the form of chemical toilets that are serviced regularly; and
- Providing environmental awareness training for workers on site.

9.3.7.2 Operation

Once operational, the 75 MW PV1 installation will require an estimated 0.025 million m^3 of water per annum for regular cleaning of the PV panel surfaces and general cleaning. The PV2 solar installation and the CSP Tower installation are expected to need 0.025 million m^3 per annum and 0.25 million m^3 per annum respectively, bringing the total requirement for the Bokpoort II installation to 0.03 million m^3 per annum.

Part 3 of the National Water Act requires that a certain amount of the water flow in a river be reserved for basic human needs and for ecological needs. The environmental flow in a river is the flow required to maintain the ecosystem in a negotiated ecological condition. Environmental requirements are dependent on the natural flow generated in the upstream catchments and therefore differ from month to month and for each year. Various parties, including The Lesotho Highlands Development Authority (LHDA), the governments of Lesotho, South Africa, and Namibia, and the World Bank have agreed that environmental flows should reside between 19% and 40% of the mean annual runoff (MAR). The flow in the Orange River is maintained by a MAR of 135 million m^3 per annum.

The estimated water balance for the Lower Orange River Water Management Area, based on information available from the Department of Water and Sanitation (Department of Water Affairs, 2013) is shown in Table 9-3.

Table 9-3: Water balance for Lower Orange WMA

Description	2020 (million m^3/a)	2025 (million m^3/a)	2030 (million m^3/a)
RSA Urban industrial demands	36.372	37.963	39.600
Namibia Urban Industrial Demands	9.379	9.474	9.570
RSA Mining	16.785	16.942	17.100
Namibia Mining	10.973	11.224	11.474
Irrigation Farming	19.800	19.800	19.800
New developments	2.880	4.108	5.299
PV1 Solar Facility	0.025	0.025	0.025
Environmental demand (Average)	39.830	39.830	39.830

Total User Demands	136.044	139.366	142.698
Natural Runoff	135.000	135.000	135.000
Upington Return Flow	6.513	6.947	7.323
Total Inflows	141.513	141.947	142.323
Net Balance	5.469	2.581	-0.375

The Bokpoort II PV1 project will increase the expected demand in 2020 by 0.018% and will thus have a negligible impact on the availability of water from the Orange River, but the other potential impacts identified for the construction phase could also occur during the operational phase, which will be of much longer duration.

A consultation process has been initiated with the Northern Cape Department of Water and Sanitation to determine the water availability within the Lower Orange River Catchment. The outcome of the consultation will be presented in the final EIA report.

The groundwater quality and yield from the local aquifers as stated in Section 8.1.9 for the project area excludes groundwater as a preferred water source for the proposed development.

The aeolian sands in the project area have high infiltration rates, ranging from 10 to 250 mm/hr (Benedek, F; Roods, M;, February 2011). If runoff does occur in this arid area, it occurs as storm flow, which subsides quickly.

The installation and operation of the PV1 plant will result in the creation of some relatively small impervious areas (e.g. buildings, roads and the surfaces of the PV panels). Such areas will not have a large enough footprint to affect the overall infiltration rate on site significantly.

Vehicular movement between the solar panels will disturb the sandy soil surface, but it will not reduce the infiltration rate significantly, because sand is resistant to compaction,

Cyanobacteria are known to cause biological crusting in the arid Kalahari Basin. Such crusts provide nutrients to desert plants. They are constantly disturbed by the movement of game and livestock, but they re-establish rapidly and there is no evidence that they interfere with infiltration.

It is thus unlikely that localised runoff from such small footprints, with spaces in between large enough for vehicular access for cleaning and maintenance purposes, will result in an accumulation of runoff that would cause erosion and migrate off site.

The potential surface water impact during the construction phase has been assessed as being of ***moderate (SP = 48)*** significance. The following measures are recommended to reduce the potential impact to one of ***low (SP = 27)*** significance:

- Remove settled silt from runoff control berms regularly, examine for contamination with oil and/or hydraulic fluids. Subject contaminated material to remediation or appropriate disposal in accordance with prevailing legislation. Clean silt can be used during re-vegetation of bare areas;
- Place drip trays under vehicles when parked;
- Service vehicles in a workshop, not in the field;
- Spillages should be cleaned up immediately and contaminated soil must either be remediated *in situ* or disposed of at an appropriately licensed landfill site;
- Potentially contaminating wastes (empty containers for paint, solvents, chemicals, etc.) and cement should be stored in bunded areas until removed by a reputable contractor for disposal at an appropriately licensed site; and
- Provide environmental awareness training for workers on site.

9.3.7.3 Closure and rehabilitation

The closure and rehabilitation phase will be of shorter duration than the construction phase. The potential impacts will be similar and similar remediation measures are recommended to reduce the assessed impacts from a ***moderate (SP = 40)*** to a ***low (SP = 21)*** significance. Demolition of containment systems such as the bunded areas should take place after all other structures have been removed.

9.3.7.4 Peer Review

In a letter dated 17 March 2016, the DEA stipulated that in-house specialist studies must be peer reviewed by external specialists – see APPENDIX C.

The surface water specialist report (Dateling, J; Boyd, L;, 2016) was peer reviewed by Dr. Bruce Randell of iLanda Water Services cc. The review findings and Golder's response are included in APPENDIX K. The main findings can be summarised as follows:

- *Recommendations were made on the incluson of additonal information relating to termperature data and rainfall data, information on the storm water management plan and erosion control;*
- *Overall, the Golder Report is considered to be acceptable, water quality data assessment is adequate and appropriate.*

9.3.8 Groundwater

9.3.8.1 Construction

Soil contamination by lubricants, hydraulic fluids and/or cement could result in groundwater contamination. Groundwater may also be impacted by poor sanitation practices of construction workers.

The potential impact is assessed as being of ***moderate (SP = 40)*** significance. It can be reduced to one of ***low (SP = 15)*** significance by implementing the surface water management measures recommended in section 9.3.7.1.

9.3.8.2 Operation

Soil contamination by spillages of lubricants, hydraulic fluids, solvents and cleaning chemicals during the operational phase could result in groundwater contamination, resulting in an impact of ***high (SP = 65)*** significance. It can be reduced to one of ***moderate (SP = 22)*** significance by implementing the following mitigation measures:

- Place drip trays under vehicles when parked;
- Service vehicles in a workshop, not in the field;
- Spillages should be cleaned up immediately and contaminated soil must either be remediated *in situ* or disposed of at an appropriately licensed landfill site;
- Potentially contaminating wastes (empty containers for paint, solvents, lubricants, cleaning chemicals, etc.) should be stored in bunded areas until removed by a reputable contractor for disposal at an appropriately licensed site; and
- Provide environmental awareness training for workers on site.

9.3.8.3 Closure and rehabilitation

The closure and rehabilitation phase will be of shorter duration than the construction phase. The potential impacts will be similar and similar remediation measures are recommended to reduce the assessed impacts from a ***moderate (SP = 40)*** to a ***low (SP = 15)*** significance. Demolition of containment systems such as the PCD and bunded areas should take place last, after all other structures have been removed.

9.3.8.4 Peer review

In a letter dated 17 March 2016, the DEA stipulated that in-house specialist studies must be peer reviewed by external specialists – see APPENDIX C. The groundwater report for the Bokpoort I project (Dindi & Troskie,

2010) and Golder's professional opinion as reflected in section 9.3.8.1 to 9.3.8.3 of this EIA report were were peer reviewed by Mr Hugo Janse van Rensburg of Aquisim Consulting (Pty) Ltd (Janse van Rensburg, H;, 3 May 2016). The report is included in APPENDIX L and his main findings can be summarised as follows:

- *The baseline information in the GCS groundwater report is applicable to the Bokpoort II project area; and*
- *The impact statement and mitigation measures are appropriate to the nature and scale of the project.*

9.3.9 Noise

9.3.9.1 Standards and Guidelines

In South Africa, the noise impact on human receptors is evaluated in terms of the SANS 10103 guidelines for sound pressure levels as listed in Table 9-4.

Table 9-4: Noise level standards for various districts

Type of District	Equivalent continuous rating level $L_{Req.T}$ for ambient noise - dBA					
	Outdoors			Indoors with windows open		
	Day-night L_{Rdn}	Daytime L_{Rd}	Night time L_{Rn}	Day-night L_{Rdn}	Daytime L_{Rd}	Night time L_{Rn}
Rural districts	45	45	35	35	35	25
Suburban districts with little road traffic	50	50	40	40	40	30
Urban Traffic	55	55	45	45	45	35
Urban districts with some workshops, business premises and main roads	60	60	50	50	50	40
Central business districts	65	65	55	55	55	45
Industrial districts	70	70	60	60	60	50

Daytime and night time refer to the hours from 06:00 – 22:00 and 22:00 – 06:00 respectively.

Typical responses of communities to various increases in noise levels are listed in Table

Table 9-5: Typical community response to increases in ambient noise level

Excess $L_{Req.T}$ dBA	Response
0	No Reaction
0-10	Sporadic complaints
5-15	Widespread complaints
10-20	Threats of community/group action
>15	Vigorous community/group action

Excess $L_{Req.T}$ is calculated from the appropriate of the following:

a) Excess LReq, T = LReq, T of ambient noise under investigation minus LReq, T of the residual noise (determined in the absence of the specific noise under investigation).

b) Excess LReq, T = LReq, T of ambient noise under investigation minus the typical rating level for the applicable district as determined from Table 9-4.

9.3.9.2 Construction

The main construction related sources of noise will be:

- Establishment of a construction camp and equipment laydown area;
- Removal of vegetation and site preparation;
- General movement of heavy vehicles such as bulldozers, tractor-loader-backhoes, front end loaders, compactors, mobile cranes, delivery vehicles and water trucks for dust suppression around the site;
- Excavation of heavy plant/building foundations and service trenches. Pneumatic breakers will be used where rock is encountered, but some blasting may be required;
- Road construction equipment, such as scrapers, dozers and compactors for construction of access roads;
- Erection of shuttering for concrete works;
- Placing and vibration of concrete. Poker vibrators will be used;
- Stripping of shuttering after concrete pour;
- Erection of structural steelwork;
- Finishing operations on buildings;
- Installation of plant and equipment;
- Construction of site fabrication workshops and plant maintenance workshops; and
- Concrete batching plant.

Typical noise levels generated by various types of construction equipment are provided in Table 9-6. Conservative attenuation conditions, related to intervening ground conditions and screening vegetation, have been applied.

Table 9-6: Typical noise levels generated by construction equipment

Plant/Equipment	Typical Operational Noise Level at Given Offset (dBA)							
	5m	10m	25m	50m	100m	250m	500m	1000m
Air Compressor	91	85	77	71	65	57	51	46
Compactor	92	86	78	72	66	58	52	46
Concrete Mixer	95	89	81	75	69	61	55	49
Concrete Vibrator	86	80	72	66	60	52	46	40
Mobile Conveyor Belt	77	71	63	57	51	43	37	32
Crusher (Aggregate)	90	84	76	70	64	56	50	44
Crane (Mobile)	93	87	79	73	67	59	53	47
Dozer	95	89	81	75	69	61	55	49
Loader	95	89	81	75	69	61	55	49
Mechanical Shovel	98	92	84	78	72	64	58	52
Pile Driver	110	104	97	91	85	77	71	65

Plant/Equipment	Typical Operational Noise Level at Given Offset (dBA)							
	5m	10m	25m	50m	100m	250m	500m	1000m
Rock Drill	108	102	94	88	82	74	68	62
Roller	84	78	70	64	58	50	44	38
Trucks	87	81	73	67	64	60	57	54

Exact daytime and night-time continuous equivalent sound pressure levels cannot be calculated with any certainty at this stage as the final construction site layout, work programme for the various components, work *modus operandi* and type of equipment have not been finalised. Using baseline data from typical construction sites, the ambient noise conditions that may be expected at various offsets from the site are shown in

Table 9-7.

Table 9-7: Predicted ambient noise levels at given offsets from construction activities

Equipment	Sound pressure level at given offset(dBA)					
	500m	1000m	1500m	2000m	2500m	3000m
Concrete Batching Plant	53.6	46.0	41.1	37.5	34.7	32.3
Concreting Operations	57.2	49.1	43.9	40.1	37.1	34.6
Compactor	52.1	44.0	38.8	35.0	32.0	29.5
Trucks	57.1	49.0	43.8	40.0	37.0	34.5

With reference to Table 9-6 and

Table 9-7, the noise levels due to the construction activities will be attenuated to about the same level as the current daytime baseline levels at a distance of 1 500 m from the site (typical baseline average noise levels in a rural area are about 45 dBA in the daytime and 35 dBA in the night-time).

9.3.9.2.1 Potential receptors

The locations of identified potential receptors are listed in Table 9-8.

Table 9-8: Identified potential receptors in the vicinity of the project

Receptor	Distance from perimeter of Bokpoort II Project Site (metres)	Direction
Perimeter of Bokpoort I site	1 100	South
Power Plant on Bokpoort I site	1 700	South-south-west
Eskom Garona Substation	3 080	South-south-west
Nearest Farmstead Buildings	3 500	South- west
Southern Perimeter of Kalahari Oryx Game Farm	1 900	North-east
Glen Lyon Farms	19 000	South-east

Receptor	Distance from perimeter of Bokpoort II Project Site (metres)	Direction
!Kheis Riverside Lodge	15 800	South-south-east
Closest agricultural area on banks of Orange River	12 600	South-south-west

The farmstead, the Kalahari Oryx Game Farm and the Glen Lyon Farms are considered to be noise sensitive receptors. From Table 9-8 it can be seen that:

- All of the receptors are more than 1 000 metres from the construction site and none of the noise sensitive receptors are closer than 1900 metres;
- None of the sensitive receptors are likely to experience noise levels that exceed typical daytime noise levels (45 dBA) for rural areas; and
- The typical night-time noise level of 35 dBA could be exceeded within a radius of 3 000 m of the construction site.
- There may be some nuisance noise effects from intermittent loud noises.

Traffic to and from the construction site will have a relatively minor effect on the noise climate alongside the main external roads in the area, but sensitive receptors along the access routes are likely to experience intermittent nuisance noise.

Higher ambient noise levels than recommended in SANS 10103 are normally accepted as being reasonable during the construction period, provided that the very noisy construction activities are limited to the daytime and that the contractor takes reasonable measures to limit noise emanating from the work site.

9.3.9.2.2 Impact assessment

The noise impact during the construction phase is assessed as being of ***low (SP = 20)*** significance before mitigation. The following mitigation measures are recommended to reduce the impact to one of ***lower (SP = 16)*** significance:

- The construction laydown area and other noisy fixed facilities should be located as far away from noise sensitive receptors (NSRs) as practicable and in locations where the terrain and vegetation offer an acoustic screening effect between the noise sources and the NSRs;
- All construction vehicles and equipment should be kept in good repair;
- Where necessary, stationary noisy equipment (e.g. compressors, pumps, pneumatic breakers) should be encapsulated in acoustic covers. Proper sound insulation can reduce noise by up to 20 dBA. Portable acoustic shields should be used where noisy equipment is not stationary;
- Construction activities, and particularly the noisy ones, should be limited to the period 06h00 to 22h00;
- With regard to unavoidable noisy construction activities in the vicinity of noise sensitive areas, ACWA Power should liaise with adjacent landowners/occupants on how best to minimise the impact;
- Machines in intermittent use should be shut down or throttled down to a minimum whenever practicable;
- All activities must meet the noise standard requirements of the Occupational Health and Safety Act (Act No. 85 of 1993); and
- Construction staff working in areas where the 8-hour ambient noise levels exceed 75 dBA should be obligated to wear hearing protection equipment.

9.3.9.3 Operation

The major noise sources associated with the operation of the PV solar facility will be the inverter, transformer substation, transmission lines, water truck(s) used for panel cleaning and workers commuting.

The inverter and transformer substation will both potentially emit a buzzing or humming sound which is expected to be between 50 – 60 dBA at close range (3 metres). It is expected that the sound from the inverter and transformer substation will fade away to background levels within 30 – 50 metres (Guldberg, December 2012), which is comparable to some of the noise sources listed in Table 9-6.

Taking into account the distance between the plan and receptors as indicated in Table 9-8 and the fact that the proposed PV 1 facility will be in close proximity to the already existing Garona Substation, the noise impact is assessed as being of ***moderate (SP = 36)*** significance before mitigation. The following mitigation measures are recommended to reduce the impact to one of ***low (SP = 18)*** significance:

- Reduce the noise from the inverter and substation by implementing a combination of shielding, noise cancellation, filtering and noise suppression;
- The site layout and design should consider, *inter alia*, the following aspects:
  - The position and orientation of buildings on the site;
  - The design of the buildings to minimise the transmission of noise from the inside to the outdoors; and
  - The acoustic insulation of particularly noisy plant and equipment.
- All plant, equipment and vehicles should be kept in good repair; and
- Where possible, very noisy activities should not take place at night (between the hours of 20h00 to 06h00).

9.3.9.4 Closure and rehabilitation

The activities associated with the closure and rehabilitation phase of the project will generate similar, but probably lower, noise levels than those experienced during the construction phase. This is likely to happen by about 2045 to 2050. The duration will also be similar, except for post closure monitoring of rehabilitation progress, which will continue for several years, but will not have any noise impacts.

Since the nature and location of sensitive receptors at time of closure cannot be predicted, the impact is conservatively assessed as being the same as during the construction phase. Without mitigation, the noise impact during closure and rehabilitation is assessed as ***low (SP = 24)***. The following mitigation measures should be implemented to reduce the impact to a level of ***low (SP = 18)*** significance:

- Sound-absorbing barriers should be demolished last;
- No noisy activities should be undertaken during night-time (22h00 to 06h00);
- Equipment and vehicles with lower sound power levels should be selected; and
- Noise abatement equipment should be maintained in good condition.

9.3.10 Visual Aspects

A visual impact study was undertaken during January/February 2016 (Ramsaroop, P; Bothma, J, 2016).

A typical visual impact assessment considers a radius of 10 km around the physical footprint of a development, because the human eye cannot generally distinguish significant detail beyond this distance.

However, taking into account the extent and nature of the proposed PV1 solar facility within the relative flat landscape and the topography of the surrounding area, this study was based on a 40 km radius around the physical footprint of all surface components of the project (based on the viewshed analysis).

9.3.10.1 Visual absorption capacity

Visual absorption capacity (VAC) is defined as "an estimation of the capacity of the landscape to absorb development without creating a significant change in visual character or producing a reduction in scenic quality" (Oberholzer, 2005). The ability of a landscape to absorb development is determined primarily by the topography and the nature and extent of vegetation cover, human structures and contrast between the proposed new project and the existing elements in the landscape.

The surrounding area has been transformed from open grazing land to include the Bokpoort I Solar facility and game farming. The combination of a flat topography with low shrubs and trees makes the viewing distance for a tall structure extensive and the area is rated as having a low VAC.

9.3.10.2 Visual receptor sensitivity

Receptor sensitivity refers to the degree to which an activity will actually impact on receptors and depends on how many persons see the project, how frequently they are exposed to it and their perceptions regarding aesthetics. Receptors of the proposed solar development can be broadly categorised into residential and transient receptors (travellers by road and air).

9.3.10.2.1 Residential receptors

There are 9 schools, 3 mines/quarries and 77 other built structures within the 40 km radius study area containing an estimated 3 785 resident receptors, broken down as shown in Table 9-9.

Table 9-9: Residential receptors

Distance from Bokpoort II site	Type of structure	Number affected
0 - 5 km	Household	7
5 - 10 km	Household	15
10 - 20 km	Household	630
	School	2
	Mine/Quarry	3
	Other built-up	1
20 - 40 km	Household	3 044
	School	7
	Other built-up	76
Total		***3 785***

Source: Rooftop count from Eskom SBC Data, 2009

9.3.10.2.2 Transient receptors

The roads in the study area include national roads (N10, N14 and R64), untarred secondary roads (Loop 16) and farm access roads. The N10 runs along the west bank of the Orange River and provides easy access to the Orange River Wine Route and other tourist destinations such as the Augrabies National Park. A railway line runs south-east of the site and crosses the lower part of Portion 0 of the farm Bokpoort 390.

Glare from the reflective surfaces of the PV panels can be a visual distraction for aircraft pilots. The project area is not close to any international flight path, but its glare could potentially impact smaller aircraft such as crop dusters, micro light craft, tourist charters and helicopters. The Kalahari Oryx Game Reserve has a landing strip to accommodate international guests with their own private planes.

9.3.10.3 Level of theoretical visibility

The level of theoretical visibility (LTV) is defined as the sections of the study area from which the proposed project or its constituent elements may be visible. This area was determined by conducting a viewshed analysis and using Geographic Information System (GIS) software with three-dimensional topographical modelling capabilities, including viewshed and line-of-sight analyses (cross-sections).

No detailed contours were available for the study area, but the 30 m Shuttle Radar Topography Mission (SRTM) data (NASA, 2014) was used. The observer height was set at 1.5 m and the viewshed was modelled for a 40 km radius around the site. The following heights were used for the infrastructural components:

- Substations: 10 m;
- PV panels: 4 m; and
- Offices - single storey building.

The viewshed analysis in Figure 9-1 shows the areas within a 40 km radius from which the PV1 facility with associated infrastructure at a height of 10 metres would be visible.

9.3.10.4 Construction

Local residents and travellers along local roads will initially see vehicles transporting personnel, equipment and materials to the Bokpoort II site. Dust plumes resulting from travel along unpaved roads and earthmoving activities on the site would be visible from distances of several kilometres.

The PV 1 solar panels are expected to be 4 metres. Although it will be theoretically visible from as far as 40 km, it will not be prominent to the naked eye from distances in excess of 10km.

Lighting on the site and the lights of vehicles moving at night will be visible from as far as 40 km, but will not be prominent to the naked eye from distances in excess of 10km.

The visual impact is assessed as being of ***moderate (SP = 40)*** significance. The following mitigation measures are recommended to reduce the impact to one of ***low (SP = 24)*** significance:

- Avoid unnecessary removal of screening vegetation;
- Wet suppression of dust generation, especially on dry, windy days;
- Paving bare areas, covering them with a layer of crushed rock or gravel, or treating them with chemical binders such as Dustex or Dust-a-side;
- Re-vegetating bare areas that will not be used frequently;
- Placing dust collection buckets around the perimeter of the construction area to monitor dust fall;
- Employing motion activated security lighting, where practical, to avoid unnecessary constant illumination;
- Balancing the height of floodlight masts against the need to maintain the required levels of illumination;
- Avoid up-lighting of structures and use light fittings that direct the light inwards, downwards and towards areas that must be illuminated;
- Construct and/or paint offices and workshop buildings in colours that are complementary to the surrounding landscape, such as olive green, light grey, grey-green, blue-grey, dark buff, rust, ochre and variations of tan. Avoid using white or shiny surfaces, especially galvanised steel, which causes glare; and
- Utilise construction materials that have matt textures where practicable.

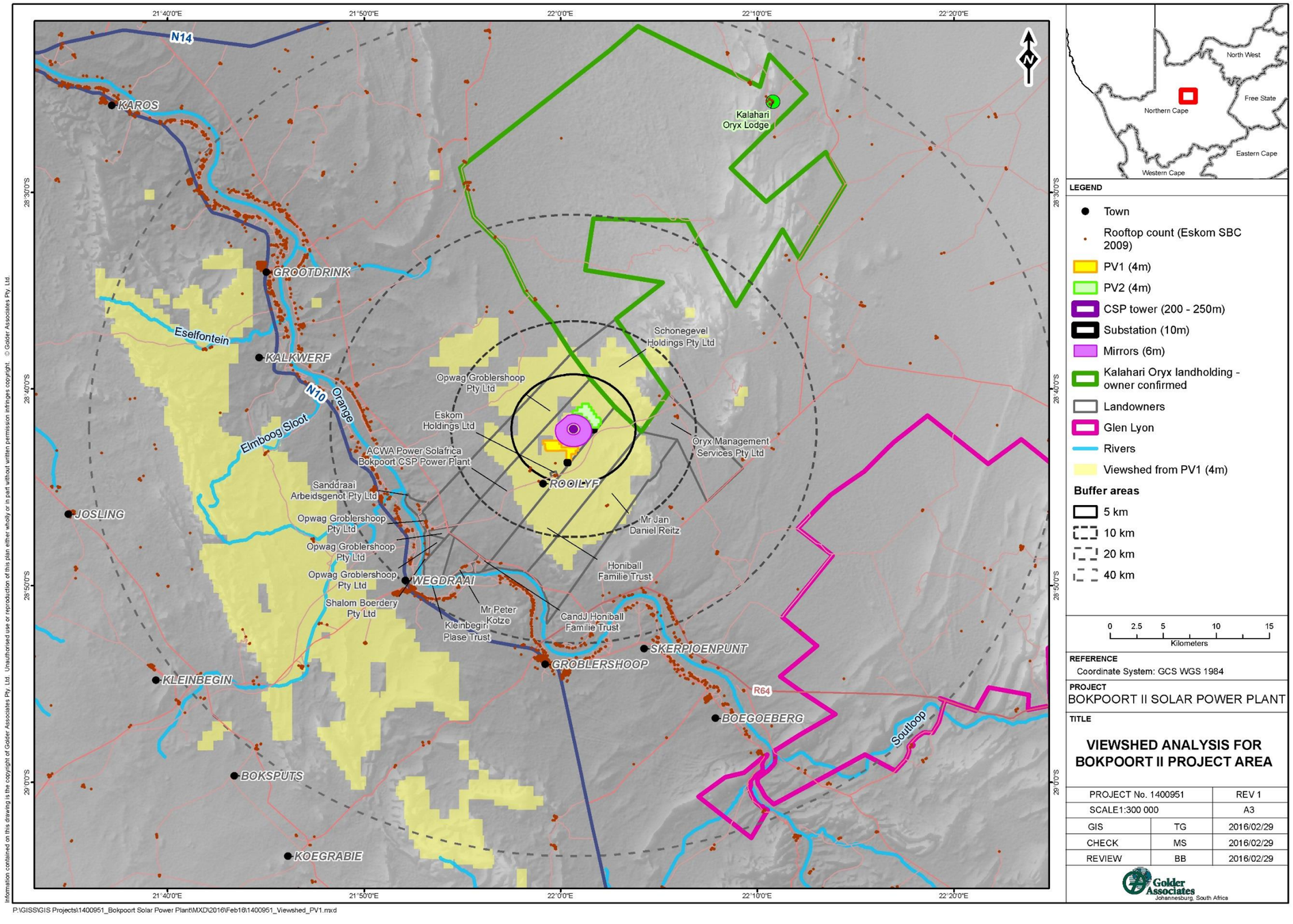


Figure 9-1: Viewshed analysis for PV 1 solar installation

9.3.10.5 Operation

The visual impact during the operational phase will be the glare from the reflective surfaces during the day – see Section 3.1 for a typical illustration. On a clear day the reflected glare from the PV panels and associated infrastructure will be 95% visible in a 0 – 5 km radius and 60% in the 5 – 10 km radius around the site. Visual intrusion relates to how well an observer considers the project components to fit into the ecological and cultural aesthetic of the landscape as a whole. It is a subjective opinion that differs from one observer to another.

The existing Bokpoort I Solar Trough facility is smaller in area. The heat exchanger is the tallest structure at 20 m in height. The PV Panels will be 4 metres and the substation will be 10 metres high. The CSP Trough facility is more intrusive than the PV solar facility would be, but it already constitutes a significant visual impact on the landscape.

The PV1 solar facility will have a night-time visual impact, due to the typical lighting needed on any industrial site.

The visual impact of the PV 1 installation during the operational phase is assessed as being of ***moderate (SP = 56)*** significance. The following mitigation measures are recommended to reduce the impact to one of ***moderate (SP = 36)*** significance:

- If practicable, reduce the reflected glare by:
  - Using materials that are darker in colour to absorb more light and reflect less;
  - Using matt surface finishes that absorb and/or scatter more light and reflect less;
  - Placing and aligning the PV panels in a manner that will reduce the intensity of the reflected glare towards the most sensitive areas, such as the Kalahari Oryx and other similar properties.
- Paving of roads and other bare areas, covering them with a layer of crushed rock or gravel, or treating them with chemical binders such as Dustex or Dust-a-side;
- Maintaining vegetation cover on areas that are not used frequently;
- Placing dust collection buckets around the perimeter of the construction area to monitor dust fall;
- Employing motion activated security lighting, where practical, to avoid unnecessary constant illumination;
- Balancing the height of floodlight masts against the need to maintain the required levels of illumination; and
- Avoid up-lighting of structures and use light fittings that direct the light inwards, downwards and towards areas that must be illuminated;

9.3.10.6 Closure and rehabilitation

The activities and their impacts will be similar to those experienced during the construction phase. The visual impact is assessed as being of ***moderate (SP = 40)*** significance. The following mitigation measures are recommended to reduce the impact to one of ***low (SP = 24)*** significance:

- Wet suppression of dust generation, especially on dry, windy days;
- Continued monitoring of dust fall;
- Re-vegetating bare areas with locally indigenous grasses and forbs as soon as possible;
- Using motion activated security lighting, where practical, to avoid unnecessary constant illumination; and

- Avoid unnecessary vehicle trips at night.

9.3.10.7 *Peer Review*

In a letter dated 17 March 2016, the DEA stipulated that in-house specialist studies must be peer reviewed by external specialists – see APPENDIX C

The visual assessment specialist report (Ramsaroop, P; Bothma, J, 2016) was peer reviewed by Graham Young of Newtown Landscape Architects cc. The review findings are included in APPENDIX M. The main findings can be summarised as follows:

- *The report has been written to acceptable National and IFC Standards and that there is adequate relevant science to justify and adequately explain and defend the conclusions in the report.*

9.3.11 Sites of archaeological and Cultural Significance

As indicated in section 8.1.12, a scattering of ironstone, quartz and meta-quartzite artefacts was found near the Garona Substation (see Figure 8-18), but no other cultural or historical resources were found at the proposed Bokpoort II site. The red sand dunes seem to be sterile, but more such Later Stone Age artefacts may possibly be buried beneath the sand. Widespread lithic scatters occur over a large area in the region, but the artefacts found to date are considered to be of low significance.

9.3.11.1 *Construction*

The archaeological survey showed that Middle and Later Stone Age artefact scatters could potentially be found across the study area. The surface will be disturbed during construction and similar artefacts to those found near the Garona Substation may be unearthed. Based the findings of the survey at the Bokpoort II site, the potential impact is assessed as being of ***low (SP = 21).*** However, there is always a possibility of uncovering and damaging or destroying buried resources, such as human remains, fossils or other resources of high significance. If that happens, the potential impact could be of ***high (SP = 80)*** significance, but it can be mitigated to one of ***low (SP = 21)*** significance by implementing the following recommended mitigation measures:

- Training construction workers to recognize potentially significant archaeological resources; and
- Applying the following chance find procedures in the event of any buried resources (e.g. human remains) being discovered during activities:
  - Cease all work in the immediate vicinity of the find;
  - Demarcate the area with barrier tape or other highly visible means;
  - Notify the South African Heritage Resources Authority (SAHRA) immediately;
  - Commission an archaeologist accredited with the Association for Southern African Professional Archaeologists (ASAPA) to assess the find and determine appropriate mitigation measures. These may include obtaining the necessary authorisation from SAHRA to conduct the mitigation measures; and
  - Prevent access to the find by unqualified persons until the assessment and mitigation processes have been completed.

9.3.11.2 *Operation*

It is highly unlikely that any heritage resources will be found during the operational phase, but not entirely impossible, if work involving soil disturbance is undertaken on previously undisturbed areas. The potential impact is assessed as being of ***Low (SP = 16)*** significance, reducing to ***Low (SP = 10)*** significance by implementing the same mitigation measures as in section 9.3.11.1 above.

9.3.11.3 Closure and rehabilitation

There is almost no possibility of finding any previously undiscovered resources on the previously disturbed areas during the closure and rehabilitation phase ***(SP = 0)***, as the rehabilitation activities will be confined to the previously disturbed areas.

9.3.12 Traffic

The following comments were received from interested and affected parties about the Bokpoort I project:

- *"Dust caused by increased traffic at higher speeds along unpaved roads during construction of the Bokpoort I project have already affected quality of grapes produced along the Orange River and resulted in revenue losses. The Bokpoort II project will exacerbate the situation;*
- *Why were foreign truck drivers used on the Bokpoort I project? They disregarded traffic rules, travelled at high speeds, raised a lot of dust and endangered other road users; and*

The local dirt roads were not built to carry heavy vehicles."

A traffic impact assessment study was undertaken (Van Wyk, L; Reutener, I, 2016) and mitigation measures to address to address the identified impacts and concerns raised during the scoping phase were formulated.

9.3.12.1 Construction

9.3.12.1.1 Access to the Project Site

A new internal access road will be constructed at the project site to connect the private Transnet Road with the project site. The new access road will be constructed via the existing Bokpoort I site access road (see Figure 2-1).

Table 9-10 lists the distance via the various roads in the vicinity of the project to Upington which is a central node connecting the major roads to Cape Town and Walvis Bay harbours that will possibly be used to deliver major infrastructure components to the project site.

Table 9-10: Haul Road Distances from Upington to proposed site

Route	Distance (km)
N14 / Gariep Road Crossing via Upington and N10 to Bokpoort	191
N14 / Gariep Road Crossing via Gariep Road to Bokpoort	65
Difference	126

Travelling from the project site via the Gariep to the N14 crossing is 126 km shorter than travelling via the N10 and Upington. The Gariep Road is a gravel road and is not recommended as a haul route due to the road safety and dust issues discussed in Section 8.1.13.1.1 and Section 8.1.13.1.2 (except in individual instances when specific instructions from the relevant authority is issued for the delivery of special loads).

The distances via the various roads in the vicinity of the project area to Gauteng are listed in Table 9-11.

Table 9-11: Haul Road Distances from Gauteng to proposed site

Route	Distance (km)
Johannesburg CBD to Bokpoort via N8 and R59	794
Johannesburg CBD to Bokpoort via N8 and N12	795
Johannesburg CBD to Bokpoort via N14 to Upington and then N10	908
Johannesburg CBD to Bokpoort via N14 and Gariep Road – ***not allowed***	811

9.3.12.1.2 Personnel and Materials Conveyance to the Project Site

The anticipated duration of the construction phase of the proposed PV1 solar facility is 9 months. The anticipated number of people on site during the peak of the construction period is:

- Local residents: 40 employees;
- Foreign contractors: 10 employees;
- Total: 50 employees.

No contractors will be housed on site. They will be transported to the site by company transport, minibus taxi or private transport from nearby residential areas and the towns of Groblershoop, Upington.

A number of different types of construction vehicles will bring the construction equipment and material to site. The construction vehicles will consist of a crane, articulated flatbed to deliver the crane and the shuttering, concrete trucks, concrete pump, tipper trucks to remove the rubble from the site and to deliver raw materials (sand, gravel, salt, etc.) for the concrete batching plant, delivery vehicles and staff vehicles. The construction materials will mostly consist of the solar panels and raw materials for the concrete foundations, structures and other ad-hoc deliveries. The anticipated construction related traffic is summarised in Table 9-12.

Table 9-12: Construction Generated Traffic

	Morning (AM) Peak hour		Afternoon (PM) Peak hour		Daily	
Item	**In**	**Out**	**In**	**Out**	**In**	**Out**
Staff	16	4	6	16	31	31
Ad-hoc delivery and service support vehicles (small)	1	1	1	1	10	10
Construction and delivery vehicles (large)	4	4	4	4	37	37
Total Vehicles	**21**	**9**	**11**	**21**	**78**	**78**

The estimated number of peak hour trips per day will be:

- 30 trips in the morning; and
- 32 trips in the late afternoon.

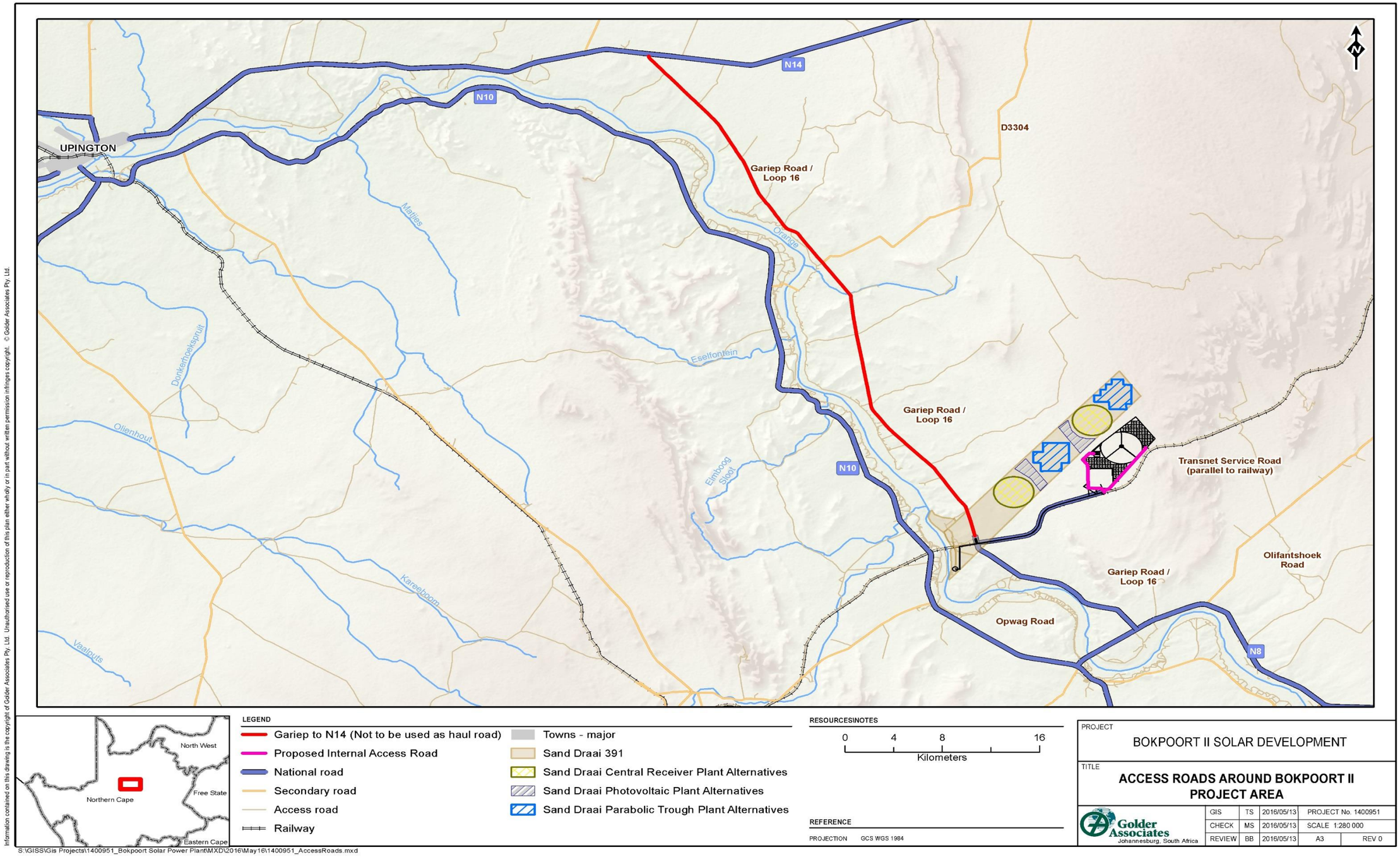


Figure 9-2: Access Roads in the vicinity of the Project Area

All personnel and equipment will be transported to the project site by road. The increase in traffic, especially heavy loads, will cause accelerated deterioration of the road network, particularly the affected section of the Gariep Road and the private Transnet Road (Van Wyk, L; Reutener, I, 2016). It is not expected that any equipment will be transported to site by rail.

The construction time and the number of workers involved in the construction phase of the PV1 solar project will be less than the Bokpoort I CSP Trough project but similar heavy equipment will be brought to site. If nothing changes, similar impacts will prevail, with an assessed impact of ***moderate (SP = 65)*** significance, but it can be mitigated to one of ***moderate (SP = 36)*** significance by implementing the following recommended mitigation measures:

- Wet suppression on unpaved access roads with water and a suitable dust palliative or with commercial binders such as Dustex or Dust-a-Side to achieve 95 % control efficiency. Water alone will only achieve 75 % control efficiency;
- Paving areas on site where vehicles travel or covering them with crushed rock;
- Using only vehicles that are in good condition;
- Ensuring that loaded vehicles are not too heavy for the road surfaces;
- Fitting trucks with recording tachometers and enforcing appropriate speed limits on paved and unpaved surfaces;
- Engaging with the road authorities to pave local roads used by ACWA Power traffic; and
- Monitoring dustfall at sensitive receptors such as crop farms.

9.3.12.2 Operation

The number of employees at the Bokpoort II PV 1 solar project (10) will be less than the number at the Bokpoort I CSP trough project (19). The PV 1 solar facility will be operated on a 24 hour basis which includes 3 shifts with 4 employees each. These numbers are not large in isolation or in comparison with existing traffic on the local roads. They are also much lower than the numbers involved in construction and they will make use of lighter vehicles. No employees will be housed on site. Nevertheless, they will have similar impacts to those listed in section 9.3.12.1 above and the impacts will be cumulative as each successive project is established.

The impact is assessed as being of ***moderate (SP = 75)*** significance, but it can be mitigated to one of ***moderate (SP = 44)*** significance by implementing the mitigation measures recommended in section 9.3.12.1 above.

9.3.12.3 Closure and rehabilitation

The traffic activities will be 60% less than those of the construction phase, but by the time of closure, it is highly likely that the local access roads will have been paved and the traffic will have an impact of ***moderate (SP = 40)*** significance, which can be mitigated to one of ***low (SP = 24)*** significance by implementing the following recommended mitigation measures:

- Using only vehicles that are in good condition;
- Ensuring that loaded vehicles are not too heavy for the road surfaces;
- Fitting trucks with recording tachometers and enforcing appropriate speed limits; and
- Monitoring dustfall at sensitive receptors such as crop farms

9.3.13 Socio-economic

The Socio-economic Impact Assessment (SIA) in the EIA focused on the impacts that the project is expected to have on the local socio-economic environment and the long term, indirect socio-economic impacts that the proposed Bokpoort II project could have on a regional and even a national scale.

9.3.13.1 Construction

Construction of the PV solar facility will take about 9 months and provide about 50 employment opportunities (40 local and 10 foreign workers, which has been assessed as a positive impact, but of ***low (SP = +18)*** significance. The following measures are recommended to enhance the impact to one of ***moderate (SP = +32)*** significance:

- Appointing one or more community liaison officers to manage the interaction with the neighbouring residents, other members of the public and the authorities;
- Communicating information regarding the transport routes, peak operational times, associated hazards and precautionary measures to the Ward councillor as well as any relevant community organisations;
- Ensuring that project information is communicated formally, consistently and responsibly to avoid misunderstandings and the creation of unrealistic expectations;
- Setting up a formal grievance mechanism for the public to lodge issues. All complaints must be recorded, followed up and resolved as expeditiously as possible;
- Using local contractors and providers of goods and services preferentially where practicable;
- Fencing off the construction area and exercising access control;
- Prohibiting access to adjacent areas, and especially to neighbouring properties;
- Imposing a strict prohibition against trapping of animals and harvesting of plants;
- Preventing the development of ad-hoc roadside dwellings, shops and so forth on or adjacent to the project site;
- The Contractor, in line with the relevant socio-economic focus of the !Kheis LM and ACWA Power's personnel policies, must develop an appropriate exit strategy for temporary employees;
- Construction traffic past community infrastructures such as schools, crèches, sporting facilities, etc. must be properly managed and the rules of the road should be strictly enforced;
- Limiting construction-related road use to daylight hours and avoiding the movement of heavy vehicles during peak traffic hours as far as practicable; and
- Developing a database of local job seekers, with skills levels and employment history, before commencing with personnel recruitment for the operational phase.

9.3.13.2 Operation

The operational phase will require about 10 local employees. The 75 MW contribution to the country's power generation capacity will contribute towards the overall stability of the national grid and a reduction in the greenhouse gas output per MWH generated. The resultant socio-economic benefits will depend on the country's effective generation capacity, which will vary over time.

The project will be of economic benefit to some local businesses, but the environmental impacts described in the preceding sections of this report, will be experienced or perceived as negative socio-economic impacts by some local residents. The project will also attract job seekers, which may result in the formation of one or more informal settlements associated with social pathologies such as crime, prostitution, communicable disease and substance abuse.

The nett socio-economic impact has been assessed as positive, but of ***low (SP = +8)*** significance. The following measures are recommended to enhance the impact to one of ***moderate (SP = +18)*** significance:

- Recruiting personnel from the local labour pool to the extent practicable;
- Preferentially procuring goods and services from local suppliers wherever practicable;
- Establishing a skills development programme to increase employees' value to ACWA Power and their employability in the broader labour market;
- Implementing effective traffic management measures to minimise the impact of project-related traffic on other road users;
- Prioritising safety for employees and visitors;
- Maintaining the grievance management system;
- Developing a retrenchment plan and procedures in consultation with employees;
- Keeping employees, including service providers under contract, informed about the general financial health of Bokpoort II and the remaining life of the project; and
- Developing a post-closure land use plan in consultation with local authorities and members of the public.

9.3.13.3 Closure and rehabilitation

The activities undertaken during this phase will be similar to those of the construction phase, but the duration will be shorter (6 to 8 months).

Most of the negative environmental impacts experienced during the construction and operational phases will be reversed over time, but the positive socio-economic impacts of job creation and cash injection into the local economy will fall away upon closure of the operation.

The negative impact of the loss of jobs and the reduction of local expenditure at project closure will be countered over time by the rehabilitation of the site and its potential use for animal husbandry or other economic activities that could result in the creation of new jobs. The overall impact is assessed as negative and of ***moderate (SP = 70)*** significance. The following mitigation measures are recommended to reduce it to an impact of ***moderate (SP = 48)*** significance:

- Proactive skills development and training of employees to enhance their value in the labour market and thereby their chances of finding employment after project closure;
- Development of a retrenchment plan in consultation with employees, starting at least five years before closure;
- Assisting redundant employees to find alternative employment as far as practicable;
- Providing training and start-up assistance to employees who want to start their own businesses;
- Leaving intact such infrastructure as can be used by the subsequent landowner(s);
- Diligent application of the rehabilitation plan as set out in the Environmental Management Programme (EMPr); and
- Monitoring vegetation re-establishment for at least five years after closure of the project.

9.3.13.4 *Peer Review*

In a letter dated 17 March 2016, the DEA stipulated that in-house specialist studies must be peer reviewed by external specialists – see APPENDIX C.

The socio-economic specialist report (Smith, T; de Waal, D, 2016) was peer reviewed by Geraldine Schoeman of of Schoeman and Associates. The review findings and Golder's response are included in APPENDIX P. The main findings can be summarised as follows:

- *Recommendations were made to clarify social licence to operate, free,prior and informed consent, a human-rights based approach and human rights due dilligence.*
- *Overall, the Golder report is acceptable in terms of the baseline information and methodology used for the assessment as well as the formulation of mitigation measures.*

9.4 Summary of environmental impacts

9.4.1 Construction Phase

Table 9-13 below summarises those impacts directly related to the Construction Phase of the proposed project, and provides a significance rating for each impact before and after mitigation. The construction period will be approximately 9 months.

Table 9-13: Environmental Impact Assessment Matrix for the construction phase of the proposed Bokpoort II PV1 solar Project on Bokpoort 390

POTENTIAL ENVIRONMENTAL IMPACT: CONSTRUCTION PHASE	ENVIRONMENTAL SIGNIFICANCE											
	Before mitigation						After mitigation					
	M	D	S	P	SP	Rating	M	D	S	P	SP	Rating
1. Geology												
Excavations for foundations of PV panels and associated infrastructure will disturb near surface geology permanently.	2	5	1	5	40	**Mod**	2	5	1	5	40	**Mod**
2. Air Quality												
Site preparation, earthworks and transport will cause mobilisation of particulates and emission of exhaust gases.	6	2	2	5	50	**Mod**	2	2	2	4	24	**Low**
3. Topography												
Construction of the surface infrastructure will have a minor and reversible effect on the topography of the site with a low probability of it being viewed as significant.	2	4	1	3	21	**Low**	2	4	1	3	21	**Low**
4. Soils, land capability and land use												
Mixing with subsoil, loss of topsoil by erosion, contamination with cement and organic chemical substances.	8	5	1	4	56	**Mod**	4	5	1	3	30	**Low**
5. Ecology: fauna and flora												
Removal of vegetation and topsoil on site and disturbance of fauna resulting in a loss of habitat, food and protection against erosion.	8	4	2	5	70	**Mod**	6	4	1	5	55	**Mod**
6. Ecosystem Services												
Compromised soil stability and erosion control both within, and in the vicinity of the Project footprint	6	5	2	5	65	**Mod**	4	4	1	4	36	**Mod**
7. Surface water and drainage												
Potential for erosion, contamination of runoff by silt and accidental spillage of hydrocarbons and chemicals	6	2	2	4	40	**Mod**	4	2	1	3	21	**Low**
8. Groundwater												
Contamination through spillages and poor sanitation practices by construction workers	6	3	1	4	40	**Mod**	2	2	1	3	15	**Low**
9. Noise												

POTENTIAL ENVIRONMENTAL IMPACT: CONSTRUCTION PHASE	ENVIRONMENTAL SIGNIFICANCE											
	Before mitigation						After mitigation					
	M	D	S	P	SP	Rating	M	D	S	P	SP	Rating
Impact will be limited by distance, existing noise levels at NSAs and relatively short construction period	4	4	2	2	20	**Low**	2	4	2	2	16	**Low**
10. Visual aspects												
Visible structures, dust and movement of construction vehicles. Security lighting and vehicles at night.	6	2	2	4	40	**Mod**	4	2	2	3	24	**Low**
11. Cultural and Heritage												
Significant impacts could occur only if human remains, fossils or artefacts of high significance are unearthed during construction operations	10	5	1	5	80	**High**	4	2	1	3	21	**Low**
12. Traffic												
Safety, damage to roads, dust damage to crops along Orange River	8	2	3	5	65	**Mod**	4	2	3	4	36	**Mod**
13. Socio-economics												
Creation of employment opportunities and local spend on goods, materials and services, but work seekers may also come in conflict with locals and place burden on services and construction activities can inconvenience local residents	2	2	2	3	+18	**Low**	4	2	2	4	+32	**Mod**

9.4.2 Operational Phase

Table 9-14 below summarises those impacts directly related to the Operational Phase of the proposed project, and provides a significance rating for each impact before and after mitigation. The operational period will be a minimum of 30 years, possibly much longer.

Table 9-14: Environmental Impact Assessment Matrix for operational phase of the proposed Bokpoort II PV1 Solar Project on Bokpoort 390

POTENTIAL ENVIRONMENTAL IMPACT: OPERATIONAL PHASE	ENVIRONMENTAL SIGNIFICANCE											
	Before mitigation						After mitigation					
	M	D	S	P	SP	Rating	M	D	S	P	SP	Rating
1. Geology												
The operational phase will not have any impact on the geology of the project area.	0	5	0	0	0	None	0	5	0	0	0	None
2. Air Quality												
Particulate mobilisation from travel over unpaved surfaces.	6	4	2	5	60	Mod	4	4	2	3	30	Low
3. Topography												
The operational phase will not have any impact on the topography of the project area.	0	4	1	0	0	None	0	4	1	0	0	None
4. Soils, land and capability and land use												
Change of land use, compaction, contamination with lubricants, hydraulic fluids, solvents and cleaning chemicals. Denuded areas could experience erosion.	8	5	1	5	70	Mod	6	5	1	5	60	Mod
5. Ecology: fauna and flora												
Removed vegetation on up to 250 ha, human presence and noise will keep fauna away from the vicinity of the site. Hunting, trapping or killing of fauna and disturbance of vegetation on adjacent land would reduce biodiversity	6	4	2	5	60	Mod	6	4	1	3	33	Mod
6. Ecosystem Services												
Project reliance on the quality and quantity of freshwater remaining constant throughout its lifetime in order to maintain its operational feasibility. Cumulative impact of abstraction by other projects could limit water availability in future.	8	4	4	5	80	High	4	4	2	4	40	Mod
7. Surface water and drainage												
Negligible impact on water availability from Orange River, but there will be potential for erosion, contamination of runoff by silt and accidental spillage of hydrocarbons and chemicals	6	4	2	4	48	Mod	4	4	1	3	27	Low
8. Groundwater												
Soil contamination by spillage of lubricants, hydraulic fluids, solvents and cleaning chemicals could cause groundwater contamination	6	4	3	5	65	Mod	4	4	2	3	22	Low

POTENTIAL ENVIRONMENTAL IMPACT: OPERATIONAL PHASE	ENVIRONMENTAL SIGNIFICANCE											
	Before mitigation						After mitigation					
	M	D	S	P	SP	Rating	M	D	S	P	SP	Rating
9. Noise												
Cumulative effect unlikely to cause exceedances of current baseline levels at sensitive receptors	6	4	2	3	36	**Mod**	4	4	1	2	18	**Low**
10. Visual aspects												
The PV1 solar facility will be will be 95% visible in a 0 – 5 km radius and 60% in the 5 – 10 km radius around the site. Lighting at night would be visible from up to 10 km away	8	4	2	4	56	**Mod**	6	4	2	3	36	**Mod**
11. Cultural and Heritage												
Discovery of heritage resources highly unlikely	10	5	1	1	16	**Low**	4	5	1	1	10	**Low**
12. Traffic												
Safety, damage to roads, dust damage to crops along Orange River	8	4	3	5	75	**Mod**	4	4	3	4	44	**Mod**
13. Socio-economics												
Operational phase will have several adverse impacts on nearest residents, but will provide about 10 local jobs.	1	4	3	1	8	**Low**	2	4	3	2	18	**Low**

9.4.3 Closure and rehabilitation Phase

Table 9-15 below summarises those impacts directly related to the Closure and Rehabilitation Phase of the proposed project, and provides a significance rating for each impact before and after mitigation. The closure and demolition of the infrastructure will take approximately 6 months. The rehabilitation period to restore the area to grazing will be approximately 24 – 36 months.

Table 9-15: Environmental Impact Assessment Matrix for the decommissioning and rehabilitation phase of the proposed Bokpoort II PV1 Solar Project on Bokpoort 390

POTENTIAL ENVIRONMENTAL IMPACT: CLOSURE AND REHABILITATION PHASE	ENVIRONMENTAL SIGNIFICANCE											
	Before mitigation						After mitigation					
	M	D	S	P	SP	Rating	M	D	S	P	SP	Rating
1. Geology												
The closure and rehabilitation phase will not have any impact on the geology of the project area	0	5	1	0	0	None	0	5	1	0	0	None
2. Air Quality												
Considerations and impacts similar to construction phase	6	2	2	5	50	Mod	2	2	2	4	24	Mod
3. Topography												
Surface will be shaped to be free draining, close to original contours, but erosion resistant	6	4	1	2	22	None	2	4	1	3	+21	Low
4. Soils, land use and land capability												
Mixing with subsoil, loss of topsoil by erosion, contamination with cement and organic chemical substances	8	5	1	5	70	High	4	5	1	3	30	Low
5. Ecology												
Incorrect rehabilitation could lead to severe permanent ecological degradation on the site.	8	5	2	5	75	High	6	5	2	3	39	Mod
6. Ecosystem services												
Incorrect rehabilitation could result in permanent impairment of project area to provide ecosystem services equivalent to pre-project services	6	4	3	5	65	Mod	4	2	1	4	28	Mod
7. Surface water and drainage												
Erosion of bare surfaces and spillages of waste materials and hydrocarbons from vehicles could cause surface water contamination	6	2	2	4	40	Mod	4	2	1	3	21	Low
8 Groundwater												
Spillage of hydrocarbons and other contaminants	6	3	1	4	40	Mod	2	2	1	3	15	Low
9. Noise												
Impact will be limited by distance, existing noise levels at receptor areas and relatively short demolition period	4	2	2	3	24	Low	2	2	2	3	18	Low
10. Visual aspects												
Similar activities to construction, but shorter duration.	6	2	2	4	40	Mod	4	2	2	3	24	Low
11. Cultural and Heritage												
The closure and rehabilitation activities cannot possibly affect any items of archaeological or cultural significance unless earth moving takes place on areas of the site where no such activities were undertaken during the construction and operational	0	0	1	0	0	None	0	0	1	0	0	None

POTENTIAL ENVIRONMENTAL IMPACT: CLOSURE AND REHABILITATION PHASE	ENVIRONMENTAL SIGNIFICANCE											
	Before mitigation						After mitigation					
	M	D	S	P	SP	Rating	M	D	S	P	SP	Rating
phases. If any such resources are found, the chance find procedures will be followed												
12. Traffic												
Significantly less traffic than operational phase, but will have some effect on road safety, wear & tear, driver frustration.	4	2	2	5	40	**Mod**	2	2	2	4	24	**Low**
12. Socio-economics												
Loss of jobs and local spend can be countered by skills training and support for entrepreneurs	6	5	3	5	70	**Mod**	4	5	3	4	48	**Mod**

9.5 Cumulative Impacts

9.5.1 Project Specific Cumulative Impacts

As explained in section 1.0 of this EIA/EMPr report, ACWA Power have also applied for a second 75 MW PV installation and a 150 MW CSP Tower installation which, if approved, will be constructed to the north-east of the PV1 solar facility – see Figure 2-3. The expected cumulative impacts are as follows:

1) The Bokpoort I (Solafrica) installation has a footprint of 350 ha, the Bokpoort II PV 1 solar facility will have a footprint of 250 ha. The PV2 installation will also have a footprint of 250 ha and the CSP Tower facility will have a footprint of 900 ha. If the CSP Tower and both PV installations are built, the contiguous solar power footprint would increase the area of vegetation removal from 350 ha to 1 750 ha.

2) With approximately 8 large solar energy facilities in various stages of the EIA application process, Pearson (May, 2016) rates the cumulative impact significance of the residual impact of collision of birds with solar infrastructure as high.

3) The water requirement for the Bokpoort I CSP trough installation is 0.875 million m^3 per annum, for the CSP Tower facility it is 0.25 million m^3 per annum and it is 0.025 million m^3 per annum for each PV installation. The three installations will increase the estimated demand on the Orange River in 2020 (Table 9-3) by 0.64%, 0.18% and 0.037% respectively, which is negligible.

4) For observers at ground level, the very high visual impact of the CSP tower, as described in section 9.4.1 of the EIA report for the proposed Bokpoort II 150 MW CSP Tower facility (Schlechter & Baxter, May 2016a), represents a high cumulative impact relative to the Bokpoort I project, where the solar collector assembly is 6m in height and the tallest non-reflective structure – the heat exchanger vessel – is 20 m in height. The proposed PV installations, with the PV panels being about 4 m and the inverter at 11.28 m in height, would add an additional visual impact of low significance.

5) With reference to observers in aircraft, each of the above installations would add a substantial area of high reflectivity causing daytime glare. The exposure to glare experienced by such observers is not directly proportional to the increased number of PV panels and/or heliostat mirrors. The latter are designed to focus sunlight on specific collection areas and the glint seen momentarily by an air traveller would be no more than that of a small dam in the landscape.

6) Each additional installation would represent a cumulative night-time visual impact due to the typical lighting needed on any industrial site. As required by the Civil Aviation Authority, the CSP tower must have a medium intensity type "B" 20 000 candela flashing light at the top of the structure.

7) The proposed Sanddraai solar facility will be located on the neighbouring Farm Sanddraai 391 and will consist of a 150 MW CSP Tower facility as well as 150 MW CSP Trough facility (Table 9-17). The possibility exists that the construction of the proposed Sanddraai solar will take place simultaneously with the construction of proposed Bokpoort II project. ACWA Power indicated that, should all three the solar projects associated with the Bokpoort II project be successful in the REIPPP Programme, all three will be built simultaneously. The Sanddraai solar facility will be constructed over approximately 30 months, the Bokpoort II CSP Tower over approximately 28 months and both the PV1 and PV2 facilities over 9 months respectively. The Bokpoort II solar facilities as well as the Sanddraai solar facilities will be accessed from the N8 via the Gariep Road – See Figure 9-2.

An estimation of traffic under the worst case scenario, where all three Bokpoort II solar projects and the Sanddraai project are constructed simultaneously, is presented in Table 9-16.

Table 9-16: Potential cumulative traffic during construction period (Van Wyk, L; Reutener, I, 2016)

	Morning (AM) Peak hour		Afternoon (PM) Peak hour		Daily	
Project	**In**	**Out**	**In**	**Out**	**In**	**Out**
Bokpoort CSP Tower	39	11	14	39	103	103
Bokpoort PV1	21	9	11	21	78	78
Bokpoort PV2	21	9	11	21	78	78
Sanddraai	44	1	1	44	115	115
Total Vehicles	**125**	**30**	**37**	**125**	**374**	**374**

Traffic volumes more than double that which was experienced during the construction of the Bokpoort I project could potentially be experienced during the period 2018 to 2020.

All of the above cumulative impacts will endure for the life of the project, currently estimated at 30 years, and will be reversible at the end of the project life. None of them represent any permanent loss of irreplaceable resources. The impacts of and mitigation measures for each project are fully described in their individual EIA/EMPr reports (Schlechter & Baxter, May 2016a), (Schlechter & Baxter, May 2016b).

9.5.2 Regional Solar Project Applications

As discussed in Section 5.1.1, the Northern Cape has been identified as one of the best places in the world to harness solar radiation. Figure 9-3 shows the currently known environmental authorisation applications for solar power developments in the vicinity of the towns of Upington, Postmasburg, Groblershoop and Prieska (south of the map area) as obtained from the database on the website of the Department of Environmental Affairs.

Table 9-17 summarises the project information pertaining to the solar development environmental authorisation applications received by the DEA up to the end of the 4th quarter of 2015 (Department of Environmental Affairs, 2016). The solar development for which environmental authorisations have been submitted to the DEA vary in solar technology, generation capacity and status of approval.

Each of the projects approved by the DEA will contribute to the cumulative impacts associated with:

- vegetation removal and loss of habitat in the region;
- water requirements for operational use either from the Orange River or from groundwater;
- regional infrastructure required to sustain the influx of contractors and suppliers, increase in traffic and socio-economic services;
- visual impact on a regional scale;
- potential impact on aircraft due to daytime glare;
- visual impact due to night-time lighting needed on any industrial site; and
- The daytime and night-time visual impacts specific to CSP Tower installations (Schlechter & Baxter, May 2016a). Unfortunately, the DEA database does not indicate which CSP projects are based on tower technology.

The projects are in different phases of approval and it is important to note that, even though a number of the projects listed in Table 9-17 have been granted environmental authorisation, due to the required approval process of the REIPPP Programme to which each project will be subjected, not all of the authorised projects will be constructed.

The above cumulative impacts will be staged over many years and will remain for the life of each project but will be reversible at the end of the project life.

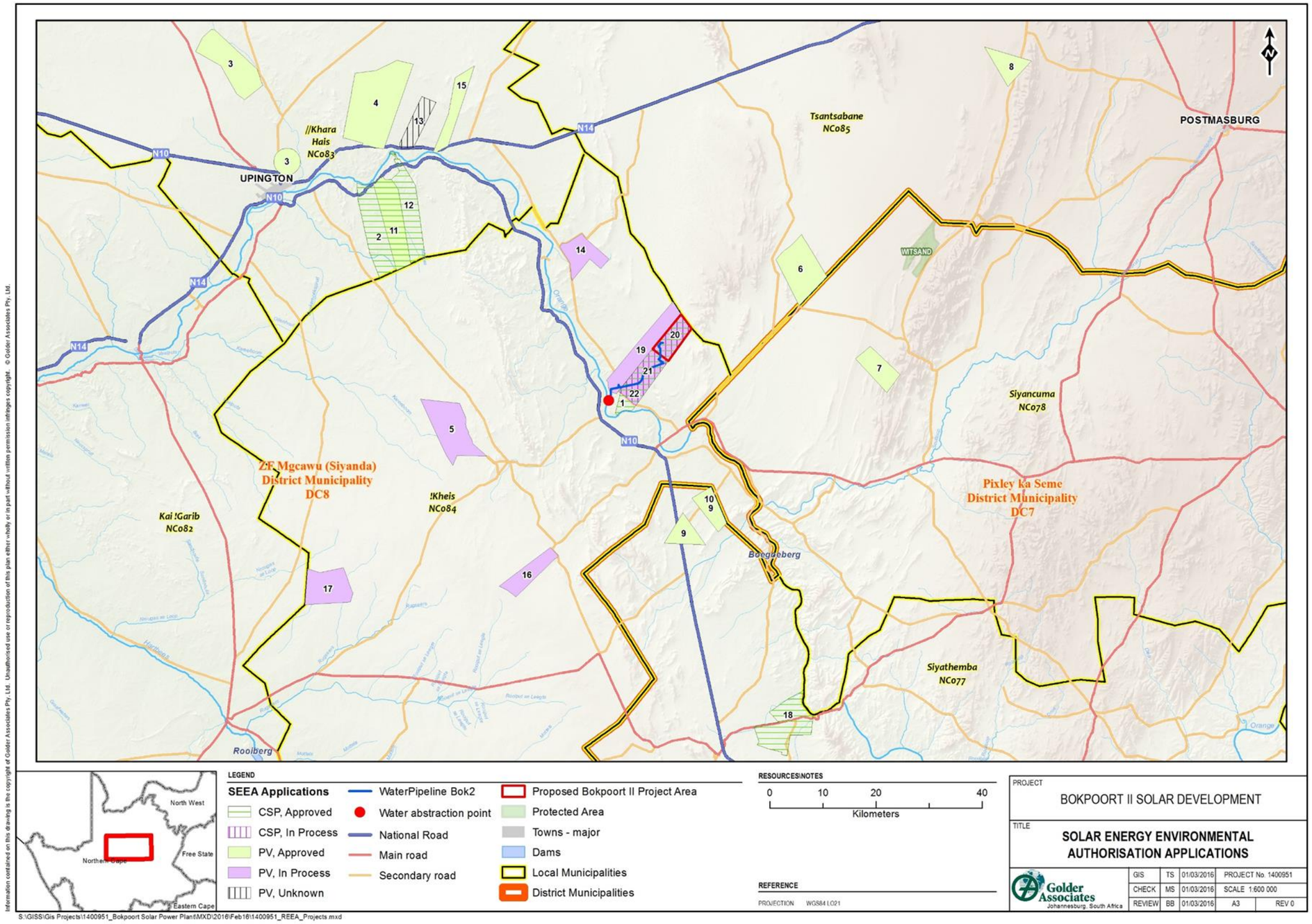


Figure 9-3: Solar Energy Development Environmental Authorisation Applications in the Bokpoort II project area (Department of Environmental Affairs, 2016)

Table 9-17: Solar Development Environmental Authorisations - Quarter 4 2015 (Department of Environmental Affairs, 2016)

ID No.	DEA Ref No.	Project Title	Applications Received	Applicant	Technology	Megawatt	Project Status
1	12/12/20/1920	Proposed 75 MW Concentrating Solar Thermal Power Plant nd Its Associated Infrastructure in the Siyanda District, Northern Cape Province	2010/05/06	SolAfrica Thermal Energy Pty Ltd	Solar CSP	50	Approved
2	12/12/20/2056/A2	Proposed construction of the Illanga Solar Thermal Power Plant, Karoshoek Solar Thermal Park.	2014/06/06	Ilangalethu Solar Power Pty Ltd	Solar CSP	-	Approved
3	12/12/20/2146	The Proposed Establishment of a Photovoltaic (PV) Installation at the Upington Airport, Northern Cape Province	To review	ACSA PV	Solar PV	8.9	Approved
4	12/12/20/2169	The Construction of a 25 MW Photovoltaic Solar Energy Facility on a Site North-East of Upington, Northern Cape Province	2012/11/15	Upington Solar Pty Ltd	Solar PV	25	Approved
5	12/12/20/2198	Proposed Construction of a Photovoltaic (PV) Solar Energy Facility on the Farm Kleinbegin, South East of Upington, Northern Cape Province	2011/02/01	Vanguard Solar Pty Ltd	Solar PV	50	In Process
6	12/12/20/2583	The Proposed Inyanga Energy Project 6 on Portion 15 of the Farm O'poort 384, Kheis Local Municipality, Northern Cape Province	2011/11/01	Islandsite Investment 519 Pty Ltd	Solar PV	75	Approved
7	12/12/20/2647/48	Proposed Construction of Three(3) 75mw Arriesfontein Photovoltaic Solar Power Plants: Phase 1, 2 and 3, on the Farm Arriesfontein 267 Barkley Wes Rd, Kgatelopele Local Municpality, Northern Cape	2011/11/01	Solar Reserve South Africa Pty Ltd	Solar PV	75	Approved
8	12/12/20/2649	Jasper Power Company	2011/11/01	Solar Reserve South Africa Pty Ltd	Solar PV	75	Approved
9	14/12/16/3/3/1/658	The Proposed Prieska Solar Power Plant, Within the Siyathemba Municipality, Northern Cape	2012/07/20	Maxwell Moss and Associates	Solar PV	19	Approved
10	14/12/16/3/3/1/909	Proposed expansion of the Prieska solar power plant within Siyathemba Municipality, Prieska, Northern Cape	2012/08/01	Maxwell Mosss and Asoociates (Pty) Ltd	Solar PV	19	Approved
11	14/12/16/3/3/2/292	The Karoshoek Concentrating Photovoltaics or Parabolic Dish (Cpvpd) 1-4 Facilities East of Upington within the Khara Hais Local Municipality in the Nortern Cape Province	2012/03/08	FG Emvelo Energy Pty Ltd	Solar PV	25	Approved
12	14/12/16/3/3/2/293	The proposed establishment of the Karoshoek Linear Fresnel 1 (LF 1) facility located on site 1.1 located 30 km East of Upington in the Northern Cape	2012/03/08	FG Emvelo Energy Pty Ltd	Solar CSP	100	Approved
13	14/12/16/3/3/2/532	Proposed Moipax solar project, Khara Hais Municipality, Northern Cape	2013/04/09	Moipax Pty Ltd	Solar PV	250	Status unknown
14	14/12/16/3/3/2/571	The Proposed Kheis Solar Park 1 PV project on a site South East of Upington within the !Kheis Local Municipality, Northern Cape Province	2013/08/28	Gestamp Asetym Solar South Africa Pty Ltd	Solar PV	75	In Process
15	14/12/16/3/3/2/619	Proposed renewable energy geneartion project on Portion 1 of the Farm Avondale No. 410, Gordonia RD, Khara Hais Local Municipality, Avondale 2 Solar Park	2014/01/17	Tita Energy (Pty) Ltd	Solar PV	75	Approved
16	14/12/16/3/3/2/625	Proposed renewable energy generation project, Kenhardt RD, !Kheis local municipality, ZF Mgcawu District Municipality, Northern Cape	2014/01/01	Ansolgenix (Pty) Ltd	Solar PV	-	In process
17	14/12/16/3/3/2/712	Proposed construction of the Boven PV1 75MW in Kenhardt, Northren Cape	2014/05/01	Mulilo Renewable Project Developments (Pty) Ltd	Solar PV	-	In process

ID No.	DEA Ref No.	Project Title	Applications Received	Applicant	Technology	Megawatt	Project Status
18	14/12/16/3/3/2/729	Proposed Solar Power Generation Plant on Portion 2 and Portion 7 of the Farm Rietfontein 11, Northern Cape Province.	2015/03/02	Kameelboom Solar Power Plant Pty Ltd	Solar CSP	125	Approved
19	14/12/16/3/3/2/738	Proposed Solafrica Sand Draai 150 MW CSP Tower and 150 MW CSP Trough Project in !Keis LM	2014/08/29	Solafrica Photovoltaic Energy (Pty) Ltd	CSP	300	In Process
20	14/12/16/3/3/2/881	Proposed Bokpoort II 75 MW Photovoltaic Development (PV1) on the Remaining Extent of the Farm Bokpoort II 390 near Groblershoop within the !Kheis Local Municipality in the Northern Cape Province.	06/01/2016	ACWA Power Africa Holdings (Pty) Ltd	PV	75	In Process
21	14/12/16/3/3/2/880	Proposed Bokpoort II 75 MW Photovoltaic Development (PV2) on the Remaining Extent of the Farm Bokpoort II 390 near Groblershoop within the !Kheis Local Municipality in the Northern Cape Province.	06/01/2016	ACWA Power Africa Holdings (Pty) Ltd	PV	75	In Process
22	14/12/16/3/3/2/879	Proposed Bokpoort II 150 MW CSP Tower Development on the Remaining Extent of the Farm Bokpoort II 390 near Groblershoop within the !Kheis Local Municipality in the Northern Cape Province.	06/01/2016	ACWA Power Africa Holdings (Pty) Ltd	CSP Tower	150	In Process
23	14/12/16/3/3/2/521	The proposed 1GW Siyathemba solar park, Northern Cape Province	2013/03/26	Central Energy Fund (Soc) Ltd	Solar PV	1000	In Process

10.0 ENVIRONMENTAL IMPACT STATEMENT

10.1 Key findings

The following potential cumulative impacts were identified and assessed:

10.1.1 Geology

Excavations for foundations for the PV panels and associated infrastructure will have a highly localised and negligible effect on the geology of the site.

10.1.2 Air quality

The construction and eventual rehabilitation activities will have low air quality impacts due to particulate mobilisation, which can be easily controlled by wet suppression and chemical binders. Exhaust emissions from vehicles will have a negligible impact on air quality in the region.

10.1.3 Agricultural Potential, Soil, land use and land capability

The project will sterilise the current land use (natural veld and grazing) for the life of the facility. Proper application of the mitigation measures listed in section 9.3.5.3 will enable restoration of the land to a condition fit for grazing and game farming.

10.1.4 Ecology

Disturbance of flora and fauna over an area of at least 250 ha for a period of about 30 years will have a high impact on the biodiversity and ecological function of the affected area and current migration patterns of fauna for the duration of the project. Similar developments in the same vicinity would have a cumulative effect, especially on fauna that are dependent on being able to roam widely. With proper rehabilitation, the impact can be reversed over time.

10.1.5 Surface water

The project will increase the current demand on the Orange River by about 0.018%. Runoff will be collected and impounded. There will be no pollution impact on any watercourse.

10.1.6 Groundwater

The project will not abstract groundwater and, apart from the spillage of fuel, lubricants and cleaning chemicals, a potential impact which can be easily mitigated, no groundwater impacts are anticipated.

10.1.7 Noise

The noise generated by the operation of the PV solar facility will add to the existing natural and man-made noise levels in the area, but is very unlikely to reach unacceptable levels at off-site locations of human receptors. There are no residences within 3 000 metres of the site. Noise output from the plant will cease upon decommissioning and closure.

10.1.8 Visual aspects

The visual impact from the PV1 solar installation will be cumulative to the existing visual transformation of anthropological origin (Bokpoort I installation, farm buildings, power lines, railway line, roads) and will be present for the operational life of the facility (estimated at 30 years). The impact will be totally reversible upon decommissioning and closure of the PV1 solar facility.

10.1.9 Traffic

Travel to and from the PV1 facility by personnel, deliveries and visitors will add to the existing traffic on the approach roads, affecting road safety, create dust from unpaved roads and road surface quality as experienced by existing road users. The cumulative impact due to the PV1 solar facility will be completely reversible upon decommissioning and closure.

10.1.10 Cultural and Heritage Resources

As stated in section 9.3.11, only some Middle Stone Age artefact scatters of low significance were found in the project area associated with the Bokpoort I development and the establishment of the PV1 project and the CSP Tower and PV2 projects are not expected to have any cumulative effect on the cultural and heritage resources within the project area.

10.1.11 Socio-economic

The socio-economic impacts described in section 9.3.13 will be cumulative to those of the Bokpoort I installation and the CSP Tower and PV2 installations. Both the positive and negative impacts will be reversible upon closure, excepting for skills transfer to employees successful self-sustaining community projects established during the life of the project.

10.2 Final Site Map

Figure 9-5 shows the preferred location of the Bokpoort II PV 1 solar installation superimposed on a map showing the environmental and culturally sensitive areas in the vicinity of the project area.

10.3 Summary of positive and negative implications and risks of proposed activity and alternatives

As described in section 9.3.13 of this document, the proposed PV1 project will, if properly managed, have a nett positive socio-economic impact within the !Kheis Local Municipality, and negative, but acceptable and largely reversible impacts on the local ecology, noise regime, surface water, visual aspects, sense of place and traffic. The project will also contribute towards the country's power generation capacity and establishment of solar energy as a significant source of power. A risk include the potential long term loss of soil capability and biodiversity on about 250 ha of land.

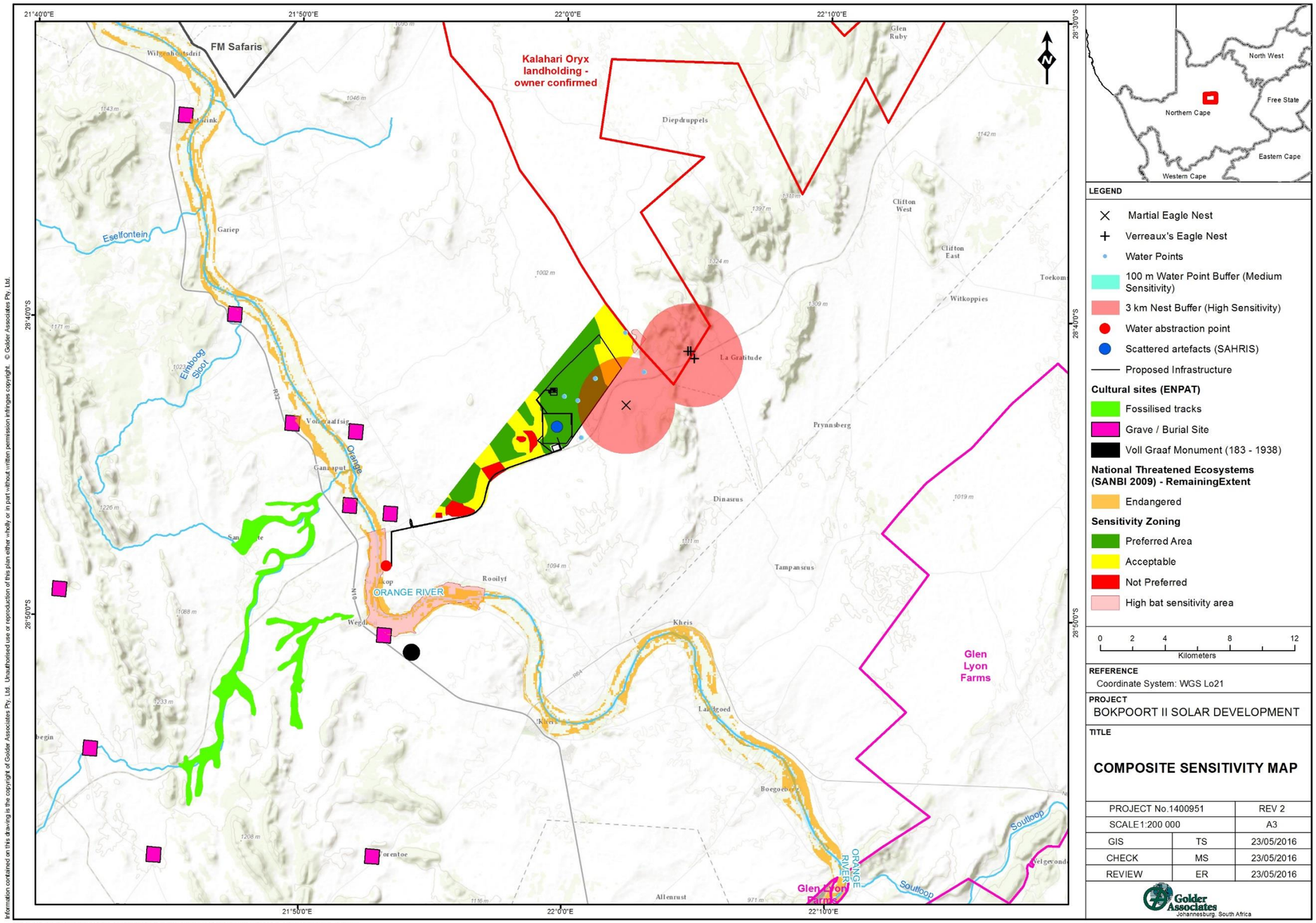


Figure 9-4: Composite sensitivity map and preferred site

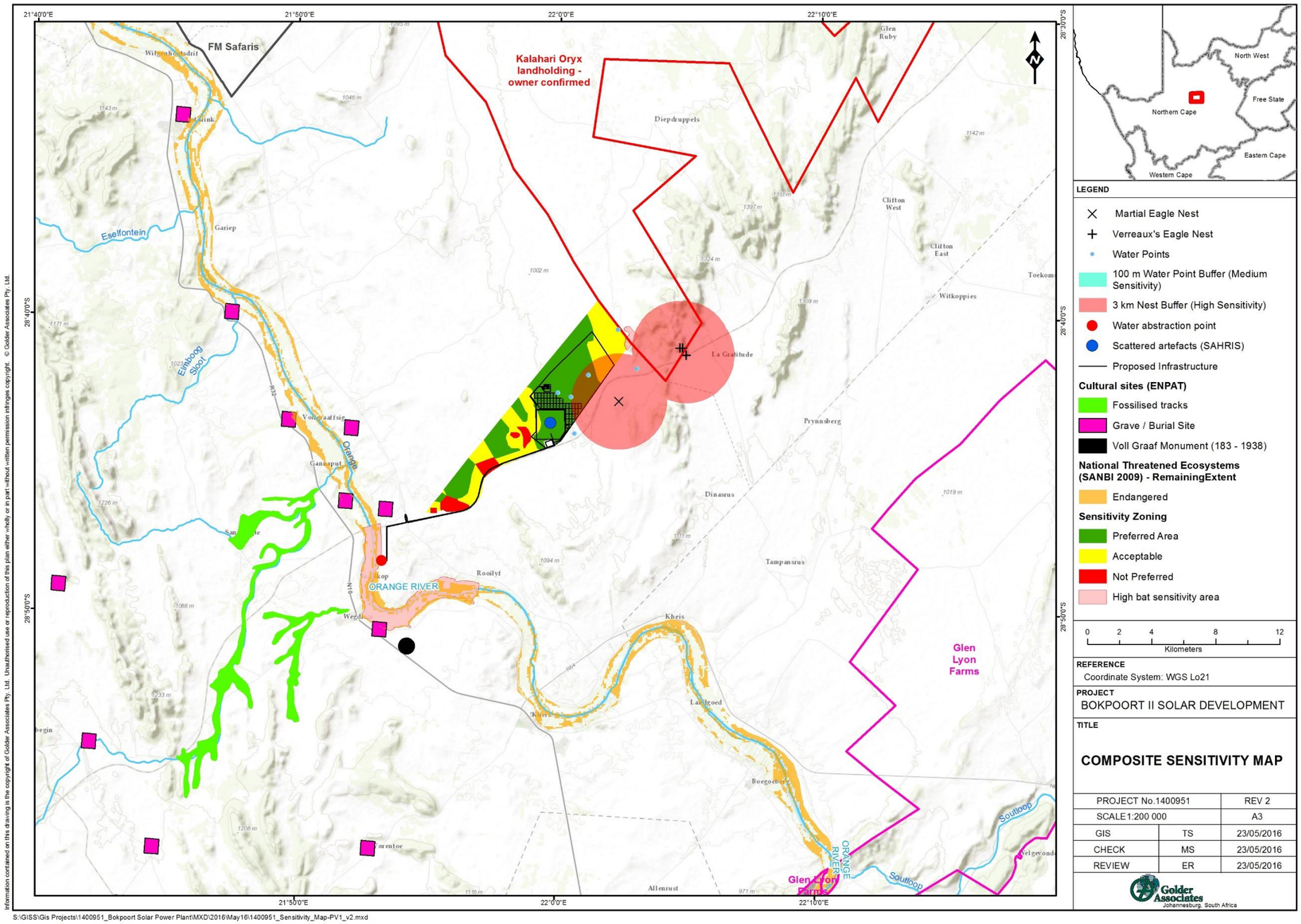


Figure 9-5: Composite sensitivity map and preferred site including final layout

10.4 Impact management objectives and outcomes for inclusion in the EMPr

The impact management objectives and outcomes for the proposed Bokpoort II project are as follows:

- To maximise the positive and minimise the negative socio-economic impacts, leaving a positive legacy after decommissioning and closure of the facility;
- To explore ways and means of reducing the glare from the PV panels and associated infrastructure in order to soften the visual impact of the project;
- To mitigate the night-time visual impact of the installation by implementing the mitigation measures recommended in section 9.3.10;
- To capture, contain and recycle all runoff water from the site and to prevent the discharge of contaminated water to the environment;
- To avoid PM_{10} concentrations exceeding 75 µg/m^3 in the local airshed for reasons of public health and to avoid exceeding the national standards for ambient air quality that were set by the publication of Government Notice 1210 in Government Gazette no 32816 on 24 December 2009. Wet suppression will be applied on unpaved areas, and air quality will be monitored;
- To shape the rehabilitated surface to be free draining along gentle slopes;
- To re-vegetate the surface with a balanced mix of locally indigenous flora that will be suitable for game farming and/or livestock grazing; and
- To maintain cordial relationships with local residents, authorities and other stakeholders *via* sustained open communication.

10.5 Final proposed alternative

The final proposed alternative for this application is a solar plant based on PV solar technology. The PV1 solar facility will be located on the south-eastern side of the Remaining Extent of the Farm Bokpoort 390. The PV1 solar facility together with the PV2 solar facility (Schlechter & Baxter, May 2016b), located on the north-western portion of the project site, have been placed to optimise the overall Bokpoort II site. The applicant's main objective for the development of the Bokpoort II site is the construction of a CSP Tower (Schlechter & Baxter, May 2016a). The construction of the PV1 and PV2 solar facilities are proposed to optimise the full utilisation of the Remaining Extent of the Farm Bokpoort 390.

The final preferred site layout as shown in Figure 9-5 and Figure 2-4 was chosen to minimise potential impacts on identified ecologically sensitive areas (Figure 9-4). As described in section 6.0 a site and layout selection process considering all relevant factors was undertaken.

10.6 Aspects for inclusion as conditions of authorisation

The conditions of authorisation should include:

- Adherence to the EMPr in sections 11.1 to 11.22 of this document;
- Bi-annual internal auditing of environmental performance and annual reporting to the DEA; and
- Annual external auditing of environmental performance and providing the DEA with a copy of the audit report.

10.7 Assumptions, uncertainties and gaps in knowledge

The ESHIA/EIA was limited to the scope of the assessment described in detail in in the scoping report (Schlechter & Baxter, February 2016a) and in section 3.0 of this EIA/EMPr report.

Some of the information on the baseline environmental conditions in the areas surrounding the Bokpoort II project site was sourced from the EIA undertaken for the Bokpoort I project (Benedek, F; Roods, M;, February 2011).

Descriptive and technical information on the proposed PV1 solar installation was provided by ACWA Power and general information on the environmental impacts was sourced from the open literature.

The EIA does not address Occupational Health and Safety as required by IFC Performance Standard 2. ACWA Power has established health and safety policies and procedures for Bokpoort I and will develop appropriate environmental, health, safety, security and quality control procedures applicable to Bokpoort II prior to the commencement of construction.

Although all effort was made by the Project team to identify all environmental social and health aspects, impacts and mitigation measures, errors and omissions may have occurred.

The Environmental and Social Management System that was developed as part of the ESHIA process will be a live database that can be adapted and updated should additional information, aspects or impacts be identified. The objective of the ESMS is for the ACWA Power Project team to continually improve environmental and social performance. In addition, according to South African legislation, the EMPr will need to be updated or amended with new information when there are significant changes during the life of the project.

Every effort was made to engage stakeholders to the extent possible, however not every stakeholder may have been consulted, or their comments may not have been recorded accurately. A grievance mechanism will be put in place at the commencement of construction through which stakeholders are able to raise grievances and continue to contribute their concerns and issues with the Project team.

10.8 Opinion on whether the activity should be authorised

In accordance with the EIA Regulations GN R982 Appendix 3, Regulation 3 (q) Environmental Assessment Practitioner (EAP) must provide an opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation must be stated.

An environmental impact assessment has been undertaken, which has incorporated consultation with and participation of the interested and affected parties. It is the EAP's opinion that due process has been followed. Where impacts have been found to be potentially significant, various mitigation measures to manage and monitor the impacts of the project have been proposed.

It has been found that the construction and implementation of the project would:

- Not give rise to any adverse biophysical impacts that cannot be adequately mitigated;
- Result in positive impacts such as an increase in the national capacity for clean power generation, thereby contributing towards the national and global move towards reducing greenhouse gas emissions;

It is the opinion of the EAP that, subject to compliance with the recommended mitigation measures, which are detailed in the EMPr, the project has significant positive aspects and acceptably low negative biophysical impacts and that it should be approved on the basis that overall the positive impacts outweigh the negative impacts.

10.9 Conditions that should be included in the authorisation

10.9.1 General conditions

ACWA Power must:

- The EMPr (section 11.0) should be implemented by senior qualified environmental personnel that have the competence to interpret the requirements of the EIA and the EMP, and that must be issued with a written mandate by a senior management member of ACWA Power to provide guidance and instructions to staff and contractors;
- Comply with all relevant legislation at all times;
- Stakeholder engagement must be maintained during the construction, operational and decommissioning phases of the project, with the emphasis on ongoing provision of information pertaining to the project, and with the goal of maintaining constructive and mutually respectful stakeholder relations;
- Undertake bi-annual internal auditing of environmental performance and annual reporting to the DEA;
- Undertake annual external auditing of environmental performance and provide the DEA with a copy of the audit report; and
- Any substantive changes to the project configuration should be the subject of environmental assessments and should result in the amendments to the EMP. In the spirit of full disclosure, information related to any such changes should be made available to the authorities as well as for the public.

10.9.2 Specific conditions

ACWA Power must:

- Capture and contain all runoff from the site and prevent the discharge of potentially contaminated water to the environment;
- Apply wet suppression on unpaved surfaces and monitor air quality in the vicinity of the site (fall out dust);
- Address concerns about traffic safety and congestion due to the travel of ACWA Power personnel on local roads by strict enforcement of traffic regulations and road rules as well as road maintenance and dust management; and
- Rehabilitate the site after decommissioning and closure as described the EMPr.

10.10 Period for which environmental authorisation is required

The planned life of the project is estimated to be 30 years. To accommodate the time needed for construction, commissioning, power production ramp up, closure and rehabilitation, the authorisation is required for a period of 36 years.

10.11 Undertaking

It is confirmed that the undertaking required to meet the requirements of this section is provided at the end of the EMPr and is applicable to both the ESHIA Report and the EMPr Report.

10.12 Deviations from approved scoping report and plan of study

There are no deviations from the scoping report and plan of study as submitted to the DEA on 6 January 2016.

10.13 Other information required by the DEA

10.13.1 Impact on socio-economic conditions of any directly affected person

The most directly affected people will be the landowners and occupants of the adjacent properties.

The impacts that they will experience to varying degrees are described in section 9.0.

While it is not possible to predict future property values in a free market, several studies have found that property values tend to rise in the vicinity of a new development. It is possible that some local landowners may benefit from the establishment of the PV 1 solar project by providing the project with goods and/or services or being employed by the project.

10.13.2 Impact on any national estate

The cultural and heritage specialist found only scatter of Middle Stone Age artefacts of low significance within the adjacent Bokpoort I project area. If any buried heritage resources are unearthed, the chance find procedures must be applied.

10.13.3 Other matters required in terms of section 24(4) of the NEMA

This section requires proof of compliance with section 24(4)(b)(i) of the National Environmental Management Act, which section reads as follows:

"24. Environmental authorisations

(4) Procedures for the investigation, assessment and communication of the potential consequences or impacts of activities on the environment -

(b) must include, with respect to every application for an environmental authorisation and where applicable-

(i) investigation of the potential consequences or impacts of the alternatives to the activity on the environment and assessment of the significance of those potential consequences or impacts, including the option of not implementing the activity;"

See sections 6.3, 6.4, and 9.0 of this report.

11.0 ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPR)

11.1 Structure of the EMPr

Pursuant to consultation with the DEA, this EMPr has been developed to conform to the structure prescribed in Appendix 4 to the EIA Regulation GN R.982. It is presented as a chapter in the EIA Report, with references to sections, tables and figures in the EIA Report that are of specific relevance to the EMPr.

11.2 Environmental Assessment Practitioner

This EMPr was prepared by Golder Associates Africa (Pty) Ltd acting as the independent EAP appointed by ACWA Power. Details of the EAP are provided in section 2.2 of the EIA Report.

11.3 Description of project and activities covered by the EMPr

ACWA Power Africa Holdings (Pty) Ltd (hereafter referred to as ACWA Power) is proposing to construct a 75 MW PV solar facility on the north-eastern portion of the Remaining Extent (RE) of the Farm Bokpoort 390, located 20 km north-west of the town of Groblershoop within the !Kheis Local Municipality in the ZF Mgcawu District Municipality, Northern Cape Province.

ACWA Power is proposing to construct a 75 MW PV (PV1) solar facility and its associated infrastructure on the north-eastern portion of the Remaining Extent (RE) of the Farm Bokpoort 390, located 20 km north-west of the town of Groblershoop within the !Kheis Local Municipality in the ZF Mgcawu District Municipality, Northern Cape Province. The facility will deliver power to the Eskom National Grid *via* Eskom's existing and adjacent Garona Substation. The powerline will be approximately 5km in length and will be located within a servitude spanning 50 metres on both sides. The powerline towers will be 35 metres high.

The final site layout, the detailed view of the associated infrastructure and the final site layout superimposed on the environmental sensitivity map are illustrated in Figure 11-1, Figure 11-2 and Figure 11-3 respectively.

11.4 Impact management objectives and statements

The overall objective of this Environmental Management Programme (EMPr) is to provide ACWA Power and its contractors with practical guidance for environmentally and socially responsible construction, operation and eventual closure of the solar development by listing South African and international guidelines and standards and describing the actions to be taken to achieve them.

ACWA Power has a legal obligation to comply with the EMPr and to ensure compliance by its contractors and agents, where relevant.

This EMPr describes mitigation measures designed to minimise or eliminate the significant adverse impacts that may be caused as a result of the proposed 75 MW PV1 solar development. Mitigation will be achieved by:

- Applying preventative measures during the construction, operation and closure phases;
- Applying management measures (including rehabilitation) during the construction and operational and closure phase, and
- Rehabilitation during and after decommissioning.

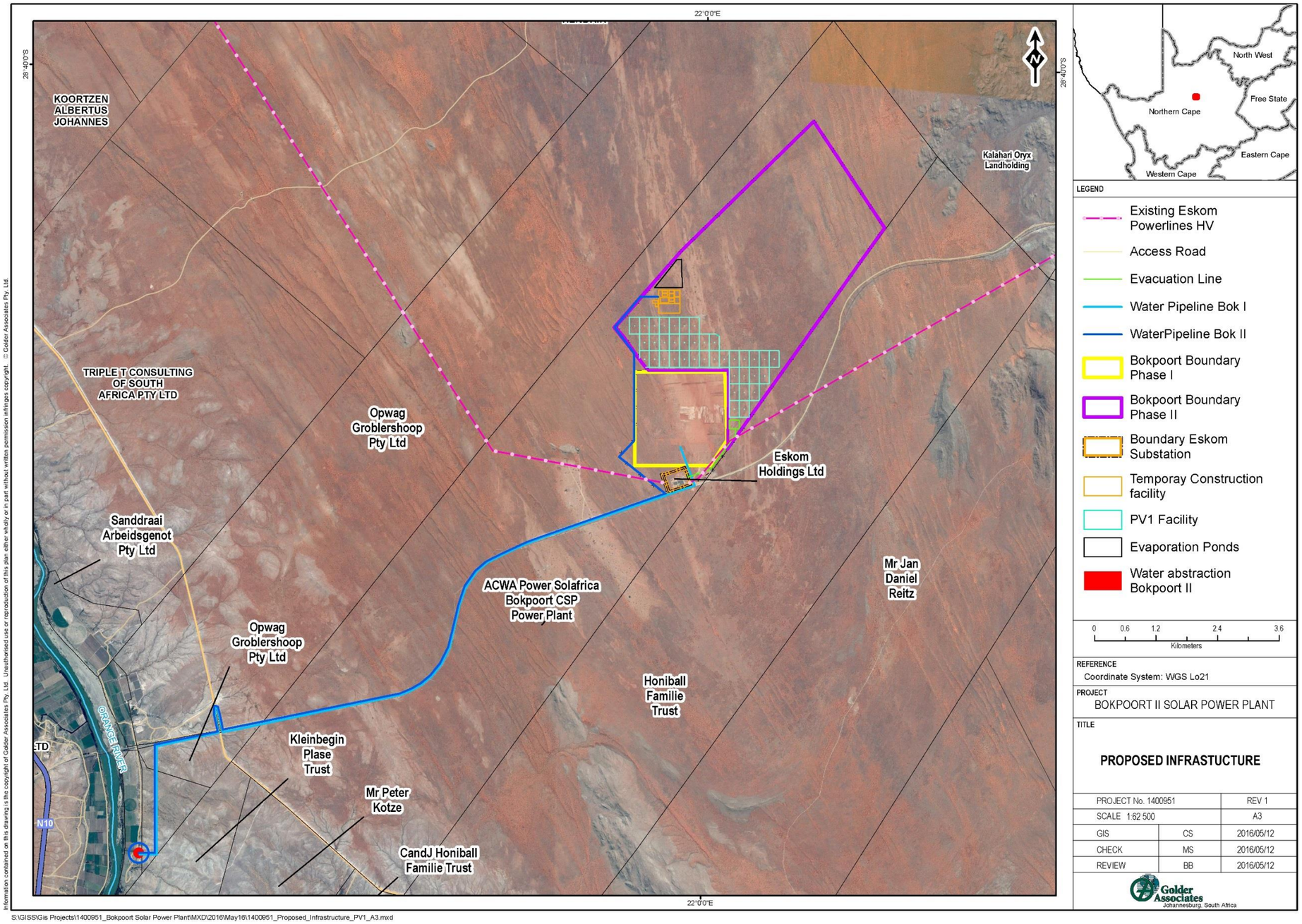


Figure 11-1: Final Infrastructure Layout for the Proposed 75 MW PV1 Solar Facility

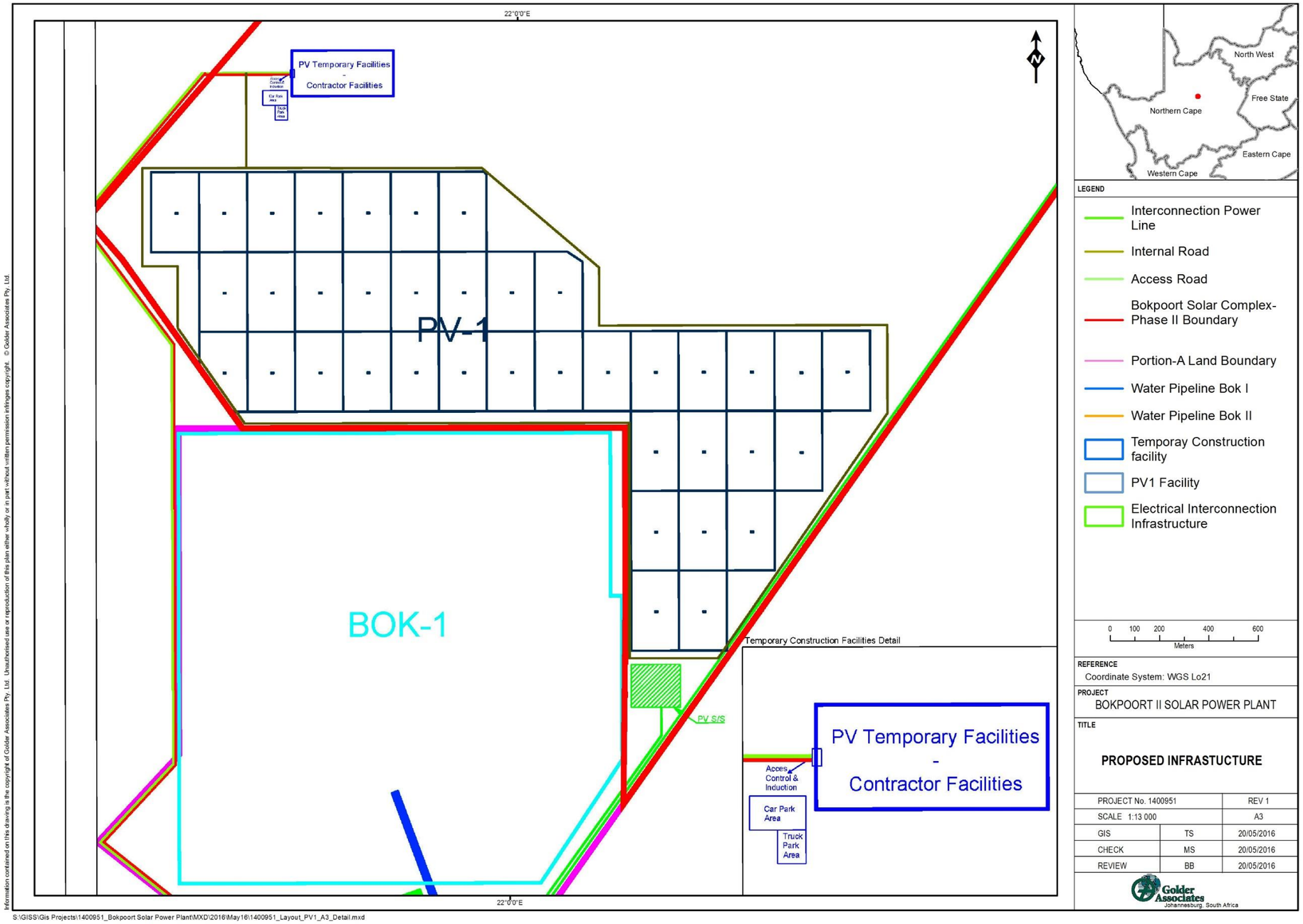


Figure 11-2: Detailed View of the Associated Infrastructure for the Proposed 75 MW PV1 Solar Facility

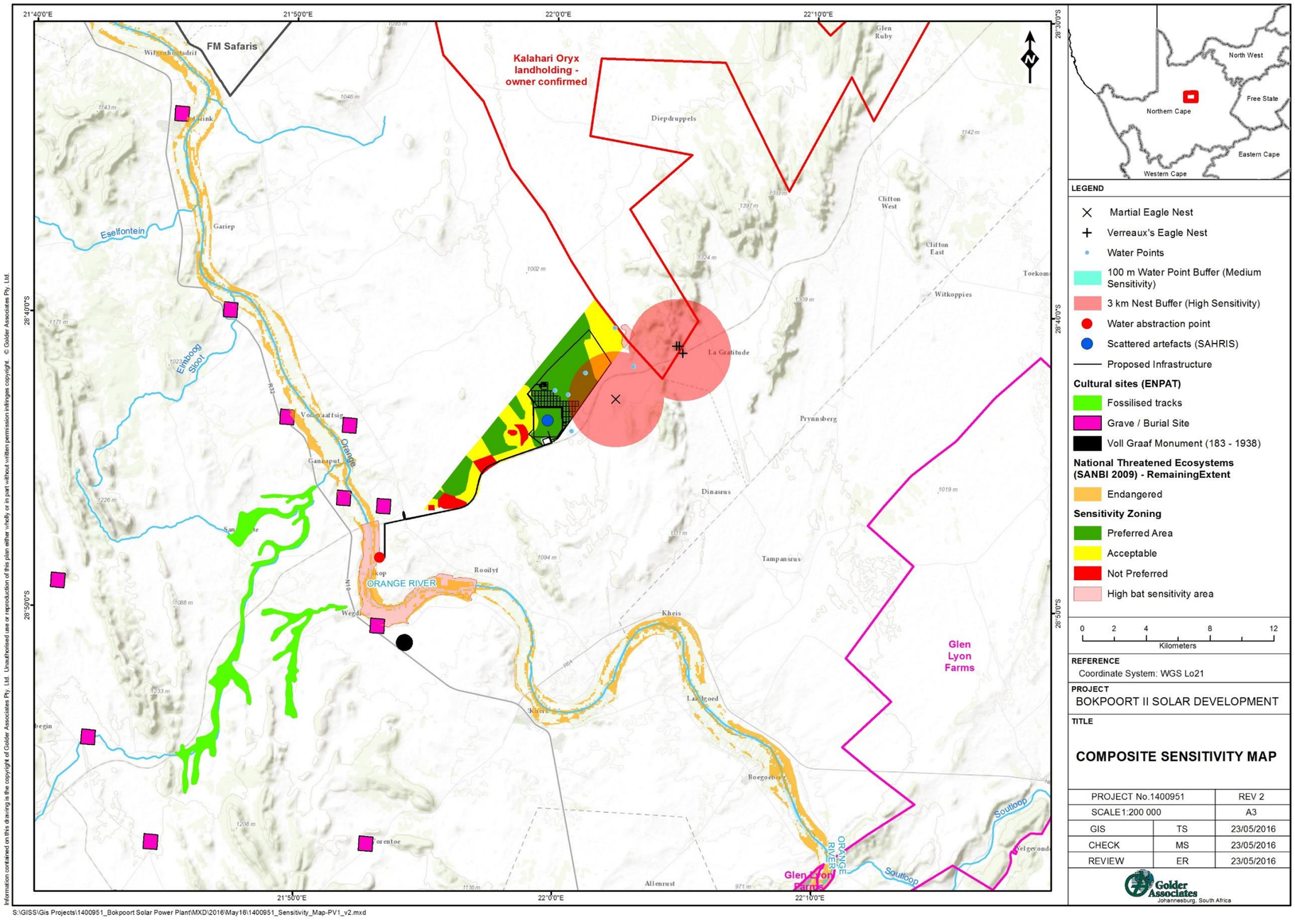


Figure 11-3: Combined Layout and Environmental Sensitivity Map for the Proposed PV1 Solar Facility

The primary objectives of the EMPr are to:

- Devise measures to mitigate the impacts that have been identified during the EIA;
- Define organisational and administrative arrangements for environmental management and monitoring of the work contract, including defining the responsibilities of staff and co-ordination, liaison and reporting procedures;
- Ensure awareness amongst site supervision staff so that potential problems can be identified and mitigation measures adopted to prevent or minimise environmental impacts and to optimise the rehabilitation programme; and
- Define actions for environmental control, in the event of pollution or similar events requiring action.

This EMPr will form the basis for environmental management on-site. This EMPr is viewed as a live document in the sense that it will be amended when circumstances change or more information becomes available, and it requires that environmental management must be integrated with health and safety and general management of the solar development. The management measures described in this section have been formulated by the independent environmental assessment practitioner and specialist consultants. These measures have been proposed to mitigate negative impacts and enhance the positive benefits of the project.

11.5 Implementation of the EMPr

A number of activities must take place before commencement of construction. Certain of these activities are not directly related to physical work on site, but are presented below, as they must be addressed before commencement of, or during the early phases of, construction. Please refer to **Table 11-1** in the document for details of the potential impacts, mitigation measures and monitoring actions.

11.5.1 ACWA's Responsibility for Implementation

- Responsibility for implementation of the EMPr rests with the General Manager of ACWA Power.
- ACWA Power will appoint an Environmental Control Officer (ECO), who will be based on-site. Responsibilities of the ECO will be to:
  - Ensure that all ACWA Power personnel members and all contractors are aware of the requirements of the EMPr and their responsibilities with regards to implementation thereof;
  - Ensure that all conditions of the EMPr are implemented;
  - Ensure that all environmental activities delegated to contractors operating on-site are implemented;
  - Resolve any conflicts that may arise between ACWA Power and contracting parties regarding implementation of the EMPr;
  - Monitor the results of the mitigation measures and keep the description of the environmental status of the site up to date;
  - Provide regular reports on the environmental performance of the construction or operation to the General Manager;
  - Evaluate and report on material and reputational risks to ACWA Power arising from environmental performance; and
  - Amend the EMPr as and when necessary to improve environmental performance and/or to accommodate changes in legislation, guidelines, standards and current best practice.

- ACWA Power will ensure that all contracting companies tendering for work that may have an environmental impact will be made aware of the relevant conditions in the EMPr and understand their responsibility to operate within the framework of the measures defined in the EMPr. When adjudicating tenders, ACWA Power will ensure that contractors have made appropriate allowance for management of environmental matters where relevant.
- ACWA Power will ensure that, on appointment, all permanent contracting companies operating on-site receive a copy of the EMPr and understand their responsibility to operate within the framework of the measures defined in the EMPr.
- ACWA Power will ensure that all employees' and contractors' Safety, Health and Environment inductions to site include environmental and social issues and awareness training to build capacity of staff and contract staff regarding management of the environment.
- The ECO will brief all employees and contractors about no development / no go areas. These will include:
  - No access to neighbouring properties without prior approval from ACWA Power. ACWA Power will inform land owners of the need for access and will secure approval to access such sites;
  - Graveyards and historical rural dwelling complexes or individual structures within such complexes falling inside the development footprint. See Figure 6-3 for locations of identified heritage resources; and
  - Sensitive sites – see Figure 8-14 for bat foraging and roosting areas and Figure 9-5 for a composite sensitivity map.
- ACWA Power will appoint a responsible person to audit the implementation of, and adherence to, the EMPr. This party will be an independent environmental practitioner.
- ACWA Power will implement an Environmental Awareness Plan.
- ACWA Power staff and contract workers will be included in the target audience of the awareness plan. Any environmental incident or breach of the conditions of the EMPr should be reported to the ACWA Power Environmental Department immediately in order for corrective action to be undertaken.
- The Environmental Manager / General Manager will notify the controlling authority of such an incident, if the environmental incident constitutes a breach of any permit or license condition then reporting is required by the applicable permit or license.

11.5.2 Contractors' Responsibilities

- All contracting companies will be made aware of applicable environmental commitments that will incur cost on their part. When adjudicating tenders, ACWA Power will ensure that contractors have made appropriate allowance for management of environmental matters where required. It is the responsibility of the contractor to ensure that all of their staff are aware of the measures applicable to their area of work onsite; and
- It is the responsibility of the contractor to bring to the attention of the ACWA Power ECO, any environmental incident or breach of the conditions of the EMPr.

11.5.3 Complaints Management

Complaints received regarding activities on the development site pertaining to the environment will be recorded in a register and the responses will be noted with the dates and actions taken. This record will be submitted with the monthly reports and a verbal report will be given at regular site meetings.

11.6 Monitoring, Evaluation and Reporting

11.6.1 Pre-Construction Audit

An internal pre-construction audit should be undertaken to verify compliance with the actions outlined in the EMPr for the pre-construction phase of the project. If non-compliances are identified, the pre-construction audit will make recommendations on what actions should be undertaken to comply with the EMPr for pre-construction.

The scope of the pre-construction audit will include:

- Verification that detailed design parameters have been addressed in the planning phase – e.g. storm water management, erosion protection, and water management systems; and
- Verifying that:
  - Environmental monitoring has commenced;
  - Equipment procurement criteria is in place; and
  - Chance find procedures are in place.

11.6.2 Auditing/Inspections

During the construction phase of the project, the ECO will be responsible for undertaking audits and inspections to verify compliance with the EMPr, and any conditions of the environmental authorisation. These audits will be undertaken on a regular basis (fortnightly) and also *ad hoc* and any non-compliance will be recorded.

Weekly tracking records of compliance will be produced and discussed during weekly EHS toolbox talks which will occur between the contractor and the ECO.

An independent environmental audit will be undertaken annually for the duration of the construction, operational and closure phases.

11.7 EMPr for the Various Project Phases

The EMPr and specific mitigation measures and monitoring actions for the identified impacts in Sections 9.3 are presented in this section. The mitigation measures associated with each of the construction, operational and decommissioning/ closure phases are described in **Table 11-1** below. The General Manager will ensure implementation of the EMPr and the ECO will be responsible for monitoring of the results.

Note:

This section can be printed and used as a field guide during each phase of the project

Table 11-1: Mitigation and Monitoring Measures

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
CONSTRUCTION PHASE								
9.3.1.1	Geology	Construction of access roads, underground pipeline and infrastructure will disturb only topsoil and subsoil	No unnecessary disturbance of geology	Removal of necessary topsoil and subsoil only	None required	ECO appointed by ACWA Power, Contractors	Duration of Construction Activities – approximately 9 months	Weekly
9.3.2.2	Air Quality	Dust fall, PM_{10} and exhaust fumes	To remain within national standards at site perimeter and at sensitive receptors	No exceedances of standards in **Table 9-1** and Table 9-2 attributable to project	Wet suppression to ensure absence of visible dust; Enforcement of low vehicle speeds on unpaved roads (< 30 km/h); Monitoring of natural re-vegetation of disturbed areas with locally indigenous grass species; Chemical binders such as Dustex or Dust-A-Side to be considered for unpaved roads; Dust fall to be monitored by dust collection buckets located downwind of construction area;	ECO appointed by ACWA Power, Contractors	Duration of Construction Activities – approximately 9 months	Weekly

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
					Monitoring in accordance with SANS 2004.			
9.3.3.1	Topography	Changes due to foundation excavations and construction of runoff control systems	To provide for runoff capture and prevention of erosion	No runoff migration from site; No erosion	Objectives achieved while minimising changes in natural topography	ECO appointed by ACWA Power, Contractors	Duration of Construction Activities – approximately 9 months	Weekly
9.3.4.1	Soil, Land capability and land use	Degradation of quality due to mixing with subsoil; Loss of topsoil due to water and wind erosion; Contamination with hydrocarbons and hydraulic fluids; and Colonisation of topsoil stockpile by weeds.	To maintain quality of topsoil until it is needed for rehabilitation	No deterioration in topsoil quality	The maximum depth of topsoil stripping should be 30 cm. Careful stripping and stockpiling to avoid mixing of topsoil and subsoil; If there is less than 30cm of unconsolidated soil material above a limiting layer of rock or hardpan, then the entire depth must be stripped and stockpiled as topsoil (even if it contains a high proportion of course fragments. Topsoil should be retained in the areas below the PV panels. Limiting the stockpile height to 3 metres and the slope to 1 in 5, and rounding the top edges; Berm down-gradient of stockpile;	ECO appointed by ACWA Power, Contractors	Duration of Construction Activities – approximately 9 months	Weekly

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
					Keeping the stockpile moist; Vegetating the stockpile with locally indigenous grass species; Regular weeding; and Construct berms 200 m apart across slope of site. Conduct regular inspections to identify areas of erosion. Dispose of all subsurface spoils from excavations where it will not impact on undisturbed land.			
9.3.5.1	Ecology	Stripping of vegetation will destroy habitat and disturb fauna on the site. Disturbance of vegetation and fauna along pipeline route. Possible disturbance of birds and bats at foraging and roosting areas. Stripping of riparian vegetation at the water abstraction point.	To limit vegetation stripping and disturbance of fauna to the minimum necessary	No unnecessary ecological impact	If protected species occur on project area, obtain permits for their destruction or relocation; Minimise and clearly demarcate area to be stripped; Stripped vegetation will be composted and/or chipped to serve as mulch during rehabilitation; Implement monitoring and control programme for exotic species;	ECO appointed by ACWA Power, Contractors	Duration of Construction Activities – approximately 9 months	Weekly

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
					Prohibit the destruction, harvesting, handling, poisoning and killing of fauna and flora on land under ACWA's control; and Employees and contractors will be made aware of the presence of, and rules regarding, flora and fauna through suitable induction training and on-site signage. Prior to construction, an avifaunal specialist should conduct a site walkthrough, covering the final road, pipeline and power line routes as well as the PV1 plant layout, to identify any nests/breeding/roosting activity of sensitive species, as well as any additional sensitive habitats. The results of which may inform the final construction schedule in close proximity to that specific area, including abbreviating construction time, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise. No construction activities or staff are permitted within 1.5			

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
					km of the identified Martial Eagle nest (Figure 8-15). A construction phase bird monitoring programme must be implemented by a bird specialist, to document potential impacts on key species such as korhaans, bustards and eagles, and must include the ongoing monitoring of the active Verreaux's Eagle and Martial eagle nest sites.			
9.3.6.1	Ecosystem services	Vegetation clearance within project area will remove: Food and habitat for locally indigenous fauna adapted to living in that area; Grazing currently utilised by local owners of sheep and goats; and Protection against soil erosion by water and wind.	Minimise reduction of ecosystem services	No unnecessary reduction in ecosystem services	Areas where vegetation must be removed will be clearly demarcated; Leave a 250 m buffer zone, within which the existing vegetation is retained, between the edge of the proposed infrastructure footprint and the outer boundary of the facility; and Berms will be built 200 metres apart across the slope of the site to capture runoff and allow silt to settle.	ECO appointed by ACWA Power, Contractors	Duration of Construction Activities – approximately 9 months	Weekly
9.3.7.1	Surface	Erosion, silt in local watercourses.	Avoid erosion	No erosion	Construct pollution control and runoff control systems	ECO appointed by ACWA	Duration of Construction	Weekly

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
	Water	Potential spillage of hydrocarbons and chemicals	No pollution of watercourses	No change in SW quality,	first, before undertaking any other activities; Remove contaminated silt from berms monthly for remediation or disposal; Place drip trays under vehicles when parked; Service vehicles in a workshop, not in the field; Spill kit and clean-up team will be available on site; Spillages will be cleaned up immediately; Potentially contaminating wastes will be stored in bunded areas until removed by a reputable contractor for disposal at an appropriately licensed site; Adequate sanitation facilities will be provided - chemical toilets that are serviced regularly; and Environmental awareness training will be provided to workers on site.	Power, Contractors	Activities – approximately 9 months	
9.3.8.1	Groundwater	Spillages of fuels, lubricants and chemicals, and lack of	No pollution of groundwater	No change in groundwater quality down-	Mitigation measures for surface water will be protective of groundwater;	ECO appointed by ACWA Power,	Duration of Construction Activities –	Monthly

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
		sanitation could result in contamination of soil and groundwater		gradient of site		Contractors	approximately 9 months	
0	Noise	Noise from general construction activities.	To avoid intrusive noise levels at sensitive receptors	No intrusive noise levels experienced by sensitive receptors. No complaints from local residents.	Limiting the noisiest construction activities to daytime hours (07h00 to 18h00) from Monday to Saturday; Using equipment with lower sound power levels where possible; Installing suitable mufflers on engine exhausts and compressor components; Keeping construction vehicles and equipment in good repair; Construction vehicles will be equipped with reverse alarms that emit lower frequencies or white noise; Where necessary, stationary noisy equipment will be encapsulated in acoustic covers, screens or sheds; Installing vibration isolation for mechanical equipment; Re-locating noise sources to areas which are less noise sensitive, to take advantage	ECO appointed by ACWA Power, Contractors	Duration of Construction Activities – approximately 9 months	Weekly

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
					of natural shielding and distance from receptors; Implementing a system to receive, record and respond to complaints; Liaison with local residents on how best to minimise the impact of unavoidable noisy construction activities on noise sensitive receptors; Machines in intermittent use will be shut down or throttled down to a minimum whenever possible; In general, construction activities must meet the noise standard requirements of the Occupational Health and Safety Act (Act No 85 of 1993); and Construction staff working in areas where the 8-hour ambient noise levels exceed 75dBA must wear hearing protection equipment.			
9.3.10.4	Visual	Vehicle movement and activities on site will be visible to local residents and travellers, especially if dust plumes develop.	To minimise intrusive and annoying visual impacts	No complaints about visual impact	Leave maximum possible screening vegetation between site and potential receptors; Maintain construction site in a neat and orderly condition;	ECO appointed by ACWA Power, Contractors	Duration of Construction Activities – approximately 9 months	Monthly

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
		Security lighting and vehicle lights will be visible at night. Visibility will increase during the construction period as the taller structures are erected			Create designated areas for material storage, waste sorting and temporary storage, batching and other potentially intrusive activities; Apply sufficient wet suppression to ensure absence of visible dust; Cover unpaved roads and parking with a layer of crushed rock or gravel, or treat with chemical dust suppressants such as Dustex or Dust-A-Side; Direct lighting at activities and away from viewshed points; and Use motion-activated security lighting along the site perimeter that is directed downwards and inwards towards the site.			

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
9.3.11.1	Cultural and Heritage	Only Middle Stone Age scatter of low significance likely, but unearthing of buried resources possible	Avoid damaging buried resources	Correct procedures in place to deal with chance finds of buried resources	If graves or other buried resources are unearthed: ▪ Cease all work in immediate vicinity of find; ▪ Demarcate area with barrier tape or other highly visible means; ▪ Notify South African Heritage Resources Authority (SAHRA) immediately; ▪ Commission an archaeologist accredited with Association for Southern African Professional Archaeologists (ASAPA) to assess find and determine appropriate mitigation measures.; and ▪ Prevent access to find by unqualified persons until assessment and mitigation processes have been completed.	ECO appointed by ACWA Power, Contractors	Duration of Construction Activities – approximately 9 months	Weekly, if buried resources found

9.3.12.1	Traffic	Increase in traffic may affect road safety adversely, increase congestion and wear and tear of the road surface and add to frustration of other road users. Increase of traffic and heavy loads on the unpaved roads will increase dust generation.	To maximise road safety, and minimise congestion and frustration.	No increase in accident rate; No complaints.	Delivery of equipment and construction materials only to take place between 7:00 and 18:00; Use only reputable contractors; Require contractors to: ▪ Keep their vehicles in good condition; ▪ Use recording tachometers in vehicles; ▪ Use properly licensed and skilled drivers; ▪ Monitor adherence to traffic regulations; ▪ Take effective measures to avoid driver fatigue; ▪ Monitor drivers for use of alcohol and other substances that could impair judgment and driving ability; ▪ Ensure that loads on trucks are properly secured during transport; ▪ Avoid using the section of the Gariep Road from the project site to the N14 crossing. The private Transnet Road to be re-gravelled (150mm thick over width) before construction commences. Thereafter it should be graded on a regular basis (at least weekly, depending on	ECO appointed by ACWA Power, Contractors	Duration of Construction Activities – approximately 9 months	Weekly

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
					the wind direction and rain conditions); Apply effective dust control measures (see section 9.3.2.2; The section of the Gariep Road between the N8/Gariep Road intersection and the Gariep / Transnet intersection to be upgraded before construction commence based on the outcome of the Basic Assessment process currently underway (8.1.13.1.1). The upgrade of this road to be coordinated with developers of other solar plants in the area, farmers, Northern Cape Province Roads Department; Provide clear and early warning of construction vehicles at the Gariep Road and Transnet Road intersection; and Record and respond to all complaints.			
9.3.13.1	Socio-economics	Construction will take some 9 months and provide an estimated 50 employment opportunities;			Community liaison officer(s) will be appointed; Project information will be communicated to I&APs to avoid misunderstandings			

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
					and the creation of unrealistic expectations; A formal grievance/complaint mechanism will be set up; All complaints will be recorded, followed up and resolved expeditiously; Local contractors and providers of goods and services will be used where practicable; Construction area will be fenced off and access control exercised; Access to neighbouring properties, trapping of animals and harvesting of plants will be prohibited; ACWA Power will work with local authorities to prevent development of ad-hoc roadside dwellings, shops and so forth on or adjacent to the project site; The Contractor, in line with the relevant socio-economic focus of the !Kheis LM and ACWA Power's personnel policies, must develop an appropriate exit strategy for temporary employees;			

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
					Construction traffic past community areas will be properly managed and the rules of the road will be strictly enforced; Construction-related road use will be limited to daylight hours and movement of heavy vehicles during peak traffic hours will be avoided as far as practicable; and A database of local job seekers, with skills levels and employment history, will be developed before commencing with personnel recruitment for the operational phase.			
General	Dangerous activities	Worker safety	To maintain safe work practices in a safe environment and to avoid personnel injuries and damage to assets	Documentation of all unplanned incidents and achievement of target safety performance statistics	Toolbox talks/staff briefing sessions; Site workers training programme; Training in the use and handling of equipment.	ECO appointed by ACWA Power, Contractors	Duration of project activities, all phases	Weekly
OPERATIONAL PHASE								
9.3.1.2	Geology	The operational phase will have no impact on the geology of the	Not applicable	Not applicable	None	Not applicable	Not applicable	Not applicable

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
		project area						
9.3.2.3	Air Quality	Vehicles travelling over unpaved surfaces will mobilise particulates	Minimisation of emissions	No exceedances of standards in Table 9-1 and Table 9-2 attributable to project	Dust suppression on unpaved surfaces by water sprays or chemical binders; Regular sweeping or washing of paved surfaces; Enforcement of low vehicle speeds on unpaved roads (< 30 km/h); Maintaining vehicles in good condition; Continuous monitoring dust fall and PM_{10} down-wind of site, with monthly reporting; and If standards are exceeded regularly, additional mitigation measures will be developed.	ECO appointed by ACWA Power	Duration of Operational phase (about 30 years)	Monthly
9.3.3.2	Topography	No effect on the topography of the site	Not applicable	Not applicable	None	Not applicable	Not applicable	Not applicable

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
9.3.4.2	Soil, Land Use and Land Capability	Potential for soil compaction and/or erosion; Potential for soil pollution due to spillages of hydrocarbons, hydraulic fluids and cleaning chemicals.	To protect soil from contamination; To preserve as much of the fertility of the topsoil as possible;	No deterioration in topsoil fertility during operational phase;	Remove silt from runoff containment berms regularly and blend with topsoil stockpile or store separately for later use during rehabilitation; Re-vegetate open areas with locally indigenous grass species where practicable; Maintain a trained clean-up team and a spill kit on site at all times; Clean up spillages of contaminants immediately. Keep stockpiled topsoil moist to reduce wind erosion and facilitate vegetation growth; Vegetate stockpiled topsoil with locally indigenous grass species; and Regular weeding. Conduct regular inspections to identify areas of erosion.	ECO appointed by ACWA Power	Duration of Operational phase (about 30 years)	Monthly

9.3.5.2	Ecology	Project site will be unavailable to fauna, except for insects, birds and rodents adapted to living in areas transformed by human activity; Potential for bird kills due to collision with structures, electrocution.	To minimise bird injuries	No bird injuries due to project operation	The ECO must be trained by an avifaunal specialist to identify the potential Red Data species as well as the signs that indicate possibly breeding by these species. If a priority species or Red Data species is found to be breeding (e.g. a nest site is located) on or within 2 km of the operational facility (or the grid connection servitude), the nest/breeding site must not be disturbed and the avifaunal specialist must be contacted for further instruction. The ECO must conduct inspections every two months of the grid connection line, and all existing transmission line pylons within 2 km of the project site boundary to locate possible nesting raptors. Any such nests must not be disturbed and should be reported to the avifaunal specialist for further instruction. No operational activities or staff are permitted within 1.5 km of the identified Martial Eagle nest (Figure 8-15). To limit bird traffic across the site, perch able structures should be avoided where possible.	ECO appointed by ACWA Power	Duration of Operational phase (about 30 years)	Monthly

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
					All artificial water points (e.g. livestock water points and wind pumps) on the project site and within 500 m from the boundary of the project site, must be moved or shut down (if not already removed from the project site during construction) so that birds are not attracted to the project site and immediate surrounding areas. All water related infrastructure (e.g. pipes, pumps, reservoirs, toilets, taps etc.) must be regularly (twice weekly) checked for leaks, and repaired immediately. Any waste water treatment ponds must either be entirely covered, or must be located at least 1 km away from the outer rim of the PV panel field. Lighting should be kept to a minimum to avoid attracting insects and birds and light sensors/switches should be utilised to keep lights off when not required. Lighting fixtures should be hooded and directed			

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
					downward, to minimize the skyward and horizontal illumination which could attract night-flying birds (Ledec et al ., 2010) and where possible, lighting should be intermittent or flashing-beam lights. External lighting to be of an intermittent and coloured nature rather than constant white light to reduce the potential impact on the movement patterns of nocturnal species. Careful selection of and modifications to solar facility equipment should be made where possible. For instance, white borders could be applied to PV panels to reduce the resemblance that arrays have of waterbodies. Where possible, power lines/cables on the project site should be underground. Where possible, the routing of power line infrastructure should avoid Medium or High Sensitivity zones (Figure 8-15). Where possible, grid connection infrastructure			

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
					should follow existing servitudes such as existing power lines, roads and fences. An avifaunal specialist must conduct a site walk through of the final Grid Connection route and pylon positions prior to construction to determine if, and where, bird flight diverters (BFDs) are required. Install bird flight diverters as per the instructions of the specialist following the site walkthrough, which may include the need for modified BFDs fitted with solar powered LED lights on certain spans. Any new power line/s must be of a design that minimizes electrocution risk by using adequately insulated 'bird friendly' monopole structures, with clearances between live components of 2 m or greater and which provide a safe bird perch. The structures to be constructed must be approved by the Endangered Wildlife Trust's (EWT) Wildlife and Energy Programme or a suitably qualified bird specialist.			

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
					The operational monitoring programme for the associated PV1 site must be in line with applicable monitoring guidelines and must include regular (at least monthly) monitoring of the grid connection power line for collision (and electrocution) mortalities. Any mortalities should be reported to the Endangered Wildlife Trust (EWT). Operational phase bird monitoring, in line with the solar guidelines, must be implemented. Frequent and regular review of operational phase monitoring data and results by an avifaunal specialist. If unacceptable impacts are observed (in the opinion of the bird specialist and independent review), the specialist should conduct a literature review specific to the impact and provide updated and relevant mitigation options to be implemented. As a starting point for the review of possible mitigations, the			

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
					following may need to be considered: Assess the suitability of using deterrent devices to reduce collision risk, which may include the use of rotating/flashing mirrors, or sound deterrents.			
9.3.7.2	Surface Water	Runoff from compacted areas could cause erosion and migrate off site.	To minimise off-site migration of runoff and formation of erosion rills or gullies	No off-site migration of runoff and no erosion rills or gullies; No change in water quality downstream of site	Regular inspection runoff control berms; Remove silt from berms regularly to maintain capacity; Place drip trays under vehicles when parked for longer than 3 hours; Spillages will be cleaned up immediately and contaminated soil will either be remediated *in situ* or disposed of at an appropriately licensed landfill site; and Environmental awareness training will be provided for workers and visitors.	ECO appointed by ACWA Power	Duration of Operational phase (about 30 years)	Monthly
9.3.8.2	Groundwater	Soil contamination by spillages of lubricants, hydraulic fluids, solvents and cleaning chemicals could result	To prevent groundwater contamination due to operational	No complaints from groundwater users;	Mitigation measures described in section 9.3.7.2 for surface water will be implemented;	ECO appointed by ACWA Power	Duration of Operational phase (about 30 years)	Monthly

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
		in groundwater contamination	activities	No deterioration in groundwater quality.	Water quality in down-gradient boreholes will be monitored			
9.3.9.3	Noise		To prevent exceedances at all noise sensitive receptors (NSRs)	Lack of complaints about noise	Responding to and closing out all complaints.	ECO appointed by ACWA Power	Duration of Operational phase (about 30 years)	Monthly
9.3.10.5	Visual	Reflected glare from the PV panels and associated infrastructure may be 95% visible in a 0 – 5 km radius and 60% in the 5 – 10 km radius around the site; Observers in aircraft may see reflection from PV panels as momentary bright flashes similar to those from water bodies;	Minimise adverse visual impacts	No complaints about visual aspects	Technical means of reducing glare from PV panels and associated infrastructure will be investigated such as: ▪ Using materials that are darker in colour to absorb more light and reflect less; ▪ Using matt surface finishes that absorb and/or scatter more light and reflect less; ▪ Placing and aligning the PV panels in a manner that will reduce the intensity of the reflected glare towards the most sensitive areas. Lighting will meet operational requirements without causing excessive illumination; Night lighting will be directed inwards, downwards and away from local roads and	ECO appointed by ACWA Power	Duration of Operational phase (about 30 years)	Annually

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
					residential areas; and Up-lighting of structures will be avoided.			
9.3.11.2	Cultural and Heritage	Highly unlikely for heritage resources to be found, but not impossible, if soil disturbance occurs in undisturbed areas;	Avoid damaging buried resources	Correct procedures in place to deal with chance finds of buried resources; No damage to buried resources	Implement chance find procedures described in section 9.3.11.1	ECO appointed by ACWA Power	Duration of Operational phase (about 30 years)	Ad hoc, as required
9.3.12.2	Traffic	Increased traffic to the solar plant will have cumulative impact on road safety, congestion, deterioration of road surfaces and frustration of other drivers.	To avoid adding to frustration of other road users or compromising road safety and quality	No project-related increase in road accidents; No complaints from other road users	Access road to site will be paved or treated with a binder such as Dustex or Dust-A-Side, inspected regularly and maintained; The private Transnet Road to be graded on a regular basis (at least weekly, depending on the wind direction and rain conditions); ACWA Power will engage with authorities to have unpaved access roads paved, if not completed prior to construction. Record and respond to all complaints.	ECO appointed by ACWA Power	Duration of Operational phase (about 30 years)	Bi-annually
9.3.13.2	Socio-	Operation will require	To maximise	No complaints	Maintain communication and	ECO appointed	Duration of	Bi-

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
	economics	about 10 local employees; Project will contribute towards stability of national grid and reduction in greenhouse gas output per MWH generated; Project will benefit some local businesses, but environmental impacts may be perceived as negative by some local residents; Project will attract job seekers, which may result in formation informal settlements and associated social pathologies.	benefits and minimise negative impacts	about socio-economic aspects	consultation with local residents; Employ local people as far as practicable; Purchase materials, goods and services locally as far as practicable; Maintain the complaints procedure and complaints register; and Follow up, resolve and close out every complaint.	by ACWA Power	Operational phase (about 30 years)	annually

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
CLOSURE AND REHABILITATION PHASE								
9.3.1.3	Geology	The closure and rehabilitation activities will not have any impact on the geology of the project area.	Not applicable	Not applicable	None	Not applicable	Not applicable	Not applicable
9.3.2.4	Air Quality	Dust fall, PM_{10} and exhaust fumes, similar to construction phase	To remain within national standards at site perimeter and at sensitive receptors	No exceedances of standards in Table 9-1 and Table 9-2 attributable to project	Wet suppression to ensure absence of visible dust; Enforcement of low vehicle speeds on unpaved roads (< 30 km/h); Monitoring of natural re-vegetation of disturbed areas with locally indigenous grass species; Chemical binders such as Dustex or Dust-A-Side will be considered for unpaved roads; Dust fall will be monitored by dust collection buckets located downwind of construction area; and Monitoring in accordance with SANS 2004.	ECO appointed by ACWA Power	Duration of closure phase (12 months)	Weekly during rehabilitation
9.3.3.3	Topography	Due to low rainfall and sandy soils, the site is not very prone to erosion, but	Site must be free draining and resistant to erosion	No development of erosion rills or gullies	Leave successful runoff control berms in place;	ECO appointed by ACWA Power	Duration of closure phase (12 months)	Bi-annually for 3 years after closure

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
		inappropriate closure and rehabilitation could increase erosion potential.						
9.3.4.3	Soil, Land Use and Land Capability	Potential loss of soil quality due to mixing with subsoil and overburden; Potential contamination with hydrocarbons and hydraulic fluids; Erosion and weed infestation.	Preserve soil quality; Avoid soil contamination; Avoid or repair erosion; Maintain weed control.	No soil contamination, erosion or loss of quality; Absence of weeds.	Demolition of containment systems (bunded areas) will be done last; Areas of potential soil contamination will be sampled, analysed and mapped; Contaminated soil will be removed and remediated *in situ* or disposed at an appropriately licensed disposal site; Site will be shaped to be free draining, but resistant to erosion; Compacted areas will be ripped, using light agricultural machinery; Soil will be sampled analysed, and fertilised by an agronomist. Stockpiled topsoil must be evenly spread over the entire disturbed surface. Vegetate with locally indigenous species;	ECO appointed by ACWA Power	Duration of closure phase (12 months)	Bi-annually for 3 years after closure

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
					Monitor progress for at least 3 years after closure; and Rehabilitation progress will be monitored three-monthly until vegetation becomes self-sustaining. Erosion rills that may have developed will be repaired and, if any bare patches larger than 4 m^2 are found, they will be re-vegetated after investigating the reasons and taking remedial action.			
9.3.5.3	Ecology	If closure and rehabilitation is not done properly, vegetation will not re-establish well and long term to permanent damage to pre-project ecological conditions may result	To establish a self-sustaining diversity of locally indigenous flora; Re-colonisation of area by indigenous fauna;	Vegetation becomes self-sustaining within three years; Area is re-colonised by indigenous fauna;	Structures will be demolished, removed and disposed of in accordance with applicable regulatory requirements; If spillages do occur, they will be cleaned up immediately and any contaminated soil will be disposed of in accordance with applicable regulatory requirements; All weeds and alien plants will be removed from the site; Compacted areas will be ripped and shaped to be free draining. Light agricultural machinery will be used to avoid compaction; Soil will be analysed,	ECO appointed by ACWA Power	Duration of closure phase (12 months)	Bi-annually for 3 years after closure

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
					conditioned fertilised as recommended by a qualified soil scientist; Site will be re-vegetated with locally indigenous grasses, shrubs and trees to encourage colonisation by fauna; Vegetation will be monitored quarterly until it has become self-sustaining. If any bare patches develop, the reason will be investigated and addressed, followed by re-vegetation of the patch.			
9.3.6.3	Ecosystem services	Incorrect rehabilitation could result in permanent impairment of project area to provide ecosystem services equivalent to pre-project services	To restore pre-project ecosystem services	Full recovery of ecosystem services	Implement mitigation measures stipulated in sections 9.3.4.3, 9.3.5.3 and 9.3.6.3.	ECO appointed by ACWA Power	Duration of closure phase (12 months)	Bi-annually for 3 years after closure
9.3.7.3	Surface Water	Pollution potential similar to that of construction phase	To prevent contamination of surface water resources downstream of site	No contamination of downstream surface water resources	The mitigation measures listed in section 9.3.7.1 will be applied; and The bunded areas will be the last structures to be demolished.	ECO appointed by ACWA Power	Duration of closure phase (12 months)	Bi-annually for 3 years after closure
9.3.8.3	Groundwater	Pollution potential similar to that of construction phase	To prevent groundwater pollution	No signs of groundwater pollution	The mitigation measures listed in section 9.3.7.1 will be applied; and	ECO appointed by ACWA Power	Duration of closure phase (12 months)	Bi-annually for 3 years after closure

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
					The bunded areas will be the last structures to be demolished.			
9.3.9.4	Noise	Similar noise levels to construction phase, but shorter duration, about 4 to 6 months. Post-closure monitoring will not generate significant noise.	To avoid intrusive noise levels at sensitive receptors	No intrusive noise levels experienced by sensitive receptors; No complaints from local residents.	Noisiest activities will be limited to daytime hours (06h00 to 22h00); Equipment with lower sound power levels will be used where possible; Mufflers will be installed on engine exhausts and compressor components; Heavy vehicles will be equipped with reverse alarms that emit lower frequencies or white noise; Acoustic enclosures will be placed around equipment causing radiating noise; Location of noise sources will take advantage of distance from receptors and natural shielding; and The system of receiving, recording and responding to complaints will be maintained for at least three years after closure.	ECO appointed by ACWA Power	Duration of closure phase (12 months)	Weekly until demolition activities cease
9.3.10.6	Visual	Similar activities and impacts as those of	Minimise negative	No complaints	Dust suppression with water or chemicals;	ECO appointed by ACWA Power	Duration of closure phase	Weekly until demolition

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
		construction phase, but shorter duration (4 to 6 months).	impact		Vehicle movement at night will be limited; If demolition activities are undertaken at night, lighting will be directed away from local roads and residential areas as far as possible; and Downwards and inwards directed motion-activated security lighting will be used along the site perimeter		(12 months)	activities cease

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
9.3.11.3	Cultural and Heritage	Very low probability of unearthing human remains or artefacts when rehabilitating project area	No damage to buried resources	Apply correct chance find procedures to unearthed resources	In the event of a chance find: ▪ All work in the immediate vicinity of the find will cease; ▪ The area will be clearly demarcated; ▪ South African Heritage Resources Authority (SAHRA) will be notified immediately; ▪ An archaeologist accredited with the Association for Southern African Professional Archaeologists (ASAPA) will be commissioned to assess the find and determine appropriate mitigation measures; and ▪ Access to the find by unqualified persons will be prevented until the assessment and mitigation processes have been completed.		Duration of closure phase (12 months)	Quarterly until rehabilitation activities cease

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
9.3.12.3	Traffic	Irregular traffic pattern, as in construction phase. Impact on road safety, congestion, wear and tear of the road surface and frustration of other drivers	To maximise road safety, and minimise congestion and frustration	No increase in accident rate; No complaints	Apply effective dust control measures (see section 9.3.2.2; Wet suppression on unpaved access roads with water and a dust palliative or with commercial binders such as Dustex or Dust-a-Side; Use only reputable contractors; Require contractors to: ▪ Keep their vehicles in good condition; ▪ Use recording tachometers in vehicles; ▪ Use properly licensed and skilled drivers; ▪ Monitor adherence to traffic regulations; ▪ Take effective measures to avoid driver fatigue; ▪ Monitor drivers for use of alcohol and other substances that could impair judgment and driving ability; ▪ Ensure that loads on trucks are properly secured during transport; ▪ Avoid using the section of the Gariep Road from	ECO appointed by ACWA Power	Duration of closure phase (12 months)	Weekly until demolition activities cease

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
					the project site to the N14 crossing. The private Transnet Road to be re-gravelled (150mm thick over width) before decommissioning commences. Thereafter it should be graded on a regular basis (at least weekly, depending on the wind direction and rain conditions); Provide clear and early warning of decommissioning vehicles at the Gariep Road and Transnet Road intersection; and Record and respond to all complaints.			
9.3.13.3	Socio-economics	Similar activities to construction phase, but shorter duration. Most of the negative environmental impacts of construction and operational phases will be reversed over time, but positive socio-economic impacts of job creation and cash injection into local economy will fall away.	To minimise negative socio-economic impacts	Former employees and suppliers/service find alternative employment or other livelihoods	Infrastructure that can be used by subsequent landowner(s) will be left intact; Proactive skills development and training of employees to enhance their value in the labour market; Development of a retrenchment plan in consultation with employees, starting at least five years before closure;	ECO appointed by ACWA Power	Duration of closure phase (12 months)	Bi-annually for three years after closure

Section No	Aspect (of Activity Service or Product)	Potential impact	Objectives	Performance Criteria	Mitigation measure(s)	Responsible person / party	Time-frame	Monitoring and Reporting Frequency
					Redundant employees will be assisted to find alternative employment as far as practicable; Providing training and start-up assistance to employees who want to start their own businesses;			

11.8 Fauna and Flora Rescue and Protection

In order to ensure minimal impact on listed and protected fauna and flora species and their habitat, avoidance and mitigation measures will be implemented during pre-construction, construction and operation.

11.8.1 Flora Rescue and Protection

Section 5.6.1 of the Biodiversity Specialist report (APPENDIX G) details the flora species of conservation concern that have been confirmed to be present or considered likely to be present in the project area. The confirmed species of concern are listed in Table 11-2.

Table 11-2: Flora species of conservation concern recorded in the study area

Species	Conservation Status	Identification
Acacia erioloba	**Protected Tree (National Forest Act, 1998)**	 Source: Robur.q – www.wikipedia.org
Acacia haematoxylon	**Protected Tree (National Forest Act, 1998)**	 Source: www.seedsforafrica.co.za
Boscia albitrunca	**Protected Tree (National Forest Act, 1998)**	 Source: www.kyffhauser.co.za

Species	Conservation Status	Identification
Stipagrostis amabilis	**Kalahari endemic**	 *Source: www.biodiversityexplorer.org*

11.8.1.1 Methodology:

- Three protected tree species were recorded in the proposed project site. The ECO will, prior to construction and preferably with the onset of the growing season, conduct a walk-through of the project to identify and label all protected trees within the construction area;
- In the event that protected trees fall within the development footprint, rescue or destruction permits must be obtained from the provincial or relevant authority;
- If any species of concern are observed during the pre-construction survey, the following principles will apply:
  - Rescue operations should preferably be conducted with the onset of the growing season;
  - Identified and potentially affected plants should be translocated to a similar habitat outside the construction area. The area identified for translocation should be mapped and clearly marked for future monitoring purposes;
  - Translocated plants should be recorded with a unique identification number, photograph and GPS coordinates;
  - Rescued plants must either be planted immediately in the area designated for translocation or planted in containers to be cared for at an on-site nursery;
  - The ECO must conduct daily inspections during site clearing to ensure that all possible species of concern are identified and handled accordingly as well as to ensure immediate response in the event of deviations from the site clearance plan;

11.8.2 Fauna Rescue and Protection

Section 5.6.1 of the Biodiversity Specialist report (APPENDIX G) details the fauna species of conservation concern that have been confirmed to be present or considered likely to be present in the project area. The confirmed species of concern are listed in Table 11-3.

Table 11-3: Fauna species of conservation concern recorded in the study area

Species name	Common Name	Conservation Status	Habitat Association in Study Area	Identification
Otocyon megalotis	Bat-eared Fox	NCNCA 2009 – Specially Protected	Open shrub duneveld, open shrub plains, calcareous low shrub plains throughout Bokpoort II footprint	 Source: www.sa-venues.com
Atilax paludinosus	Water Mongoose	NCNCA 2009 – Specially Protected	Riparian habitat at water abstraction point	 Source: www.biodiversityexplorer.org
Cynictis penicillata	**Yellow Mongoose**	**NCNCA 2009 - Protected**	**Open shrub duneveld, open shrub plains, calcareous low shrub plains throughout Bokpoort II footprint**	 Source: www.etoshanamibia.info
Galerella sanguinea	**Slender Mongoose**	**NCNCA 2009 - Protected**	**Open shrub duneveld, open shrub plains, calcareous low shrub plains throughout Bokpoort II footprint**	 Source: www.biodiversityexplorer.org
Lepus capensis	**Cape Hare**	**NCNCA 2009 - Protected**	**Open shrub duneveld, open shrub plains, calcareous low shrub**	

Species name	Common Name	Conservation Status	Habitat Association in Study Area	Identification
			plains throughout Bokpoort II footprint	 Source: www.biodiversityexplrorer.org
Lepus saxatilis	Scrub Hare	NCNCA 2009 - Protected	Open shrub duneveld, open shrub plains, calcareous low shrub plains throughout Bokpoort II footprint	 Source: www.pbase.com
Aonyx capensis	Cape Clawless Otter	NCNCA 2009 – Protected, NEMBA	Riparian habitat at water abstraction point	 Source: www.krugerpark.co.za
Ictonyx striatus	Striped Polecat	NCNCA 2009 – Specially Protected; Data Deficient	Open shrub duneveld, open shrub plains, calcareous low shrub plains throughout Bokpoort II footprint; riparian vegetation at	

Species name	Common Name	Conservation Status	Habitat Association in Study Area	Identification
			water abstraction point	Source: www.nambian.org
Mellivora capensis	**Honey Badger**	**NCNCA 2009 – Specially Protected; Near Threatened**	**Open shrub duneveld, open shrub plains, calcareous low shrub plains throughout Bokpoort II footprint; riparian vegetation at water abstraction point**	 Source: www.biodiversityexplorer.org
Orycteropus afer	**Aardvark**	**NCNCA 2009 – Specially Protected, NEMBA**	**Open shrub duneveld, open shrub plains, calcareous low shrub plains throughout Bokpoort II footprint**	 Source: www.travelsnamibia.com

11.8.2.1 Methodology

- The ECO will, prior to construction conduct a walk-through of the project to identify any burrows or any other habitats that may be destroyed during site clearing to provide the animals with sufficient time to leave;
- The rocky outcrop in the northern corner of the study area constitutes prime roosting habitat for crevice roosting bats. This area should be clearly communicated as a no-go area during construction;
- Any trenches or depressions within the cleared site must be checked on a daily basis for the presence of trapped animals. Any animals found must be removed safely and without any harm.

11.9 Management of Alien Invasive Plants

Alien or exotic plants are species that occur outside of their natural historic geographic range. In most instances they have been introduced by humans owing to their economic and/or ornamental value. Many alien species, such as common agricultural and garden plants, are unable to reproduce without human intervention and therefore do not pose an environmental or economic problem (Bromilow 2010). Certain alien species however, are able to survive and reproduce successfully under natural conditions. Once established, these 'naturalised'

species are able to spread prolifically, out-competing indigenous vegetation and creating large, almost monospecific stands (Bromilow 2010). The long-term negative ecological consequences of severe alien invasive species infestations are manifold, and include:

- A loss of indigenous biodiversity and a concomitant reduction in ecosystems functioning and services;
- Increase in evapotranspiration leading to a reduction in water availability; and
- Decrease in overall productivity of agricultural land.

Alien invasive plants are accordingly of significant economic and biodiversity concern, and in South Africa specific legislation has been promulgated to manage the problem. Legal considerations are discussed in section 11.9.1.

11.9.1 Legal Framework

South African legislation concerning alien invasive species comprises the Conservation of Agricultural Resources Act (see CARA 1983) and the National Environmental Management: Biodiversity Act (see NEMBA Alien and Invasive Species Lists 2014). Both sets of regulations have been developed to control the spread of alien invasive species. It is incumbent on all land owners to assess their properties for listed alien species and take the necessary measures to control infestations and comply with legislation.

The NEMBA and CARA regulations are briefly summarised below:

11.9.1.1 Conservation of Agricultural Resources Act (Act No. 43 of 1983)

The 2001 revision of the CARA recognises three categories of invasive plant: Category 1 - declared weeds, Category 2 - declared invader plants with a commercial or utility value, and Category 3 - ornamental plants. The regulations pertaining to each category are summarised below.

CARA Category 1: Declared weeds

Category 1 listed plants have no economic value and possess characteristics harmful to humans, animals or the environment. These species tend to produce high volumes of seed, are wind or bird dispersed, or have efficient vegetative reproduction, and are thus highly invasive causing substantial environmental degradation. Category 1 listed plants may not be planted or propagated in rural and urban areas, and trade in their seeds, cuttings and other propagatory material is prohibited. Moreover, it is required that active measures be taken to control and eradicate populations of these species (Agricultural Research Council 2010).

CARA Category 2: Declared invader plants with commercial or utility value

Although Category 2 listed plants are invasive species, they do have beneficial properties and general utility. They are permitted in demarcated areas (as granted by the Executive Officer) under controlled conditions, and in bio control reserves. Seed and propagative material may only be sold to and acquired by land users of areas demarcated for that particular species (as determined by the Executive Officer). Category 2 plants may not occur within 30 m of the 1:50 year flood line of a watercourse or wetland, except under authorisation in terms of the National Water Act (Act No. 36 of 1998) (Agricultural Research Council 2010).

CARA Category 3: Mostly ornamental plants

Category 3 plants are generally popular ornamental and garden species that show a high invasive potential and frequently encroach into natural areas. No further planting or trade in propagative material of these species is permitted. However, existing plants may remain provided they do not occur within 30 m from the 1:50 year flood line of a watercourse or wetland, and provided all reasonable steps are taken to limit the further spread of that species (Agricultural Research Council 2010).

11.9.1.2 National Environmental Management: Biodiversity Act (Act No. 10 of 2004)

According to the NEMBA regulations, exotic species can be listed into one of four categories; 1a, 1b, 2 and 3. Species may be listed under more than one category, depending on the region in which they are found (Van Oudtshoorn 2015). The regulations relating to each category are discussed below:

NEMBA Category 1a and 1b

Category 1a listed species are considered to be emerging invasive species. These species require immediate control by all landowners. Category 1b species are established invasive species. Coherent control programmes need to be implemented to control Category 1a and 1b species and existing programmes must be maintained (Invasive Species South Africa 2015).

NEMBA Category 2

Category 2 listed species are those that have economic or aesthetic value, yet which can become invasive and have negative ecological consequences. Provision has thus been made to control these species and provide mechanisms to continue to derive benefit from them (Invasive Species South Africa 2015).

NEMBA Category 3

Category 3 species are subject to exemption, however they do have the potential to become invasive and must be managed and contained accordingly (Invasive Species South Africa 2015). They are prohibited in riparian areas (Van Oudtshoorn 2015).

Both the NEMBA and the CARA require that land owners actively manage and control listed species occurring on their properties. It is thus necessary for ACWA Power to implement an alien invasive species control programme across the entire project site. Specific obligations include:

- All NEMBA Category 1b and CARA Category 1 species must be controlled; and
- NEMBA Category 2 and CARA Category 2 species can be retained, but only under a permit from the Department of Environmental Affairs. In the absence of a permit they must be controlled.

To this end, the management approach and protocols presented in section 11.9.1.2.1 through to section 11.9.1.2.4 are recommended for the control of listed alien invasive species.

11.9.1.2.1 Recommended Approach

- A combined approach using both chemical and mechanical control methods is recommended for implementation;
- To ensure that all emergent seedlings, root suckers and coppice growth are eradicated, the control programme must include an initial control phase, as well as regular follow-up treatments;
- The roll-out or scheduling of the control programme with regard to area prioritisation and clearing sequence is largely dependent on the budget allocated to the task. Once ACWA Power management have an understanding of the control programme's budget, a suitable control schedule can be decided upon - see section 11.9.1.2.3: Scheduling; and
- Periodic monitoring should be included in the control programme and must aim to:
  - Identify new invasive plant populations in previously unoccupied areas;
  - Identify previously unrecorded species; and
  - Gauge the efficacy of currently employed control methods.

11.9.1.2.2 Recommended Control Methods

A brief description of chemical and mechanical control methods is outlined below:

Mechanical control

- Mechanical control involves the physical removal of the exotic plants. Hand pulling is highly effective against young seedlings that are shallow rooted and that occur in low densities (Coetzee 2005);
- For larger or mature plants the physical cutting back or felling of the plant is most effective.

This can be done using machetes, axes, brush cutters or saws. In many instances felled plants will coppice, so it is therefore important that follow-up cutting back be coupled with the application of a herbicide to kill any re-growth (Coetzee 2005). The application of herbicide on cut stumps immediately after felling is often an effective means of preventing coppicing; and

- Ring barking is also effective against mature exotic trees. This method relies of the removal of bark, including the cambium layer, around the trunk of a tree using an axe or a saw. The ring barked area should also be treated with a herbicide (Coetzee 2005).

Chemical control

Chemical control involves the application of a suitable herbicide in order to kill the target plant. Herbicides are classed as follows:

- Contact herbicides are those that affect the plant parts directly sprayed with the herbicide (Bromilow 2010);
- Systemic herbicides are those that get absorbed by the plant and are transported throughout the plant tissue. Systemic herbicides may have a long residual action - acting for months to years, or short residual action - acting over a couple of days (Bromilow 2010); and
- Selective herbicides target specific plant species or plant groups (dicotyledonous vs monocotyledonous plants), while non-selective herbicides will harm or kill any plant they come into contact with (Bromilow 2010).

All herbicide mixtures should be prepared and used in strict compliance with the manufacturer's instructions. The chemical concentrate (herbicide) will generally be added to water or a hydrocarbon solvent in a concentration recommended by the manufacturer for a specific application. Many herbicides are toxic to humans and wildlife so must be handled and used responsibly, and with the necessary personal protective equipment (PPE).

Liquid herbicides are typically applied using a suitable water sprayer or paint brush, to which a dye is often added to identify plants that have been treated. Herbicide is sprayed or painted directly onto the foliage or exposed stumps and stem notches of the target plants.

Alternatively, herbicides can also be applied to the soil in the form of pellets. These are gradually broken down, assimilated into the soil and eventually taken up by plant roots. Another application method, specific to larger plant specimens, involves the insertion of a herbicide plug into the base of the target plant.

11.9.1.2.3 Scheduling

Alien invasive control programmes generally include an intensive control phase, where initial costs are high and where the major infestations are brought under control. This is then followed by an on-going, extensive monitoring and maintenance phase at much lower cost. Practical scheduling to manage cash flow within budget constraints is thus an important consideration for the control programme.

Two possible strategies are recognised:

- The first option involves targeting scattered individual plants and localised pockets throughout the property, before targeting dense infestations, which are often spatially discrete (localised). This option allows the majority of a property to be cleared of alien species at comparatively low cost, before committing to the labour intensive and often expensive clearing of dense infestations; and
- The second option involves targeting dense localised infestations first, and then moving across the property to clear the remaining scattered individual plants and localised pockets. This option, although focussing on priority sites first, does require a large initial monetary output, which may limit the overall total area to be cleared.

In general however, the following scheduling principles are suggested:

- It is recommended that the control programme be initiated during the growing/wet season. This is when alien species will be readily visible and identifiable;
- All plant species and sizes (mature, sapling and seedlings) growing at a particular site should be targeted and treated, before moving to the next site; and
- After the initial control phase, annual follow-up treatments at each site should be conducted to target new emergent seedlings, root suckers and coppice growth. The scope of follow-up treatments should be informed by the findings of regular monitoring.

11.9.1.2.4 Monitoring

Monitoring is a critical component of alien invasive species management. By gauging the efficacy of control methods, monitoring can highlight the need to modify or improve methods and also identify new sites and species of concern. It is therefore recommended that:

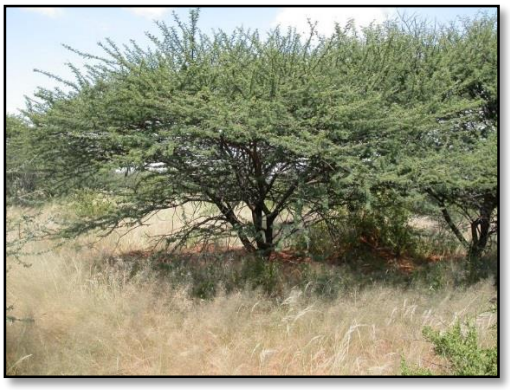
- Alien species monitoring be conducted on an annual basis during the wet/growing season; and
- Monitoring should focus on identified priority sites, as well as other disturbed sites throughout each property to identify potential new sites of colonisation.

11.9.1.3 Encroaching, Alien and Invasive Species

Table 11-4 lists the three encroaching, alien and invasive species have been recorded in the project area.

Table 11-4: Encroaching and declared alien and invasive species recorded in the study area

Species	Threat Status	Identification
Prosopis glandulosa	Category 2 Invader	 Source: www.naturalmedicinefacts.info
Rhigozum trichotomum	Indicator of encroachment	 Source: www.kyffhauser.co.za

Species	Threat Status	Identification
Acacia mellifera (Swarthaak / Black Thorn)	Indicator of encroachment	 Source: www.suntrees.co.za

11.10 Re-vegetation and Habitat Rehabilitation

11.10.1 Objectives of Re-vegetation

Re-vegetation is the process whereby indigenous plants are actively used to stabilise and rehabilitate a disturbed site. The process aims to fast-track natural plant colonisation and ultimately, to establish a self-sustaining vegetation community, characterised by successional processes allowing for the restoration of ecosystem functioning, productivity and services (Coetzee 2005). Proximate step-wise objectives of the re-vegetation process thus include:

- The successful germination/establishment of grass species, and the survival of out-planted woody species;
- Densification and spread of the grass layer and the growth of woody species; and
- Natural recruitment of sub-climax and climax grass species, as well as woody species.

11.10.2 Plants recommended for re-vegetation

Plants used for re-vegetation must be locally-occurring, indigenous species. Selected grasses should be a combination of hardy, pioneer, sub-climax and climax species that can tolerate harsh conditions, and that ideally, are not palatable to herbivores. Perennial grasses are generally preferred over annual species, as the former are denser, offer greater basal and aerial coverage and persist over a number of seasons (Coetzee 2005). Selected woody plants should be monoecious[16], relatively fast growing and able to tolerate periods of moisture stress that are typical of the local environment.

It is thus recommended that a selection of both tree and grass species are selected, as required, for future re-vegetation efforts. The species recommended, in
Table 11-5, for use in re-vegetation have been selected from those recorded on-site (Section 8.1.6.1), and include a spread of hardy pioneer species, as well as more climax species.

Table 11-5: Recommended species to be used in re-vegetation of disturbed areas.

Species Name	Characteristics
Trees	
Acacia erioloba (Camel Thorn, Kameeldoring)	Small shrub to large tree. Although slow growing, *A. erioloba* germinates readily from seed and mature trees are highly desirable in arid areas.

[16] Male and female flowers occur on the same plant

Species Name	Characteristics
Grewia flava (Velvet raisin, Brandewynbos)	Compact multi-stemmed shrub or small tree.
Parkinsonia africana (Greenhair-thorn, Groenhaardoring)	Large shrub to small tree growing to 5 – 12 metres tall, dry season deciduous, with sparse, open, thorny crowns and green bark.
Acacia haematoxylon (Grey Camel Thorn, Vaalkameeldoring)	Shrub or small tree. Form dominant, albeit mostly sparse stands.
Rhigozum trichotomum (Three-thorn Rhigozum, Driedoringgranaat)	Shrubs or multi-stemmed trees that grow up to 3 metres in height. The branches are rigid and twist in angular directions. A hardy species,that can establish in harsh conditions, however it is a known encroacher, so care should be taken to prevent densification.
Searsia lancea (Karee)	Small to medium- sized tree. Easily propagated from seed, cuttings or truncheons.
Acacia mellifera (Black Thorn, Swarthaak)	A shrub to small tree, and grows readily from seed and vegetatively. A hardy species that can establish in harsh condition, however it is a known encroacher, so care should be taken to prevent densification.
Grasses	
Enneapogon desvauxii	Annual, pioneer/subclimax species
Eragrostis lehmanniana	Perennial, subclimax/climax species
Schmidtia kalahariensis	Annual, pioneer species
Stipagrostis ciliata	Perennial, climax species
Stipagrostis obtusa	Perennial, climax species

11.11 Open Space Management

The proposed PV 1 solar development will only be constructed on a portion of the entire Remaining Extent of the Farm Bokpoort 390 (Figure 2-1). In order to minimise the impact on open spaces and undeveloped land, the following will be implemented:

- The project site will be fenced off and there will be dedicated access roads to prevent the unauthorised driving on open spaces and undeveloped land;
- Employees and contractors will be prohibited from disturbing or harvesting any plant material and from trapping, removing or hunting any fauna within the open spaces and undeveloped land;
- No dumping of waste will be allowed on the open spaces and undeveloped land, which will be left in its natural state.

11.12 Traffic Management Plan

Transport of construction material, abnormal loads, employees and contractors could potentially have an adverse impact on road safety, and cause deterioration of the road surface and congestion. A traffic management plan will be developed and implemented to mitigate such impacts on the access roads servicing the project site. The appointed EPCM contractor in conjunction with the ECO for the project will compile a detailed Traffic Management Plan (TMP prior to commencement of construction. The TMP will contain the following as a minimum:

- Assessment of route required for movement of abnormal loads

  A detailed investigation must be undertaken to assess and plan the proposed routes as well as alternative routes to be used for the transport of construction material and abnormal loads from port of entry (Cape Town, Saldanha, or Walvis Bay harbours) and larger manufacturing centres (Gauteng and Cape Town) to site after finalisation of the technical design and prior to construction.

  The assessment should specifically focus on road limitations, bridges and river crossings to ensure structural integrity of the crossings as well as turn and clearance requirements of the vehicles transporting the freight and abnormal loads to site. The assessment should pay special attention to the road-over-rail bridge on the Gariep District Road over the Sishen-Saldanha railway line (Bridge #5185) to check for sufficient capacity. The required clearances required for the equipment that will be delivered must be confirmed.

  The preferred routes for the transportation of container freight and abnormal loads must be along National and Provincial Roads with suitable standards for transportation of the freight.

- Stakeholder Coordination

  Consultation with Eskom and Telkom on the route assessment to ensure that their infrastructure is not placed at risk during the transport of loads exceeding 5.8 m in height for Eskom and 5,5 m for Telkom.

  All heavy and wide load movements need to be coordinated with SANRAL and the applicable Provincial Authorities. The schedule and the routes for abnormal load movements should be published in advance.

  Access to the project site is planned via the private Transnet Service Road. ACWA Power must confirm the continued use of the Transnet Service Road for the construction and operation of the proposed solar development.

- Adherence to legal requirements

  The plan will ensure compliance with applicable legal requirements and take into consideration the possible need for permits for abnormal loads.

- Road Signage

  Stipulate type of signage and location within the close vicinity of the project site that should be present throughout the construction, operational and decommissioning phases of the project.

- Road Maintenance

  Stipulate the requirements, frequency and responsibility for road maintenance applicable to the private Transnet Service Road as well as the Gariep Road from the N8 to the Transnet Service Road.

- Site access

  The strategic positioning of entry and exist points must be in such a location as to ensure as little impact / effect as possible on the traffic flow.

  The main roads to site must be clearly defined and signposted. The prohibition on the use of the Gariep Road from the Transnet Service Road turn-off to the N14 must be clearly signposted.

Sufficient parking must be provided at the project site for delivery and construction vehicles to avoid congestion at the site entrance and along the private Transnet Service Road.

- Speed Restrictions

The on-site speed restrictions will be 40 km/h on the access road to the site (turn-off from the Transnet road) and 15km/h once the driver has passed through the security gate.

All trucks will be fitted with recording tachometers and speed limits will be enforced.

11.13 Storm Water Management Plan

The PV1 facility requires a storm water management plan (SWMP) to mitigate erosion and flows towards key infrastructure and to prevent clean storm water from interacting with potentially polluted runoff water. There are no regulations specifically for solar power facilities that provide guidance on the design criteria for sizing storm water management infrastructure. In the absence of specific guidelines, the mining Regulation 704, which is commonly used in the power sector was used. Regulation 704 states that: "*every person in control of an activity must design, construct, maintain and operate any dirty water system at the activity so that it is not likely to spill into any clean water system more than once in 50 years*".

At this stage it is not known which components of ACWA Power's bid (CSP Tower, PV1 and PV2) the Department of Energy will accept, if any. Accordingly it is only possible to provide a conceptual stormwater management plan. The proposed channel diversions are described below. The proposed region for the PV1 facility was discretised into sub-catchments based on the topography of the region. The sub-divided catchments are shown in Figure 11-4.

Storm water flowing through the site will be diverted if required, but natural flow will not be impeded unnecessarily. Key infrastructure that could generate polluted runoff was identified as the, local infrastructure and the on-site Eskom Substation. The storm water runoff being generated from the surrounding catchments will be collected, contained and diverted around the, local infrastructure and substation. The locations of the channels are shown in Figure 11-4. The diverted water will then be discharged back into the environment which will flow naturally to the Orange River.

- The storm water runoff from sub-catchment S2 will be diverted away in a south westerly direction from the local infrastructure by means of the channel C1;
- The storm water runoff from sub-catchment S1 will be diverted away in a southern direction from the local infrastructure by means of the channel C2;
- The storm water runoff from sub-catchment S3 will be diverted away in a south westerly direction from the substation and local infrastructure by means of the channel C3;
- The storm water runoff from sub-catchment S4 will be diverted away in a south westerly direction from the substation and local infrastructure by means of the channel C4.

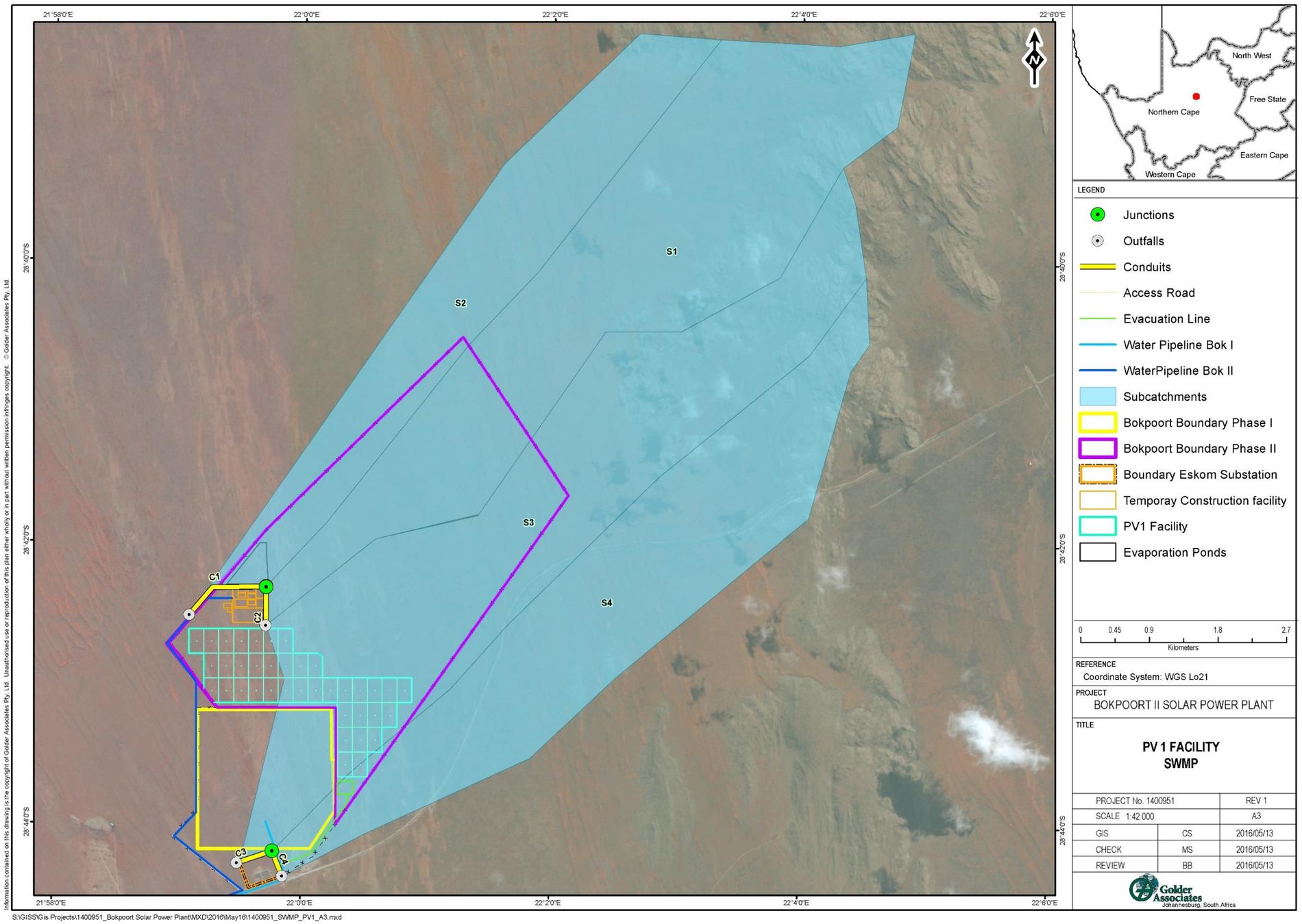


Figure 11-4: Proposed storm water management plan for the PV1 Facility

11.14 Fire Management Plan

Veld fires or infrastructure fires emanating from the proposed PV1 facility could pose a serious threat to personnel safety, livestock and infrastructure at the project site as well as neighbouring farms and businesses. The following fire prevention and protection measures will be implemented:

- Store liquid fuel in a bunded area large enough to contain 110% of the volume of the largest container;
- Store paint, solvents, welding and cutting gases, lubricants and other flammable materials in well ventilated fire-resistant bunded structures away from combustible materials and equipment that could be damaged by fire;
- Construct and maintain fire breaks annually around the site boundary to prevent the spread of fire from the solar facility or from neighbouring farms to the solar facility;
- Frequently inspect the perimeter fence for vegetation growth, especially invasive alien plants;
- Ensure availability of sufficient and appropriate fire-fighting equipment. Fire-fighting equipment onsite should include portable fire extinguishers, fire hose reels and a mobile fire tank (for rapid response to veld fires);
- Provide basic fire risk identification, reporting and response training to all employees and contractors;
- Compile an emergency evacuation plan and conduct period mock emergency drills;
- Ensure availability of emergency telephone numbers at strategic places at the site. The emergency numbers should include local fire department, other emergency services and neighbouring landowners.

11.15 Erosion Management Plan

Site clearance and the removal of vegetation during the construction phase will result in exposed and unprotected soils that could lead to soil erosion.

In order to prevent erosion during the construction, operation and decommissioning phases of the project, the following control measures will be implemented:

- Site clearance will be restricted to areas required for construction purposes only. Large areas will not be cleared at once, especially in areas where the erosion risk is high;
- Topsoil will not be stripped and stockpiled, but will be retained in the areas below the heliostats ;
- If levelling requires significant cutting, topsoil will be temporarily stockpiled and then re-spread after cutting, so that there is a covering of topsoil over the entire surface before the heliostats are mounted;
- Site activities will be minimised after heavy rainfall events to reduce the risk of erosion;
- Locally indigenous vegetation cover will be established on topsoil stockpiles to minimise losses through erosion;
- Road planning and construction will be done in a manner to minimise erosion. Roads will be constructed to follow the contours of the land and avoid running along the slope direction.
- Implement the storm water management plan in Section 11.13 in order to prevent down slope erosion;
- Retain as much vegetation cover over as much of the site as possible to protect soil from water and wind erosion;
- Implement re-vegetation and habitat rehabilitation as per Section 11.10.
- Conduct periodical site inspections to determine the effectiveness of the run-off control system and specifically record occurrences of any erosion on site.

11.16 Hazardous Substances Management

Hazardous substances such as hydrocarbons, paints, solvents, adhesives, etc. will be used during construction, operation and decommissioning of the proposed solar facility. In order to prevent the contamination of soils, surface and groundwater, the following control measures will be implemented:

- All hazardous materials will be stored in designated storage areas. The storage area will comply with the following requirements:
  - Clearly labelled to indicate the type of material to be stored;
  - Display the Material Safety Data Sheet of the material stored;
  - Construct an impermeable bund that is sized to contain 110% of the largest container stored;
  - A spill kit to clean up spills will be available at the storage area at all times.
- A hazardous substances management procedure will be made available to all employees and contractors describing the safe use, storage and disposal of hazardous substances, inclusive of spill clean-up. The procedures will as a minimum address the following:
  - Requirements for permanent hazardous material storage facilities (labelling, bund capacity and requirements, good ventilation, don't store incompatible chemicals together, etc.);
  - Temporary storage of construction machinery, equipment and containers to prevent spillage to the soil, surface and groundwater (use of drip trays, etc.);
  - Prohibition on servicing of vehicles on site;
  - Inspection procedure for hazardous substance storage facilities;
  - Management and disposal of contaminated rain water within the hazardous substances storage facilities (bunds);
  - Containment, clean-up and disposal procedure in the event of a spill;
  - Notification procedure to the relevant authority in the event of a major spill;
  - Remediation of contaminated soil;
  - Procedures to follow to obtain storage and disposal permit / license, where applicable;
  - The implementation of an effective monitoring system to detect any leakage or spillage of hazardous substances during transportation, handling, use and storage;
  - Specific measures to prevent spillage of hazardous substances near or in the Orange River when installing and maintaining the abstraction pumps.
- All employees will receive initial induction training and periodic refresher training on the hazardous substance management procedures.
- Periodic mock drills will be conducted to test employee and contractor spill response; and
- Transport of hazardous chemical substances will be in accordance with the relevant legislation, regulations and by-laws.

11.17 Waste Management

The activities during the construction, operation and decommissioning of the solar facility will generate a number of waste streams. To ensure the correct handling, storage and disposal of all waste types, the following will be implemented:

- The ECO will develop a waste inventory for each of the project phases. The waste inventory will consider all possible waste streams in terms of general and hazardous waste;
- On completion of the waste inventory, the ECO will determine the best disposal method for each type of waste with special consideration in terms of recycling;
- A site specific waste management procedure describing the requirements for the storage, handling and disposal of waste will be made available to all employees and contractors. The procedure will be drafted in accordance with the ACWA Power Waste Management Plan Guideline (Version 1, dated 05 May 2016 - APPENDIX R) and will as a minimum address the following:
  - Prohibition on burning waste on-site;
  - Requirements for the separation of waste into the identified waste streams (metal, paper, plastic, food, medical, etc.);
  - Information regarding the supply, labelling, storage and collection of waste containers;
  - A map depicting the designated waste storage areas (permanent and temporary). All waste storage areas will be located away from sensitive areas and water courses;
  - Frequency of waste removal to/by licensed and approved waste removal contractors;
  - Names and contact details of the licensed and approved waste removal contractors;
  - Waste generated at the water abstraction point will be transported to the solar facility site for handling and disposal;
- All employees will receive initial induction training and periodic refresher training on the waste management procedure.
- The ECO will conduct regular inspections on all waste storage areas;
- The ECO will keep the waste manifest and safe disposal certificates of all waste removed from the site and disposed at a licensed landfill site.
- The ECO will conduct regular checks on contractors directly disposing their waste to licensed and approved waste removal contractors;
- The ECO will keep record of waste types and volumes generated as well as the final destination of disposal; and
- Waste management will in accordance with the relevant legislation, regulations and by-laws.

11.18 Environmental Awareness Plan

As stipulated in section 11.5.2 above, environmental conditions will be included in any operational contracts, thereby making contractors aware of the potential environmental risks associated with the project and the necessity of implementing good environmental and housekeeping practices.

The following principles and training will apply to the Environmental Awareness Plan and the Environmental Management System (EMS):

- All personnel, including contactors, will as a minimum undergo general safety, health and environmental (SHE) induction and environmental management system (EMS) training;
- The Safety, Health, Environmental and Quality (SHE) Manager will identify the SHE training requirements for all Bokpoort II personnel and contractors. The training requirements will be recorded in a training needs matrix indicating particular training that must be undertaken by identified personnel and contractors. The training matrix will be administered by ACWA Power's Human Resources Department (HRD); and
- Development of the training programme, which will be based on the EMPr and will include:
  - Job specific training – training for personnel performing tasks which could cause potentially significant environmental impacts;
  - Assessment of extent to which personnel are equipped to manage environmental impacts;
  - Basic environmental training;
  - EMS training;
  - Comprehensive training – on emergency response, spill management, etc.;
  - Specialised skills;
  - Training verification and record keeping; and
  - Periodic re-assessment of training needs, with specific reference to new developments, newly identified issues and impacts and associated mitigation measures.

11.19 General Awareness Training

- The Human Resources Development (HRD) Manager, together with the SHE Manager, will be responsible for the development of, or facilitating the development of, the required general SHE induction and awareness training. A general environmental awareness training module will be developed and integrated into the general induction programme. The general awareness training must include the Environmental Policy, a description of the environmental impacts and aspects and the importance of conformance to requirements, general responsibilities of Bokpoort II personnel and contractors with regard to the environmental requirements and a review of the emergency procedures and corrective actions; and
- A Training Practitioner or the Environmental Control Officer (ECO) will conduct the general awareness training. The training presenter will keep a record of the details of all persons attending general awareness training. Such attendance registers shall indicate the names of attendants and their organisations, the date and the type of training received.

11.20 Specific Environmental Training

- Specific environmental training will be in line with the requirements identified in the training matrix; and
- Personnel whose work tasks can impact on the environment will be made aware of the requirements of appropriate procedures/work instructions. The SHE Manager will communicate training requirements to responsible supervisors to ensure that personnel and contractors are trained accordingly.

11.21 Training Evaluation and Re-training

- The effectiveness of the environmental training will be reflected by the degree of conformance to EMPr requirements, the result of internal audits and the general environmental performance achieved by the Bokpoort II project;
- Incidents and non-conformances will be assessed through the Internal Incident Investigation and Reporting System, to determine the root cause, including the possible lack of awareness/training;
- Should it be evident that re-training is required, the SHE Manager will inform the Heads of Departments of the need and take the appropriate actions;
- General awareness training of all personnel shall be repeated annually; and
- The re-induction shall take into consideration changes made in the EMPr, changes in legislation, current levels of environmental performance and areas of improvement.

11.22 Emergency Procedures

The following emergency procedures are relevant to the project:

- The SHE Manager shall define emergency reporting procedures for the Bokpoort II project;
- All personnel shall be made aware of emergency reporting procedures and their responsibilities;
- Any spills will be cleaned up immediately in accordance with relevant legislation; and
- Telephone numbers of emergency services, including the mine's proto team and the local fire-fighting and medical services, shall be conspicuously displayed.

12.0 UNDERTAKING

I, Marie Schlechter, hereby confirm that the information provided in this report is correct at the time of compilation and was compiled with input provided by the applicant, ACWA Power Africa Holdings.

I hereby also confirm that all comments received from I&APs will be included in the final EIA/EMPr Report that will be submitted to the DEA.

13.0 ASSUMPTIONS AND LIMITATIONS

The report does not address Occupational Health and Safety as required by IFC Performance Standard 2. However it is anticipated that ACWA will provide a Health and Safety policy for the EIA.

Although every effort has been made by the Project team to identify all environmental social and health aspects, impacts and mitigation measures, errors and omissions may occur. The Environmental and Social Management System that has been developed as part of the EIA process is a live document that must be adapted and updated as additional information, aspects or impacts are identified. The objective of the ESMS is for the Bokpoort II Project team to continually improve environmental and social performance. In addition, according to South African legislation, the EMPr will need to be updated or amended with new information when there are significant changes during the life of the Project.

Every effort has been made to engage stakeholders to the extent possible, however not every stakeholder may have been consulted or their comments may not have been recorded accurately. A grievance mechanism will be put in place for the project through which stakeholders will be able to raise grievances and continue to contribute their concerns and issues with the Project team.

14.0

15.0 REFERENCES

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