BASIC ASSESSMENT REPORT

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Basic Assessment for the Proposed Development of a Transmission Line and associated electrical infrastructure (KENHARDT PV 1 - TRANSMISSION LINE) to support the proposed 75 MW Solar Photovoltaic Facility (KENHARDT PV 1) on the remaining extent of Onder Rugzeer Farm 168, north-east of Kenhardt, Northern Cape Province: **BASIC ASSESSMENT REPORT**

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APPENDIX A: SITE LAYOUT PLANS

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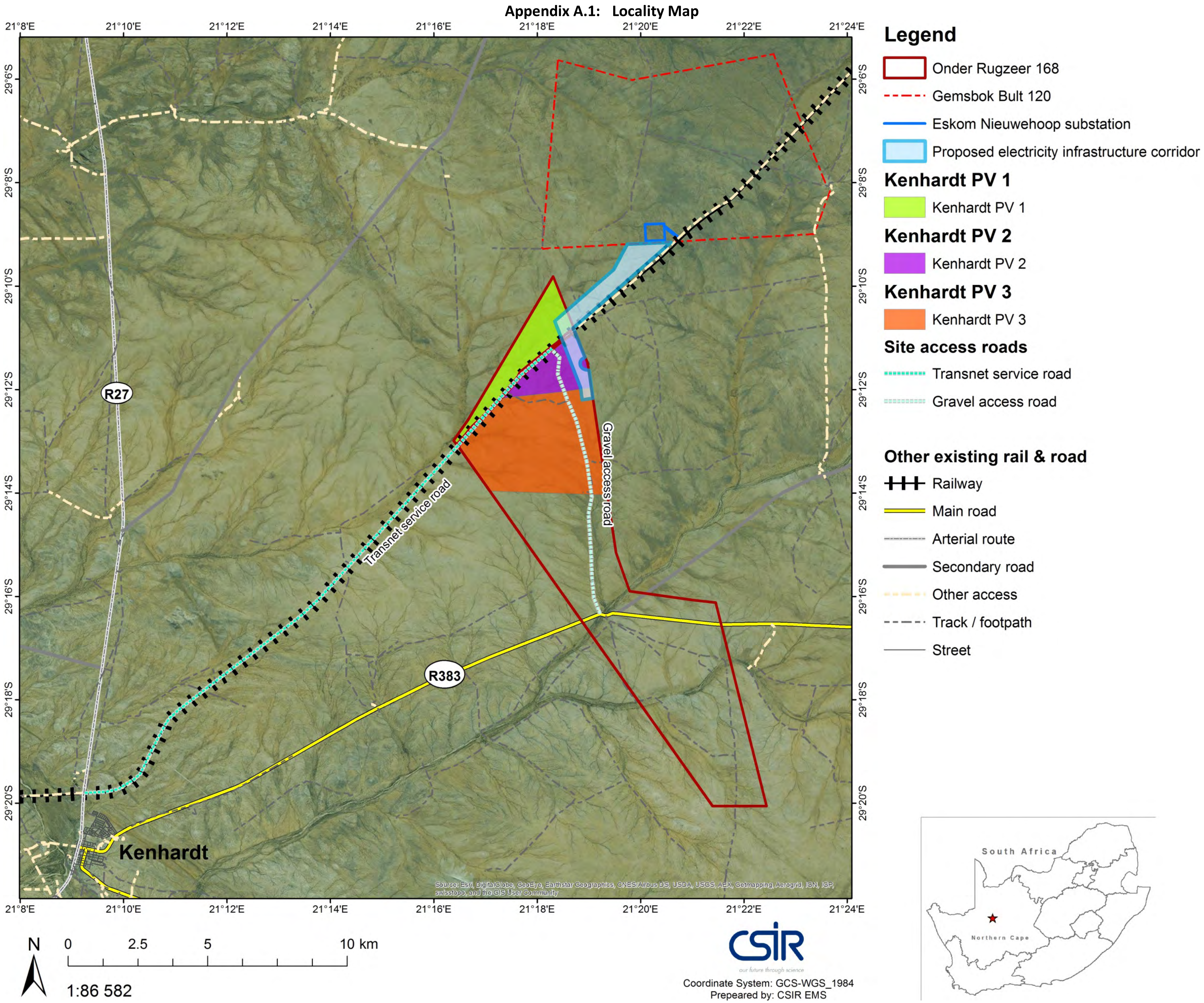
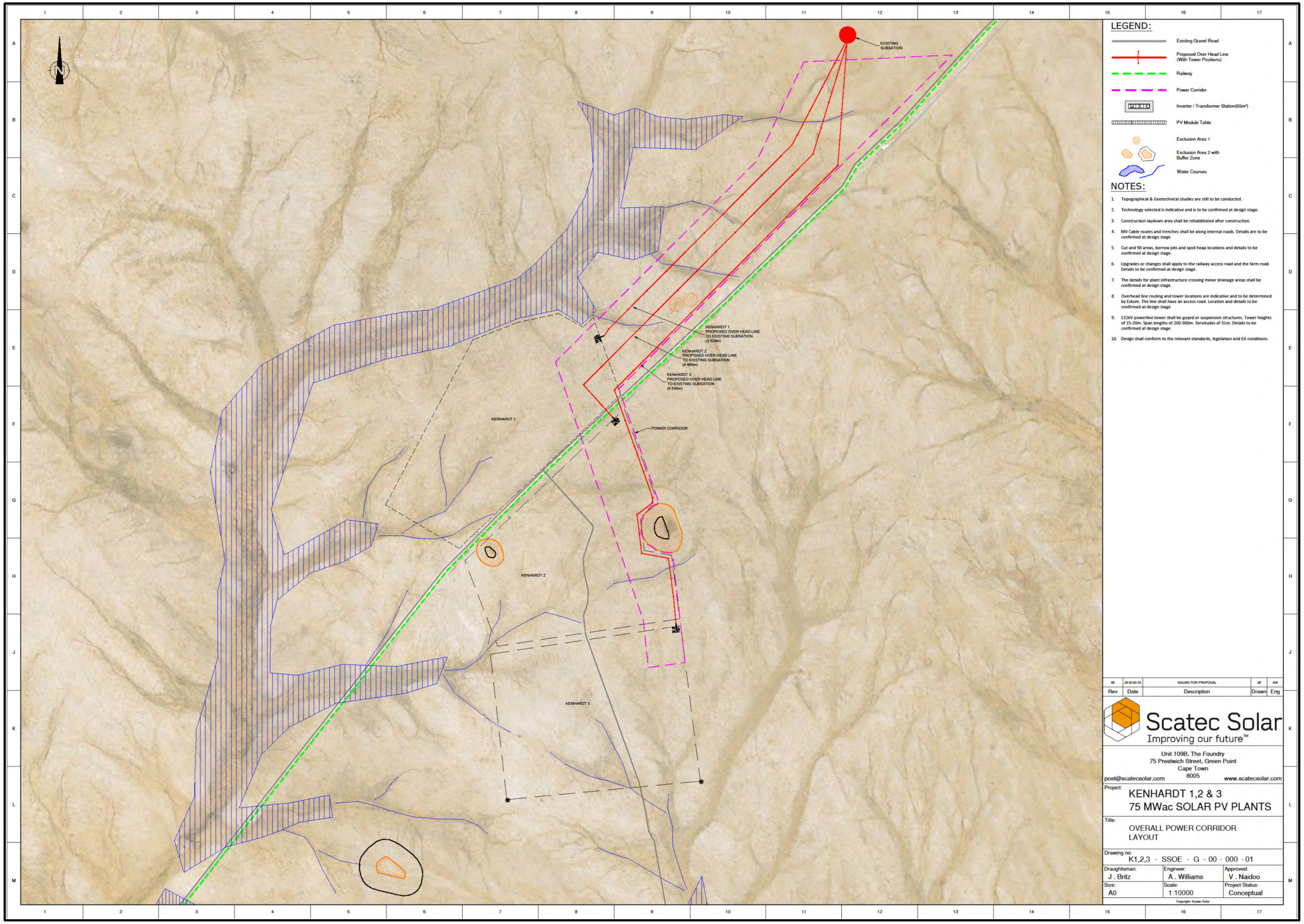
Appendix A.1: Locality Map

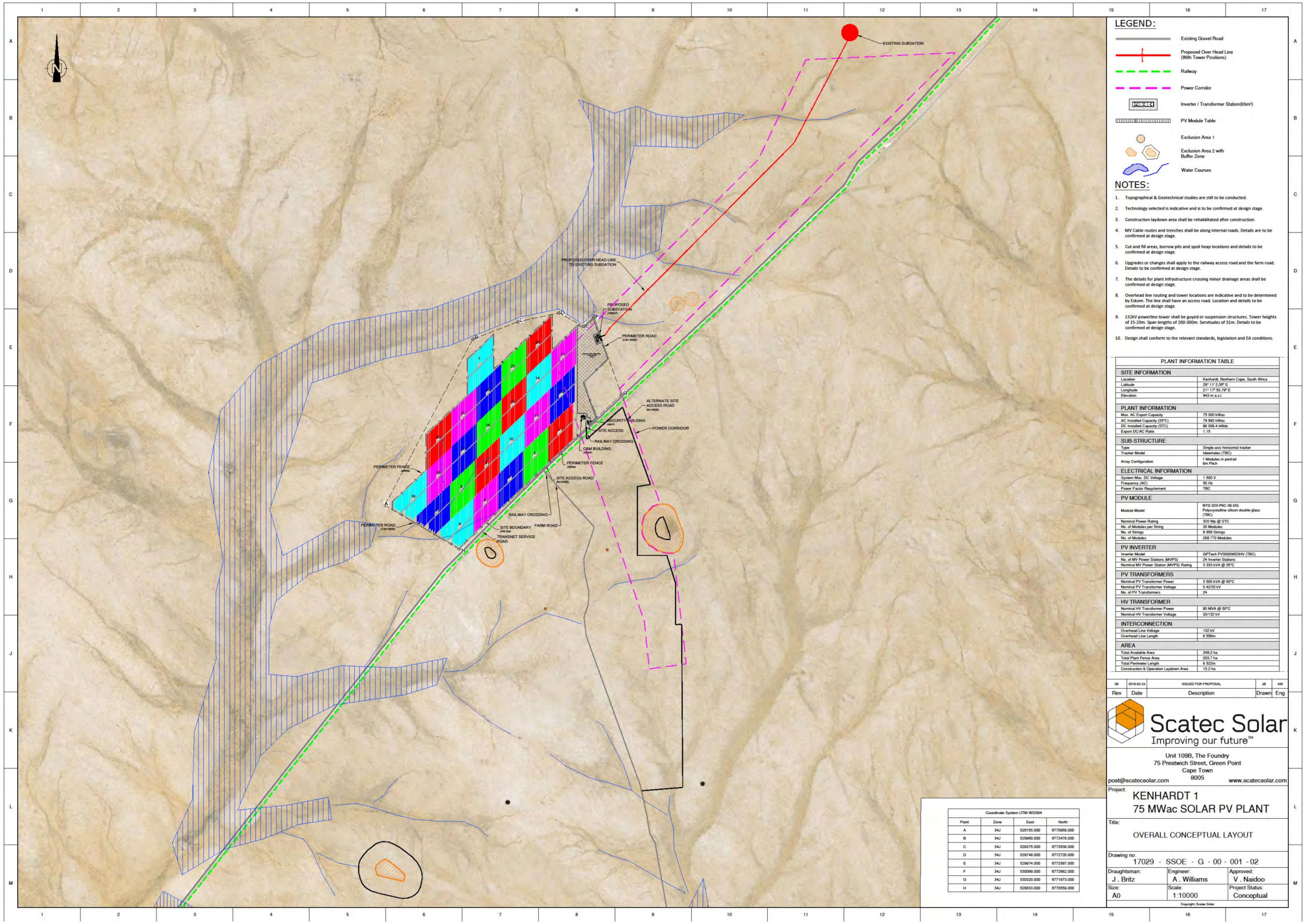


Note from the CSIR: Locality Map showing the Kenhardt PV 1 – Transmission Line Electrical Infrastructure Corridor in blue (and the Kenhardt PV Solar Facilities which are subject to separate EIA Processes).

Appendix A.2: Layout Maps/Route Plan

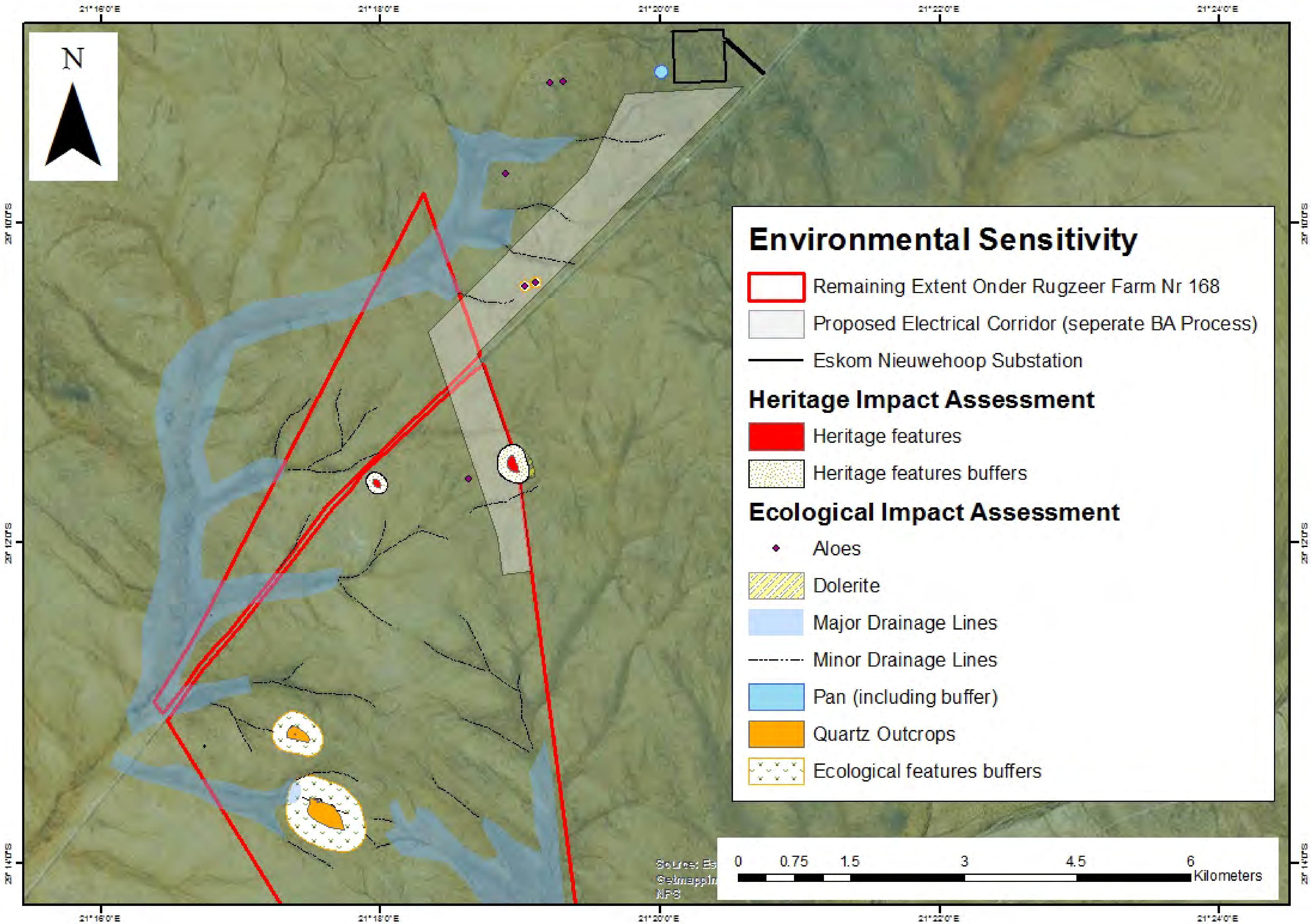


<u>Note from the CSIR: Layout Map showing the Kenhardt PV 1 – Transmission Line Electrical Infrastructure Corridor (and the Kenhardt PV Solar Facilities which are subject to separate EIA Processes). Note that the Kenhardt PV 1, PV 2 and PV 3 Transmission Lines are indicated on the map (as they will be constructed within a single corridor)</u>

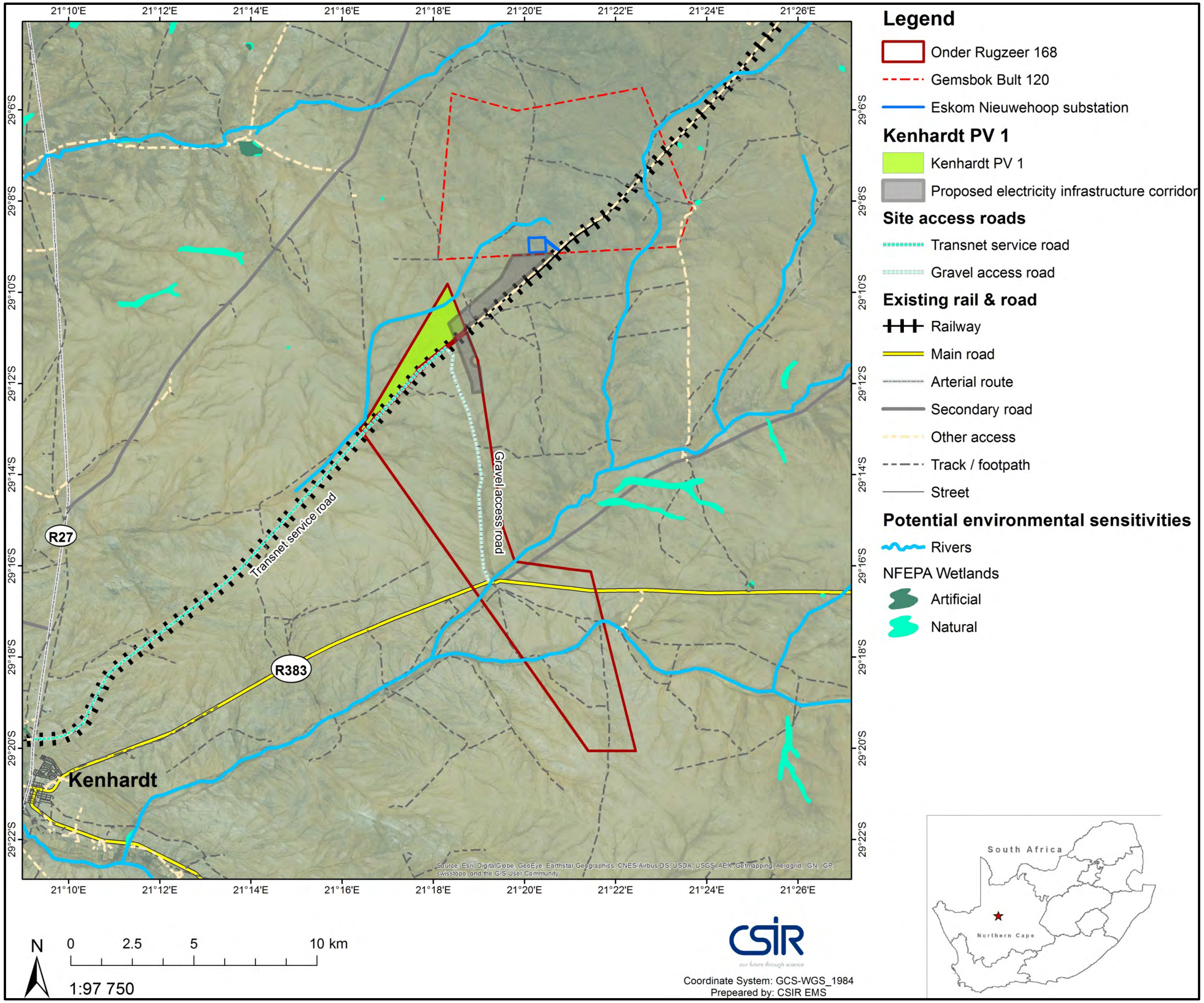


Note from the CSIR: Layout Map showing the Kenhardt PV 1 – Transmission Line Electrical Infrastructure Corridor and Proposed Transmission Line Routing (and the Kenhardt PV 1 Solar Facility which is subject to a separate EIA Process).

Appendix A.3: Sensitivity Maps



Combined Sensitivity Layout Map for the Electrical Infrastructure Corridor (this BA Process) and the Kenhardt PV 1, 2 and 3 EIA Projects



General Sensitivity Map for the Electrical Infrastructure Corridor (this BA Process) and the Kenhardt PV 1 EIA Project

Appendix A.4: Approximate Project Co-ordinates

1. Co-ordinates at every 250 m along the centre line of the Electrical Infrastructure Corridor

	Degrees Minutes Seconds Format	
Point/Area	**Latitude**	**Longitude**
A	29° 12' 1.91"S	21° 18' 57.92"E
B	29° 11' 48.46"S	21° 18' 53.19"E
C	29° 11' 28.55"S	21° 18' 46.53"E
D	29° 11' 10.79"S	21° 18' 40.87"E
E	29° 10' 50.54"S	21° 18' 33.93"E
F	29° 10' 41.62"S	21° 18' 31.20"E
G	29° 10' 30.32"S	21° 18' 43.59"E
H	29° 10' 20.81"S	21° 18' 55.61"E
I	29° 10' 8.61"S	21° 19' 8.46"E
J	29° 9' 54.50"S	21° 19' 25.12"E
K	29° 9' 40.09"S	21° 19' 38.26"E
L	29° 9' 27.26"S	21° 19' 51.83"E
M	29° 9' 12.86"S	21° 20' 8.18"E

2. Corner Point Co-ordinates of the Electrical Infrastructure Corridor

	Degrees Minutes Seconds Format	
Point/Area	**Latitude**	**Longitude**
A	29°12'12.16"S	21°18'52.51"E
B	29°11'57.77"S	21°18'50.46"E
C	29°10'40.97"S	21°18'20.55"E
D	29° 9'41.02"S	21°19'28.99"E
E	29° 9'12.04"S	21°19'44.30"E
F	29° 9'9.55"S	21°20'35.31"E
G	29°10'48.98"S	21°18'41.92"E
H	29°11'22.48"S	21°18'55.48"E
I	29°11'29.09"S	21°18'50.07"E
J	29°11'33.45"S	21°18'50.71"E
K	29°11'37.96"S	21°18'57.36"E
L	29°11'38.24"S	21°19'0.44"E
M	29°12'10.35"S	21°19'4.80"E

BASIC ASSESSMENT REPORT

APPENDIX B: PHOTOGRAPHS

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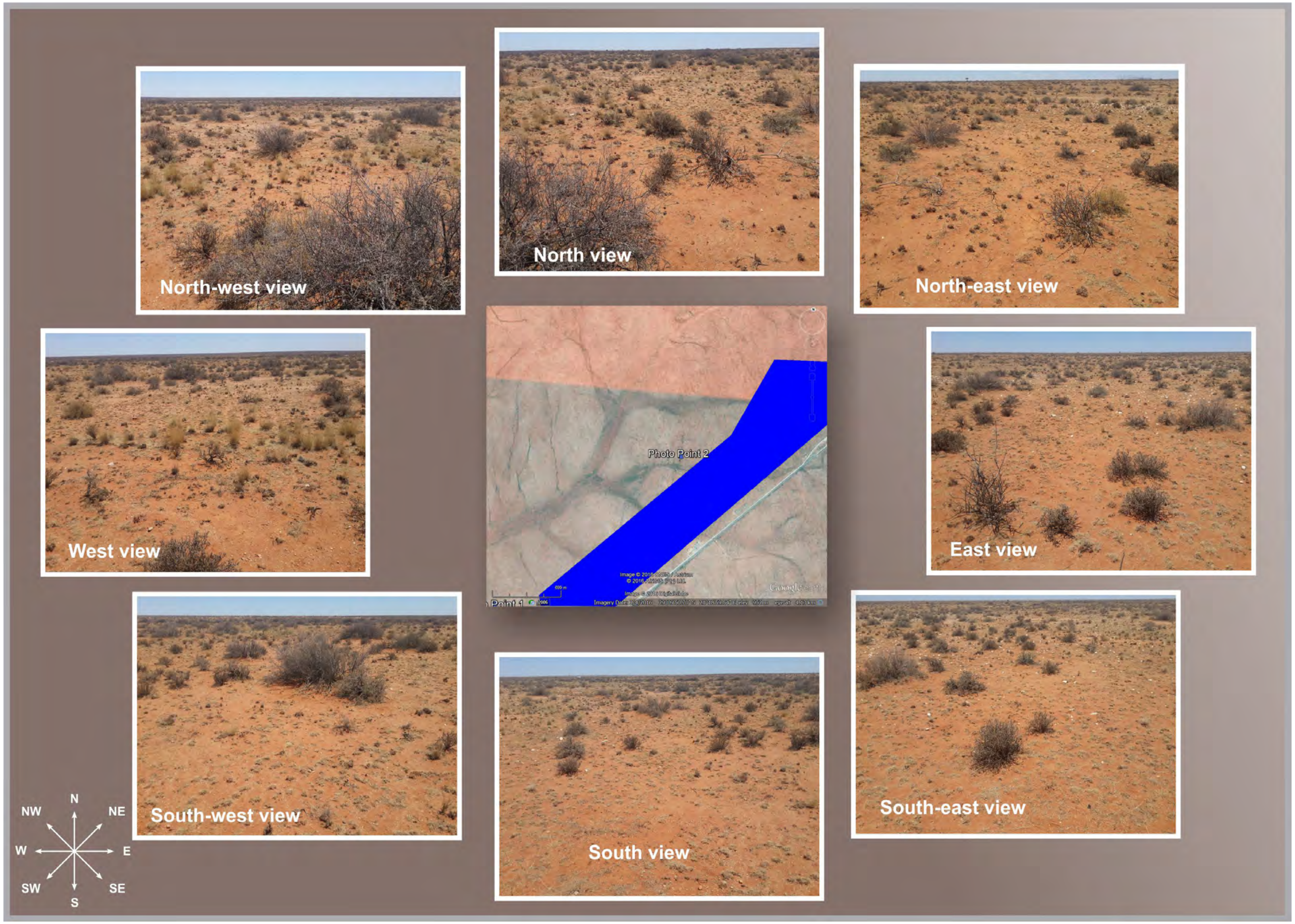
Appendix B.1 PHOTOGRAPHS

- **Point 1**

Appendix B.2 PHOTOGRAPHS

- **Point 2**



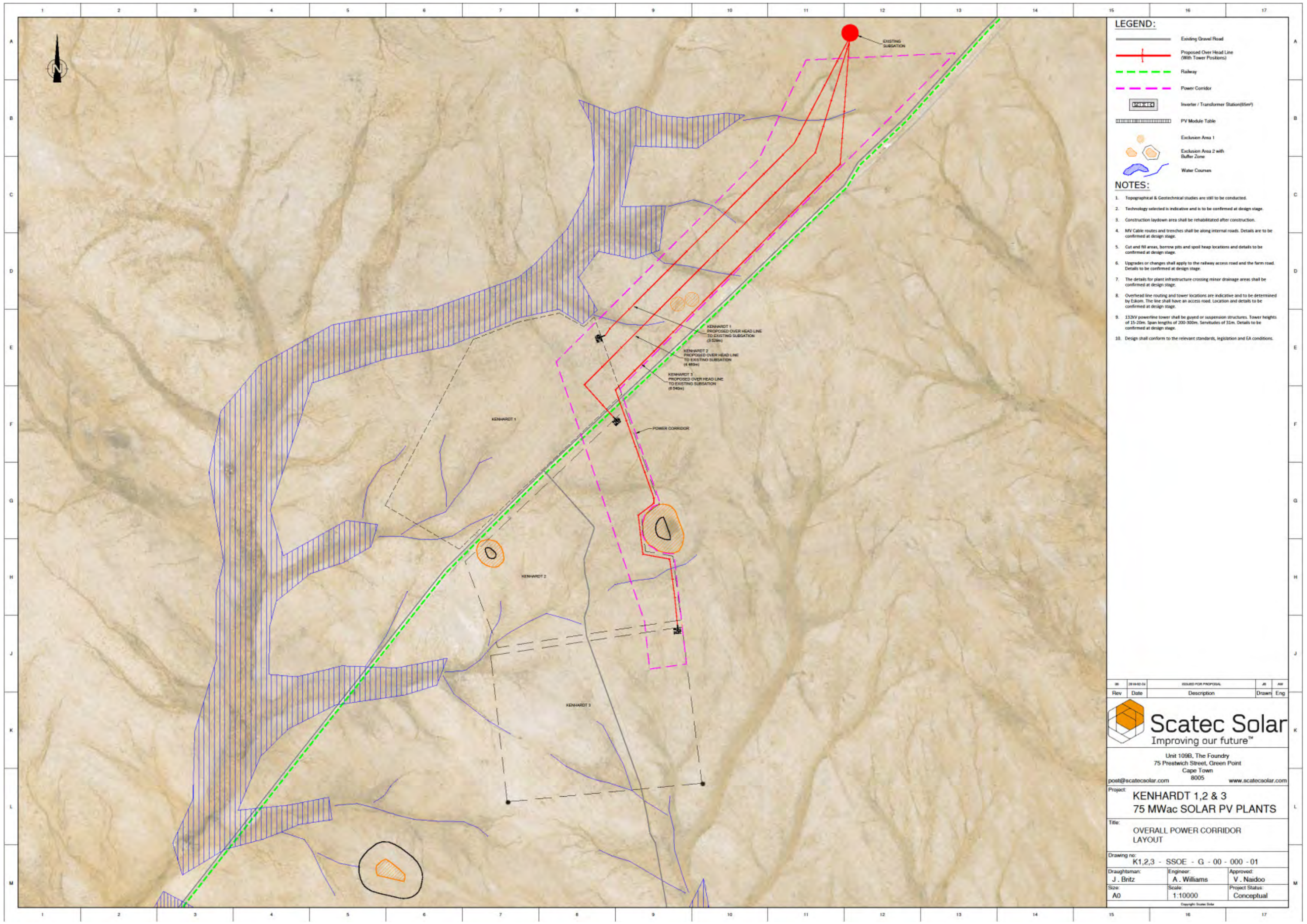
Appendix B.3 PHOTOGRAPHS

- **Point 3**

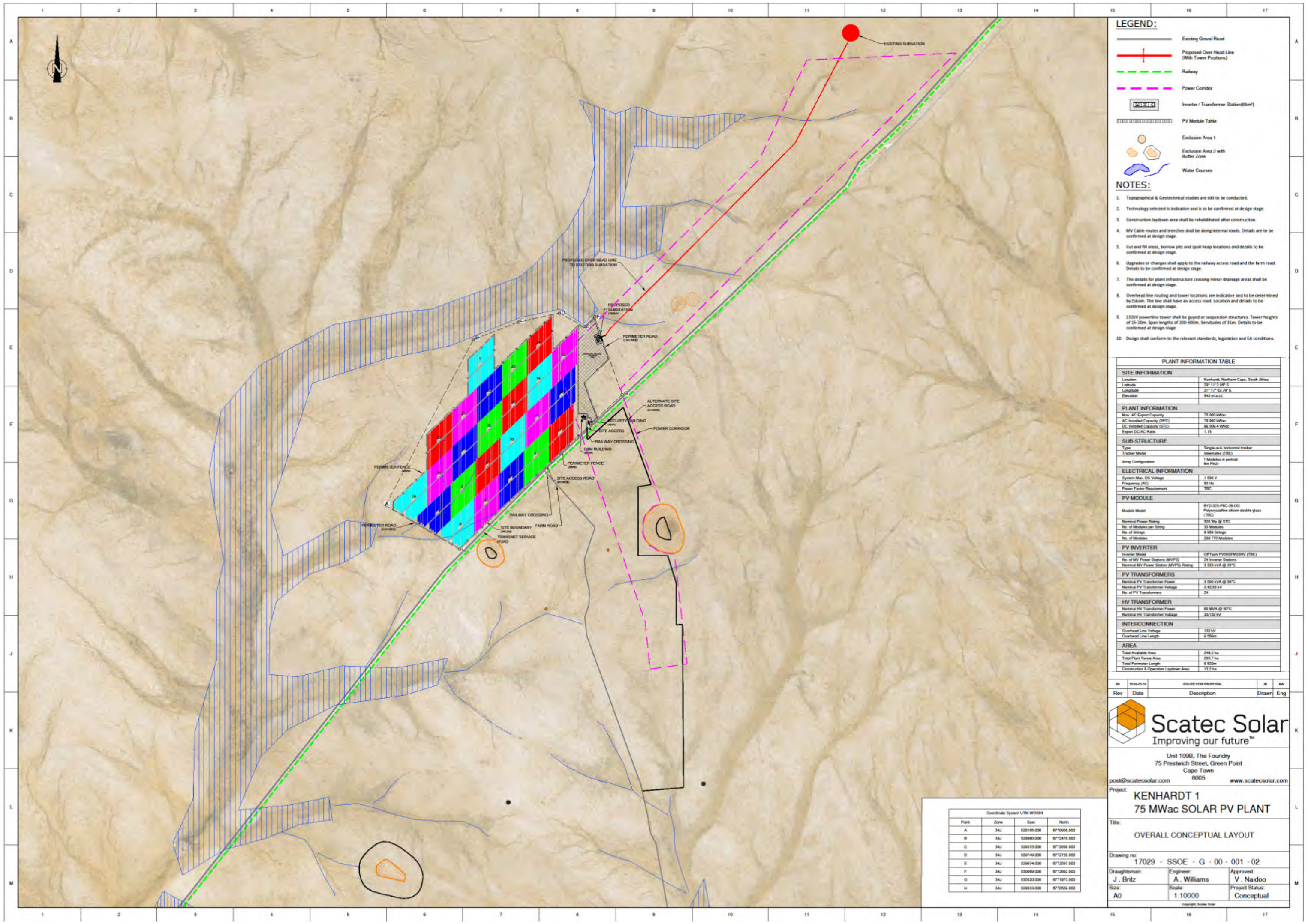
Appendix B.4 ADDITIONAL PHOTOGRAPHS SHOWING THE GENERAL LANDSCAPE

BASIC ASSESSMENT REPORT

APPENDIX C: FACILITY ILLUSTRATIONS



<u>Note from the CSIR: Layout Map showing the Kenhardt PV 1 – Transmission Line Electrical Infrastructure Corridor (and the Kenhardt PV Solar Facilities which are subject to separate EIA Processes). Note that the Kenhardt PV 1, PV 2 and PV 3 Transmission Lines are indicated on the map (as they will be constructed within a single corridor).</u>



Note from the CSIR: Layout Map showing the Kenhardt PV 1 – Transmission Line Electrical Infrastructure Corridor and Proposed Transmission Line Routing (and the Kenhardt PV 1 Solar Facility which is subject to a separate EIA Process).

BASIC ASSESSMENT REPORT

APPENDIX D: SPECIALIST REPORTS

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BASIC ASSESSMENT REPORT

Appendix D.1:
Ecological Impact Assessment

ECOLOGICAL IMPACT ASSESSMENT

Basic Assessment for the Proposed Development of a 132 kV Transmission Line (Kenhardt PV 1 – Transmission Line) to service the proposed 75 MW Solar Photovoltaic Facility (Kenhardt PV 1) on the remaining extent of Onder Rugzeer Farm 168, north-east of Kenhardt, Northern Cape Province

Report prepared for:

CSIR – Environmental Management Services

P O Box 17001

Congella, Durban, 4013

South Africa

Report prepared by:

Simon C Bundy – SDP Ecological

P.O. Box 1016

Ballito 4420

South Africa

March 2016

SPECIALIST EXPERTISE

Simon Colin Bundy

NAME Simon Colin Bundy
PROFESSION Ecologist
DATE OF BIRTH 7 September 1966
PLACE OF BIRTH Glasgow, Scotland
NATIONALITY South African / British
MEMBERSHIP OF PROFESSIONAL BODIES: South African Council of Natural Scientific Professionals No. 400093/06 – Professional Ecologist

KEY QUALIFICATIONS

Simon Bundy has been involved in environmental and development projects and programmes since 1991 at provincial, national and international level, with employment in the municipal, NGO and private sectors, providing a broad overview and understanding of the function of these sectors. Bundy has a core competency in coastal management and botanical issues and has worked on coastal projects in the Seychelles and Tanzania providing ecological and general environmental advice and support. Bundy has been involved in a number of renewable energy projects including the Kalkbult, Dreunberg and Lindes Solar Parks in the Northern and Eastern Cape, as well as wind energy and solar projects in the Western Cape and Rwanda. In such projects Bundy has provided both technical ecological support, as well as the undertaking of environmental impact assessments.

Allied to the above, Bundy has provided technical assistance to the "Save the Wild Coast" initiative through a technical report outlining the concerns relating to dune mining in and around the Xolobeni prospecting region while also evaluating critically, a number of environmental impact assessments and technical reports for various clients. Such evaluations have included "sea defence structures at Buffalo Bay, Western Cape", through the Nelson Mandela University. Bundy has also assisted iSimangaliso Wetland Park in its initiatives against unlawful developments in the Bangha Nek area. Bundy has also acted as expert witness on ecological issues on a number of legal cases.

From a technical specialist perspective, Bundy is competent in a large number of ecological methodologies and analytical methods including statistical methods ; multivariate analysis and ordination. Bundy is competent in wetland delineation and has formulated ecological coastal set back methodologies for EKZN Wildlife and the Oceanographic Research Institute. Bundy acts as botanical specialist for Eskom Eastern Region, with specific interest in coastal habitat forms.

EDUCATION

BSc Biological Science MSc University of Natal,
Diploma Project Management (1997) Executive Education,
PhD candidate Dept of Engineering UKZN
1998: "Sustainable development initiatives" in Europe. Training Programme in Berlin, Germany
2000: Training course: "Environmental Economics and Development". University of Colorado (Boulder) USA.

SELECTED RELEVANT PROJECT EXPERIENCE

Task Team Chair and Project Ecologist: Task Team for Coastal Disaster Management, KwaDukuza 2007 - 2011

Management of coastal clean up programme immediately following March storm event of 2007. Activities included introduction of geofabric bag protection options, coastal retreat implementation and development of policy on coastal management following destruction of coastline.

Ecological Review of Lake Mzingazi for Umhlatuze Water: University of KwaZulu-Natal – (2010)
Review of habitat structure and integrity of Mzingazi Lake System at Richards Bay required to interpret transformation of aquatic system over time and evaluate forecast for future reference.

Ecological Review and Agricultural Assessment – Dreunberg Solar Park, Eastern Cape: Scatec Solar – (2012)
Ecological review of proposed solar park near Burgersdorp, with additional evaluation of veld carrying capacity.

Ecological Review and Rehabilitation Planning : Sodwana Bay: iSimanagaliso Wetland Park Authority – (2013 - 2014)
Analysis and review of state of dune cordon in and around Sodwana Bay with consideration of the impacts of removing exotic trees from route to rejuvenate dune and beach dynamics

Ecological Review of Kalkbult Solar Park (2009)
Ecological review and delineation of ecologically significant areas within the proposed Kalkbult Solar Park, near Potsfontein, Northern Cape.

Ecological and Dune retreat investigation of the Kosi Bay Illegal Development Isimangaliso Wetland Park Authority (2011)
Specialist investigation into the impact upon the dune cordon of structures placed in and close to dune cordon near Kosi Bay mouth.

PUBLICATIONS

Bundy S C and Forbes N T 2015. *"Coastal dune mobility and their use in establishing a set back line*" 9th West Indian Ocean Marine Science Conference 2015

Bundy S C and Smith A M 2009 *" Analysis of the Recovery of Two Separate Coastal Dune Systems Following the 2006 – 2007 Marine Erosion Event and Assessment of the Artificial Dune System in Coastal Management*" KZN Marine and Coastal Management Symposium, Durban South Africa.

Bundy S C , Smith AM, Mather AA 2010" Dune retreat and stability on the Northern Amanzimtoti Dune Cordon" EKZN Wildlife Conservation Symposium 2010

Smith, A Mather AM Bundy SC, Cooper AS Guastella L, Ramsay PJ and Theron A ; 2010 "*Contrasting styles of swell-driven coastal erosion: examples from KwaZulu-Natal, South Africa*" Geology Journal", Cambridge University Press

Smith, AM, L Guastella , SC Bundy and AA Mather 2007"*Coastal Storm Damage in the March 2007 Storm* SA Journal of Science 2007 "A Synopsis of Recent Storm Events"

Guastella L, Smith A Mather A and Bundy S 2008 "*As Memories Fade - A Review of the Post 2007 Coastal Erosion Events"* African Wildlife 32 / 2008

Smith A, Mather A, Theron A, Bundy S and Guastella L 2008 **"***The 2006-2007 KwaZulu – Natal Coastal Erosion Event in Perspective*" 2009 Contribution to the The South African Environmental Observation Network publication " Climate Change in Southern Africa"

Smith A and Bundy S 2009 "*Coastal erosion: reparative work on the Ballito coastline, KwaZulu-Natal, South Africa, was it enough?*" 2009 International Multi Purpose Reef and Coastal Conference, Jeffrey's Bay South Africa.

Smith AM, SC Bundy 2012 "Review of Coastal Defence Systems in Southern Africa" Article for Springer Scientific Publications through Ulster University, Pilkey and Cooper

Bundy SC AM Smith, L Guastella 2012 "*A Review of Select Dune Rehabilitation Initiatives and a Proposed Methodology towards Ensuring a Prudent Approach towards the "Greening of Dunes*" VI International Sandy Beaches Symposium Emphakweni Port Alfred

Various popular articles including documentaries on coastal and climate change issues

Andrew Craig Blackmore

Full name	Andrew Craig Blackmore
Postal address	96 Uplands Road, Blackridge, Pietermaritzburg, 3201 Kwa-Zulu-Natal South Africa
Language	English (Excellent spoken & written)
Nationality	South African

TERTIARY EDUCATION

Diploma – Multilateral Agreements University of Finland (2011)
Master of Laws (Environmental Law) ***cum laude*** University of KwaZulu-Natal, Pietermaritzburg (2005)
Master of Science – Ecology University of the Witwatersrand (1992)
Bachelor of Science (Honours) University of the Witwatersrand (1987)
Bachelor of Science University of the Witwatersrand (1986)
Candidate PhD – University of Tilburg Holland

PROFESSIONAL EXPERIENCE

- Research Officer. University of Witwatersrand. 1987 – 1990
- Nature Conservation Scientist. Natal Parks Board. 1990 - 1997
- Regional Ecologist. KZN Conservation Service. 1997 - 1999
- Head Integrated Environmental Management. Ezemvelo KZN Wildlife. 1999 – 2012
- Manager Protected Area Planning & Integrated Environmental Management. Ezemvelo KZN Wildlife 2012 – Present
- External Examiner Environmental Law, University of KZN – Howard Collage 2007 - Present
- Council Member of the Botanical Society of South Africa 2013 - Present
- Executive Member of the Botanical Society of South Africa2013 - Present

PROFESSIONAL MEMBERSHIP

- Environmental Law Association
- Botanical Society of Society
- Elephant Specialist Advisory Group (Trustee)

References

Mr Trevor Sandwith Director, Global Protected Areas Policy Deputy Chair: World Commission on Protected Areas tsandwith@tnc.org Tel Washington (703) 841-2644

Mr R Porter Previous Head Biodiversity Planning. Ezemvelo KZN Wildlife roger.n.poter@gmail.com +27 (0) 82908488

SPECIALIST DECLARATION

I, Simon C Bundy, as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

- I act as the independent specialist in this application;
- I perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I have no vested interest in the proposed activity proceeding;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist: _______________ _______________

Name of Specialist: Simon C Bundy

Date: 8 February 2016

EXECUTIVE SUMMARY

An Ecological Impact Assessment has been undertaken in order to provide supporting information in respect of an application for Environmental Authorisation associated with the proposed establishment of a 132 kV powerline near the town of Kenhardt. The proposed powerline will be constructed in order to service the requirements of and to enable connection of the proposed Kenhardt PV 1 project (which is the subject of a separate Scoping and EIA Process) to the national grid. The assessment which extended to consideration of the habitat and faunal components of a portion of land on the Farm Onder Rugzeer 168 was undertaken during the period of August to November 2015. The assessment included desktop evaluations, as well as site evaluations of the land within the proposed transmission line route/corridor.

The investigations looked specifically at habitat form and structure and the relationship of such form and structure to the surrounding geology and geomorphology. The assessment sought to identify the ecological status of the land within the route and identify key bio physical drivers. Such information was then considered in respect of any changes to the prevailing habitat that may arise as a consequence of the establishment of the powerline.

The site is considered to fall within a xeric environment (dry or semi desert) and as such, is subject to significant seasonal to daily fluctuations in meteorological and physical factors which influence the prevailing ecology. In addition to the above, anthropogenic interventions associated with both the presence of livestock on the land in question, as well as indirect influences arising from the establishment of infrastructure (roads and rail) have served to alter other bio physical factors, including surface hydrology and the nature and composition of habitat.

The proposed powerline corridor serving the Eskom Nieuwehoop Substation traverses lands presently set aside for the grazing of livestock. The corridor includes two Aloe consocies (*Aloe dichotoma* and *A claviflora*) of limited extent, which are linked to specific physical drivers. These consocies (i.e. associations of different genus) have been identified in the planning of the corridor. The routing of the transmission line must avoid the Aloe consocies identified. This may be achieved, preferably by locating the final route proximal to the existing railway line/roadway, or less favourably by spanning over the associes. Mitigation and management measures proposed are that the actual powerline lie either to the south or north of the identified associes and where applicable, towers be suitably positioned at points distal from these communities. The relocation of these specimens is possible; however this method should be avoided. Towers should be spaced adequately to avoid the necessity for relocation. A 60 m buffer should be implemented around the Aloe consocies.

Wolfkopseloop, a drainage feature that is inundated on an intermittent basis (periods greater than a year) lies to the north of the site and forms the most significant surface feature. As a significant hydro-geomorphological feature, a buffer of 32m has been applied to this feature, where it intersects with the subject site. Wider buffers are considered to be inappropriate, given the nature of the terrain in question and the nature of the development.

Surface drainage along the proposed transmission line corridor traverses a number of minor drainage lines which serve the Wolfkopseloop drainage feature. As is common to this region, minor drainage lines are influenced by the variability and intensity of rainfall and other factors, in particular the movement of livestock. Such drainage lines have been identified and should be given consideration in the final layout and design of the transmission line. However, these morphological features do not have to be avoided.

Other mitigation measures that may address or redress identified potential impacts were identified during the course of the assessment and proposed in the Environmental Management Programme.

Having given due consideration to the proposed powerline route and its present ecological state, as well as the nature of the proposed development, it is our opinion that the development cannot be precluded from the route on ecological grounds, provided that suitable measures, as espoused in this report are implemented.

COMPLIANCE WITH THE APPENDIX 6 OF THE 2014 EIA REGULATIONS

Requirements of Appendix 6 – GN R982	Addressed in the Specialist Report
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Preliminary Sections of this Report
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Preliminary Sections of this Report, Section 1.1.6 and Appendix I of the BA Report
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1.1.
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1.1.4.
e) a description of the methodology adopted in preparing the report or carrying out the specialised process;	Section 1.1.3
f) the specific identified sensitivity of the site related to the activity and its associated structures and infrastructure;	Section 1.3
g) an identification of any areas to be avoided, including buffers;	Section 1.3.
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 1.3, Section 1.5 and Section 1.6
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.1
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment;	Section 1.6
k) any mitigation measures for inclusion in the EMPr;	Section 1.6
l) any conditions for inclusion in the environmental authorisation;	Section 1.6
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 1.8
n) a reasoned opinion- i. as to whether the proposed activity or portions thereof should be authorised; and ii. if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 1.9
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 1.6
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Section 1.5
q) any other information requested by the competent authority.	n/a

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TABLES

FIGURES

LIST OF ABBREVIATIONS

BFD	Bird Flight Diverter
DEA	Department of Environmental Affairs
EIA	Environmental Impact Assessment
ELP	Electrical light pollution
NEMA	National Environmental Management Act
NEMBA	NEM Biodiversity Act
TWINSPAN	Two Way Indicator Species Analysis

GLOSSARY

Definitions	
Arid	Areas which receive low levels of rainfall or there is a moisture deficit.
Crepuscular	Fauna that is active at twilight
Dendrogram	A diagram showing relationships determined through a cluster analysis
Calcrete	A carbonate horizon formed in semi-arid regions. Also known as a caliche.
Dolerite	Form of igneous rock.
Drainage line	A geomorphological feature in which water may flow during periods of rainfall.
Edaphic	Pertaining to soils.
Fossorial	Pertaining to burrowing animals or those which live underground
Geophyte	Plants with underground storage organs.
Graminoid	Grasses or grass-like. Also monocotyledonous plants.
Gully	An erosion line exceeding 30cm in depth where water flow is concentrated and erosion resulting from flow is clearly evident.
Hydrogeomorphological	The interaction of geomorphic processes, landforms and /or weathered materials with surface and sub-surface waters.
Hygrophilous	Plants growing in damp or wet conditions
Multivariate analysis	A statistical method of evaluating non linear relationships between groups of data.
Non perennial	Flow is intermittent and irregular
Rill	Shallow erosion lines less than 30cm deep
Xeric	A dry, as opposed to wet (hydric) or mesic (intermediate) environment.

ECOLOGICAL IMPACT ASSESSMENT

This report presents the Ecological Impact Assessment Specialist Study that was prepared by Mr. Simon Bundy (of Sustainable Development Projects cc (SDP)) as part of the Basic Assessment (BA) for the proposed Kenhardt PV 1 – Transmission Line project within the Northern Cape Province.

1.1 INTRODUCTION AND METHODOLOGY

1.1.1 Scope and Objectives

The establishment of a 132 kV overhead powerline serving the proposed Kenhardt PV 1 solar facility and the Eskom Nieuwehoop Substation requires the undertaking of a BA in terms of the EIA Regulations. Such an application entails the provision of information that allows the mandated authority to provide a considered opinion on the proposed project and identify any environmental matters that may require mitigation or moderation either in the planning, construction or operation phases of the project. The specialist study includes an evaluation of the bio-physical and ecological aspects of the receiving environment.

This bio physical evaluation of a portion of the Onder Rugzeer Farm 168 was undertaken during the period August 2015 to November 2015 and entailed both a literature review of the region, as well as site evaluations, during which specific site information and data was collected and evaluated. In addition, the identification of key ecological features along the proposed line route was undertaken and an interpretation of the prevailing habitat form is provided.

All information was evaluated and interpreted in order to provide an understanding of the nature of the prevailing environment at a landscape and habitat level, together with specific evaluation of data relating to habitat form and structure. A key focus of the investigation was to identify anomalies within the prevailing uniform environment common to the area. Such variance may be considered to be indicative of differing habitat forms, which under consideration, may be of higher order ecological value in relation of the prevailing environment.

1.1.2 Terms of Reference

The overall objectives of the Ecological Impact Assessment are to:

- Identify and establish an understanding of the route under consideration at a landscape scale of evaluation with particular consideration being given to aquatic or important terrestrial habitats, as they may be identified.

- Provide an evaluation and status of habitat composition and significance within the corridor in order to evaluate the potential impact of the proposed powerline on the ecological function of the subject area.

- Assess the potential impacts arising from the development on both the habitat and fauna within the study area. Such impacts may be directly applicable to the route and contained within the route boundaries, or may be indirect impacts, which may have ramifications outside of the route boundary. Consideration of cumulative impacts arising from similar developments or activities within the region should also be given consideration.

- Provide guidance on the implementation of mitigation measures that may serve to moderate any negative impacts that may arise on route as a consequence of the development.

The Scope of Work is based on the following broad Terms of Reference, which have been specified for this specialist study:

- Review detailed information relating to the project description and precisely define the environmental risks to the terrestrial and aquatic environment (including avifauna) and consequences for ecology.
- Compile a baseline description of the terrestrial and aquatic ecology (including avifauna) of the study area, and provide an overview of the entire study area in terms of ecological significance and sensitivity (i.e. in terms of the major habitat forms within the study area, giving due consideration to terrestrial ecology (flora), terrestrial ecology (fauna) and freshwater ecosystems/wetlands).
- Provide specific ecological data in respect of the floral, faunal and aquatic components of the site using ground-truthing methods, with an emphasis on those areas considered to be of “high” and possibly, “moderate” sensitivity (based on the desktop study).
- Based on the desktop study, undertake field work and sampling across the site to record relevant data and to compile an overview of the habitat under review.
- Collate all data collected during the field work and undertake a statistical review using methodologies that allows for comparison of biological data.
- Consider wetlands (endoreic pans) and associated water resources within the site in terms of significance within the catchment, habitat value and significance and delineation of extent through preliminary on site evaluation and the use of aerial imagery interpretation (where these arise). Determine if a Water Use Licence is required.
- Undertake a faunal investigation on site based on the points identified during the preliminary aerial photographic interpretation.
- Provide a detailed terrestrial and aquatic ecological sensitivity map of the site, including mapping of disturbance and transformation on site.
- Identify and rate potential direct, indirect and cumulative impacts (in line with the impact assessment methodology provided in Section D of the BA Report) on the terrestrial and aquatic ecology, communities and ecological processes within the site during the construction, operation and decommissioning phases of the project.
- Provide input to the Environmental Management Programme, including mitigation and monitoring requirements to ensure that the impacts on the terrestrial and aquatic ecology are limited.
- Compile an assessment report qualifying the risks and potential impacts on terrestrial and aquatic ecology in the study area and impact evaluations.

1.1.3 Approach and Methodology

A literature review and desktop analysis was undertaken prior to site reconnaissance, utilizing various sources including the South African National Biodiversity Institute (SANBI) data and other relevant sources, including spatial data. Recent and historical, aerial imagery of the route was reviewed in order to identify points for investigation during the field survey.

Utilising the above information, a field investigation was undertaken during the early summer of 2015 (November), whereby:

- The proposed transmission line corridor (with a corridor width of approximately 1000m) was subject to an evaluation using recent historical imagery, with some comparative review of older imagery. Notably additional powerlines have been proposed in conjunction with the subject powerline (Figure 1), which are subjected to separate BA Processes (as noted above). These projects are namely powerline PV 2 and PV 3 to the south which would form part of a continuous powerline should the projects all come to realization.

- Field reconnaissance was undertaken during the period of 3 – 6 November 2015, whereby the entire proposed transmission line route/corridor, as well as adjacent points along the route, was given consideration. Consideration was given to:
  1. Geomorphological features identified from aerial imagery.
  2. Habitat form and structure along the proposed transmission line route/corridor, including species composition.
  3. Other factors of a bio-physical nature were given consideration.

Figure 1 below shows the proposed transmission line corridor serving the proposed Kenhardt PV facilities.

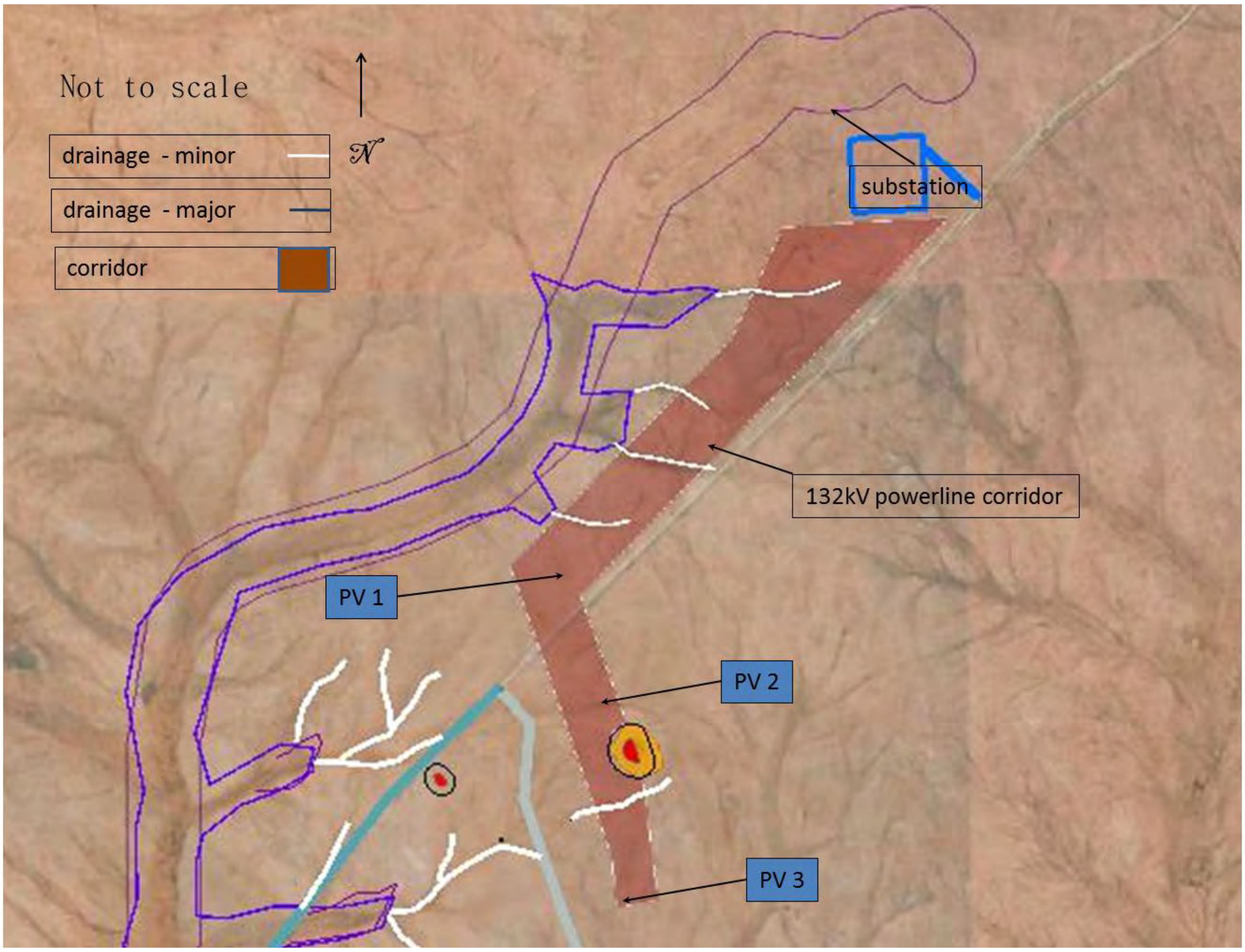

Figure 1: Image of the proposed transmission line corridor and its routing through the Kenhardt PV 1, PV 2 and PV 3 – proposed PV facilities, as well as major drainage lines (purple) and minor drainage lines (white) (Imagery Source: Google Earth, 2015), Not to scale.

Figure 2 below shows a finer resolution of the corridor under consideration as proposed between the Kenhardt PV 1 facility and the Eskom Nieuwehoop Substation.

In evaluating this corridor all data was collated and evaluated, including the following steps:

1. The position and nature of drainage features proximal to and within the proposed transmission line route/corridor.

2. Botanical species presence within and along the proposed transmission line route/corridor were noted and their alignment with the prevailing Bushmanland Arid Grassland veld type was given consideration.

3. The presence of exotic and identified alien invasive species was given consideration.

4. Faunal presence including that of avian species was noted, including species that were noted within the region, but not within the study area. Evidence of faunal activity was also noted and given consideration.

5. Identification of any habitat anomalies that may be identified in such analysis.

In addition, using methods identified in the Department of Water Affairs' "A Practical Field Procedure for Identification of Wetlands and Riparian Areas" (2005), wetland and riparian areas were identified. Such evaluations utilised both geomorphological, geohydromorphic edaphic conditions and botanical indicators in order to identify such components. In practise, only geomorphological components were utilised, as discussed below. Where riparian and wetland systems are identified and lie within 500 m of the proposed development/activity, an application in terms of Section 21 c and i, of the National Water Act (1998) is required to be submitted to the mandated authority.

1.1.4 Assumptions and Limitations

The route assessment and collation of data was undertaken in the period of 3 - 6 November 2015, during a period of successional and unseasonably high temperatures and low rainfall (SA Weather Services, http://www.weathersa.co.za). Such meteorological stressors mean that some botanical species, in particular graminoids and geophytes, are not generally evident. This may affect both the analytical and observation results of the investigation.

Allied to the above, the route investigation coincided with the regular, early summer dry period. As higher rainfall in the region is a late summer phenomenon, many botanical species remain dormant, until the advent of rains, effectively masking their presence.

In terms of the assessment of potential cumulative impacts included in this specialist study, these take into consideration certain developments that occur with a 20 km radius of the proposed project, as shown in Section D of the BA Report.

1.1.5 Source of Information

This assessment was undertaken utilising:

- 1:50 000 topographic mapping sourced from the Surveyor General's office; and
- Aerial imagery sourced from Google Earth.

In addition, use was made of the following data:

- Wetland and riparian habitat GIS data sourced from the National Freshwater Ecological Priority Area Programme of SANBI;
- SANBI veld types data; and
- Literature as referenced.

1.1.6 Declaration of Independence of Specialist

Refer to the preliminary sections of this specialist report for the Curriculum Vitae of Mr. Simon Bundy and Mr. Andy Blackmore, which highlights their experience and expertise. The declaration of independence by the specialist is provided in Box 1.1 below, with a full declaration provided in the preliminary section of this report and included in Appendix I of the BA Report.

BOX 1.1: DECLARATION OF INDEPENDENCE

I, Simon Bundy, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed Kenhardt PV 1 – Transmission Line Project, application or appeal in respect of which I was appointed, other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.

Simon Bundy

1.2 DESCRIPTION OF PROJECT ASPECTS RELEVANT TERRESTRIAL, AVIFAUNA, AND AQUATIC ECOLOGY (INCLUDING HYDROLOGICAL FEATURES)

A single powerline corridor has been given due consideration. This corridor of approximately 1000 in width has been identified for expediency purposes and forms the most logical and efficient powerline route available to serve the proposed Kenhardt PV 1 facility. Upon the identification and finalization of the proposed corridor, it is envisaged that the final route will accommodate the most applicable and from an ecological perspective, most appropriate line route:

The proposed transmission line and electrical infrastructure connectivity options that have been considered are:

- The construction of a single 132 kV transmission line from each Kenhardt PV facility to the Eskom Nieuwehoop Substation; or
- Separate 22 kV/33 kV transmission lines are proposed to connect the Kenhardt PV 2 and Kenhardt PV 3 projects to the proposed Kenhardt PV 1 on-site substation, which will link via a 132 kV line to the Eskom Nieuwehoop Substation; or
- Construct one 132 kV transmission line from the Kenhardt PV 1 project to the Eskom Nieuwehoop Substation and connect the Kenhardt PV 2 and Kenhardt PV 3 facilities together via medium voltage transmission lines to either the on-site substation of Kenhardt PV 2 or PV 3, followed by the construction of one 132 kV transmission line from the on-site substation to the Eskom Nieuwehoop Substation.

The transmission lines are being assessed separately as part of a BA for each Kenhardt PV project. The Kenhardt PV 1 – Transmission Line project will entail a single 132 KV transmission line from the Kenhardt PV 1 project to the Eskom Nieuwehoop Substation, within the overall corridor.

Regardless of which connectivity option is selected, all the options occur within an electrical infrastructure corridor (shown in Figure 2).

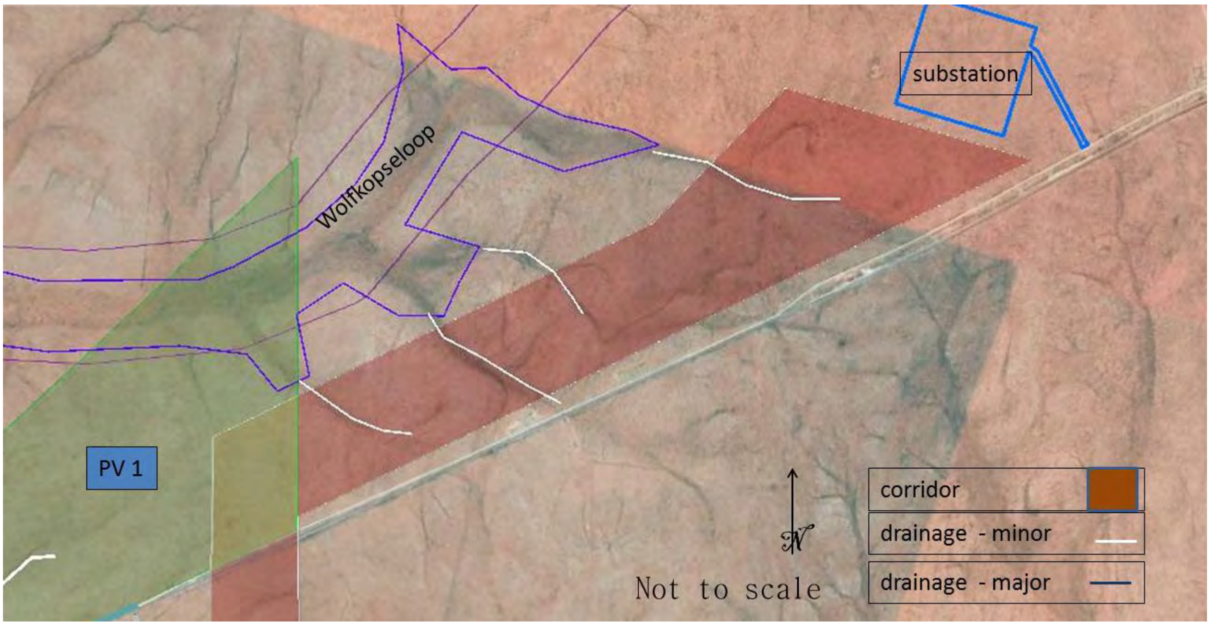

Figure 2: Image showing the proposed corridor associated with the Kenhardt PV 1 transmission line lying between the proposed Kenhardt PV 1 facility and Eskom Nieuwehoop Substation. The Wolfkopseloop feature and its associated drainage lines, lying to the north of the corridor, are considered a major hydrogeomorphic feature and is outlined in purple. Minor dendritic drainage features are identified in white.

Other activities associated with the powerline construction are:

1. Finalisation of the proposed powerline route and identification of tower positions.
2. Clearance of points around the powerline towers.
3. Establishment of towers using earthscrews or similar foundation methods. A steel framework or concrete tower will be constructed thereon.
4. Stringing of the proposed powerline utilising cabling dispensed from a truck which drives the length of the route.

The establishment of the proposed powerline will thus entail *low to moderate* alteration of the prevailing habitat (i.e. during the construction phase). Once established, the powerline is a generally benign structure (i.e. during the operational phase).

A detailed project description is included in Section A of the BA Report, which includes dimensions and specifications of the proposed project components.

1.3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

According to Mucina and Rutherford's veld type classification of 2006, Kenhardt and surrounding regions fall within the Bushmanland Arid Grassland veld type (NKb3). This veld type is located extensively south of the Orange River, but may include a number of smaller habitat forms within its broader extent.

The proposed Kenhardt PV 1 transmission line corridor can be described as a generally level portion of land, with a low gradient draining towards the west, into a shallow drainage feature known locally as "Wolfkopseloop" (Figure 2 and Figure 3). This drainage line serves an area of approximately 280 km^2, most of which lies outside of the study area. Wolfkopseloop drains into the Hartebees River, which in turn serves the Sout River and Orange River systems. Figure 1 and Figure 2 show that the minor drainage lines which serve the Wolfkopseloop River flow through certain sections of the transmission line corridor. The Wolfkopseloop system and its immediate tributaries may be regarded as major drainage features.

Figure 3: Image indicating Wolfkopseloop in the background – more verdant vegetation - with a camp fence in the foreground and an indication of the general nature of the receiving habitat.

The area in general can be considered to have a low rainfall of less than 200 mm per annum (SA Weather Services, 2015) although the recorded average rainfall for the period 2000 to 2012 approximates 238 mm within an average of 51 rain days per year (www.worldweatheronline.com). As such the area has been described as a "semi-arid region" (Bailey, 1979). Using the Koppen-Geiger climate classification method (www.koeppen-geiger.vu-wien.ac.at), the area is classified as "BWh", which is indicative of an *arid hot environment*, - which is supported by Esler *et. al.,* (2006) who have defined areas with an annual rainfall of less than 200 mm as being "deserts". This *desert* status may be the case in the Kenhardt region under its lower rainfall periods. In addition, the highest annual temperatures for the region are recorded between January and February, with maximum temperatures being 37˚C (www.worldweatheronline.com). Extreme temperatures thus coincide with the peak rainfall period. Such correlation may give rise to the low groundwater recharge rates projected for the region, this being estimated at approximately 0.03 mm / annum (Musekiwa and Majola, 2011). Groundwater is described in greater detail in Geohydrological Assessment (which forms Appendix D.5 of the BA Report).

With the above in mind, the most definitive physical drivers of the Bushmanland Arid Grassland veld type that lies within which the subject route, are meteorological and will relate to surface and subsurface hydrology. Other physical drivers will include localised geologies and edaphics.

1.3.1 Habitat and Vegetation

The proposed Kenhardt PV 1 transmission line corridor will run parallel to the Sishen – Saldanha railway line and its associated support road, as indicated in Figures 1 and 2 above. The establishment of the railway line has altered surface hydrology on route, although it is evident that such transformation would relate primarily to minor dendritic drainage lines. In general the site is level, within little topographic variation and a low, gentle gradient to the west. These minor dendritic drainage features in turn, serve the Wolfkopseloop drainage line. Minor and major drainage lines are shown in Figures 1 and 2 above.

In general, the area appears to have been subject to extensive and significant grazing. The proposed powerline route will traverse one existing camp, which at the time contained livestock. The dominant vegetation form is a Rhigozum – Aristida association with some quartz exposures. Two consocies of the quiver tree, *Aloe dichotoma* are noted, these lying to the west and to the east of the proposed transmission line corridor (Figure 4). In addition, *A claviflora* are also evident in association with *A dichotoma* (Figure 5). Common to the dendritic and minor surface drainage features that dissect the line route are more verdant associations of *Rhigozum trichomotum*, *Aristida ascensionis* and *A congesta*. *Stipagrostis ciliata* is also common to these features. A list of species identified across the proposed transmission line route is presented in Table 1 below.

Table 1. List of observed species within the proposed transmission line corridor.

Species	Conservation Significance	
	NC NCA *	NFA#
Acacia karroo		
Acacia mellifera		
Aizoon elongatum		
Aloe dichotoma	X	
Aloe claviflora	X	
Aptosimum spinescens		
Aristida ascensionis		
Aristida congesta		
Asparagus suaveolens		
Atriplex lindleyi		
Blepharis capensis		
Cadaba aphylla		
Chrysocoma ciliata		
Enneapogon scaber		
Datura ferox$		
Enneapogon cenchroides		
Eragrostis nindensis		
Eriocephalus encoides		
Euphorbia glanduligera		
Euphorbia stellispina		
Felicia muricata		
Lessertia annularis		
Lyceum cinereum		
Mesembryanthemum guerichianum		
Monechma incanum		
Osteospermum spinescens		
Pentzia spinescens		
Prosopis glandulosa $		
Rhigozum trichotomum		
Riccia albornata		
Salsola tuberculata		
Schmidtia pappophoroides		
Stipagrostis anomala		
Stipagrostis ciliata		
Tetragonia arbuscular		
Tribulus cristatus		
Tribulus pterophorus$		

*NC NCA = Northern Cape Nature Conservation Act (1998)
#NFA = National Forest Act (1998)
$ = exotic

Figure 4 Image indicating *A dichotoma* in foreground and prevailing habitat to the west of the proposed powerline route/corridor.

Figure 5: Image indicating Aloe concocies that lies to the east of the proposed powerline route/corridor. *A claviflora* in foreground.

From the above and as depicted in Appendix A of this report, it is evident that the proposed transmission line corridor, if developed, should not intersect with the two Aloe consocies identified or the routing may be established in order to accommodate the presence of these specimens. This may be achieved, preferably by locating the final route proximal to the existing railway line/roadway, or less favourably by spanning over the associes. Final planning of the powerline route should take consideration of the position of the Aloe consocies, as well as other factors including existing powerlines and infrastructure. The positioning of towers and where possible the routing of the line either to the west or east of the Aloe consocies is proposed. A 60 m buffer should be implemented around the Aloe consocies.

1.3.2 "Aquatic" and Riparian Habitat

As indicated above, surface drainage along the proposed transmission line corridor traverses a number of minor drainage lines which serve the (major) Wolfkopseloop drainage feature. These drainage features do not show specific hygrophilous vegetation characteristics as may be defined, nor do they show the presence of geohydromorphic soils, primarily on account of the erratic levels of inundation over extended periods of time, which is driven by the intensity and erratic rainfall experienced in this region. Interaction with the farmer presently utilising the land in question, indicated that the drainage lines show short term inundation during high rainfall periods, "every 4 to 5 years" (S Strauss *pers. comm*.). Flow is sluggish under these conditions, and following the cessation of rains, the water rapidly drains from route on account of the percolative, sandy conditions, or is lost to evaporation. For this reason, the major drainage lines have been delineated according to geomorphological features and an apparent change in vegetation form from a sparse and arrested growth form to a more verdant state (Figure 6).

Hydrogeomorphological features are indicated primarily by evidence of flow or deposition of materials (Brinson et al 1993; USDA 2008) while verdant vegetation establishment is a combination of both improved plant water relations and increased nutrient availability. Therefore major drainage features were allied with a combination of both vegetation structure and significant geohydromorphic indicators, while minor drainage features were distinguished through the presence of a more verdant vegetative association and in some cases indicators of minor surface flow ('rills').

The interface between major and minor drainage lines is often vague, however where rills exceeded a depth of 30cm (gullies), such features were defined as 'major' drainage systems.

Figure 6: An image indicating a verdant vegetation state around a drainage feature within the Kenhardt PV 3 area. Compare with adjacent vegetation forms which appear arrested in growth.

Although ephemeral in terms of the presence of water within these features, these drainage lines do bestow intermittent hydrological benefit to the landscape and can be considered groundwater "recharge zones" in respect of the local subsurface hydrology. From a biotic perspective, the drainage lines do serve as seasonally important refugia and congregation points for *inter alia* invertebrates (e.g. Class Odonata) and vertebrates (e.g. Order Anura) (faunal aspects are described further in Section 1.3.4 of this report).

Figure 2 and Appendix A of this report indicates the position and extent of the major drainage features, with minor dendritic features (those features that show only minor indications of flow and some vegetation change), also being identified. The evident differentiation between the major and minor drainage features is highlighted in the mapping imagery. The former are considered to be important ecological factors within the landscape, while the latter are of less significance, but should be given consideration, where they may intersect with the development footprint of the proposed transmission line corridor.

1.3.3 Habitat Sensitivity

Appendix A of this report indicates exclusion zones, relating to the proposed development within the study route. **These zones relate to the major drainage features**. No additional sites of ecological significance that should be excluded from the development footprint have been identified.

A 32 m "buffer" or "setback" around the major drainage lines has been established, which is an indicative "norm" recommended by the various authorities. This buffer is to be established and applied around the major drainage systems. This buffer is considered acceptable in light of the fact that hydrogeomorphic features are the primary dictate in the identification and delineation of the major drainage lines, rather than other functional features such as geohydromorphic soil conditions or botanical species diversity and compositional variation. It is evident that a 100m exclusion area around the major drainage lines would incorporate extensive tracts of land which are in no way indicative of the concentrated surface hydrology. The application of 32m from such features is expected to accommodate both the variation in habitat structure and the erosive action associated with gullies and larger drainage features.

The “minor” drainage features are not considered to require exclusion from any land use change or a development akin to that proposed on account of:

1. The transformed surface hydraulics arising from the establishment of the railway line and its associated stormwater management infrastructure.

2. The nature of the proposed powerline, whereby the towers may be strategically positioned in order to minimise their influence and position in relation to the identified watercourses.

3. The origins of many of the minor features, as explained above.

4. Other anthropogenic interventions, such as borrow pits and roadways, which have further altered surface drainage.

Therefore, based on the above, the minor drainage lines occurring within the transmission line corridor do not require avoidance. **It would however be best for the design of the proposed transmission line to note the presence of these minor features and avoid establishing structures such as buildings and other permanent and significant structures (powerline towers) within them.**

1.3.4 Fauna

1.3.4.1 Terrestrial

Fauna that prevail along the proposed transmission line route are considered to be typical of a xeric environment, with limited habitat variation across the study area. Table 2, below indicates species evidence of their presence observed *en route* and in the general locale. The occurrence of such species is likely in respect of these animals either utilizing the subject area as refugia or as part of a wider foraging range or territory. As is typical of the region, a large number of fossorial and burrowing species, including mammals and invertebrates, were identified across the route in general. Such species included suricates (meerkat), (*Suricata suricata*) and ground squirrel, (*Xerus inauris).* These species live in mutual habitation within active burrows (Figures 7 and 8). In addition foraging excavations indicating the presence of Aardvark (*Orycteropus afer*), as well as the porcupine (*Hystrix africaeaustralis*) are evident.

Other larger mammals that were noted on route of the proposed transmission line include Springbok (*Antidorcas marsupalis),* which are prevalent across the area and may be accompanied by Steenbok (*Raphicerus campestris*), which are also common in the region and open habitat (Estes, 1992).

Most larger mammals located within the proposed transmission line route and general study area are not reliant upon the study area in particular and are likely to forage over extensive ranges that extend beyond the study area. Estes (1992) indicates that suricates may use warrens for a number of months or possibly years, before relocating.

Noted on other PV routes, suricates are quite capable of establishing warrens within solar parks following their construction, while aardvark (*O afer)* and other fossorial species are capable of excavating under fencing, which may only initially serve to exclude them from an area.

Figure 7: Suricate warren located in proximity to the proposed transmission line route.

Figure 8: Ground squirrel (*Xerus inauris).*

Table 2. List of Terrestrial Species identified within the proposed Transmission Line Route and likely to be Present within the region/corridor. Species of Conservation Importance is Identified.

		Observations	**TOPS (2007)**	**Conservation importance (IUCN Red List) ***
Mammals				
Orycteropus afer	Aardvark	Foraging evidence?		LC
Felis nigripes	Black-footed cat			VU
Atelerix frontalis	South African hedgehog	Pers.comm J Orven	Protected	LC
Canis mesomelas	Black back jackal			Not listed
Xerus inauris	Cape ground squirrel	Observed		Not listed
Lepus capensis	Cape hare	Observed		Not listed
Felis caracal ?	Caracal ?	Remains of prey		Not listed
Procavia capensis	Rock dassie	Observed		LC
Suricata suricatta	Meerkat	Observed		LC
Aethomys namaquensis	Namaqua rock mouse			Not listed
Hystrix africaeaustralis	Porcupine	Foraging evidence?		LC
Antidorcas marsupalis	Springbok	Observed		LC
Raphicerus campestris	Steenbok			LC
Cynictis penicillata	Yellow mongoose	Observed		LC
Reptiles				
Ptenopus spp	Barking gecko			LC
Naja nivea	Cape cobra			Not listed
Chondrodactylus angulifer	Giant ground gecko			LC
Cordylus spp	Girdled lizard		Protected	*C cataphractus* ; - VU
Psammobates tentorius	Karoo tent tortoise			Not listed
Geochelone pardalis	Leopard tortoise	Observed		Not listed
Bitis arietans	Puff adder			Not listed
Agama makarikarica	Spiny agama			Not listed
Amphibians				
Tomopterna cryptotis	Tremolo sand frog			LC
Invertebrates				
Locustana pardalina	Brown locust	Observed		Not listed
Pterinochilus spp	Baboon spider		Protected	Not listed
Seothyra spp	Buckspoor spider			Not listed
Family Vespidae	Various wasps	Observed		
Opistophthalmus spp	Burrowing scorpions?	Burrow entrance?	Protected	Not listed
Parabuthus spp	Parabuthid scorpion			Not listed
Family Hodotermitidae	Termite			Not listed

TOPS – Threatened or Protected Species GN R151 of the National Environmental Management: Biodiversity Act (Act 10 of 2004)
IUCN – International Union of Conservation Networks
* LC = Least concern; NT = Near threatened; VU = Vulnerable; EN = Endangered
CR = Critically endangered; EW = Extinct in the wild; NE = not evaluated; DD = data deficient

1.3.4.2 Avifauna

As the study area is located in an arid region, it is expected that the avifaunal densities will be low, typical of the Bushmanland Arid Grassland environment. Consideration of the birds observed within the study area during the beginning of November 2015 (Table 3) and the Southern African Bird Atlas Project (SABAP) sighting data (see http://sabap2.adu.org.za/) indicates that the proposed powerline presents a **limited risk to the avifaunal community**.

The SABAP data indicates three species of potential concern. These species are two raptor species - the Pygmy Falcon (*Polihierax semitorquatus*) and the Southern Pale Chanting Goshawk (*Melierax canorus*), and the Kori Bustard (*Ardeotis kori*). The predatory flight habit of the raptor species is such that they are likely to avoid collision with horizontal and vertically aligned infrastructure. It is, however, to be recognized that the powerlines and pylons provide these species with artificial perching points. This, as has been recorded elsewhere, provides both the falcon and goshawk a predatory advantage, increasing their prey species vulnerability. Given the current low numbers of these artificial perches, this impact is considered *low to moderate* at a route specific level and *low* at a landscape level. Caution is however raised that with an increase in the number of artificial perching points possible in the future, the resultant cumulative impacts are likely to become significant at a landscape level. Although generally indeterminate at a coarse level of evaluation such changes that may favour predatory birds could result in an equilibria shift in the populations of various prey species. The assessment of this potential impact is assessed in Section 1.6 of this report.

The Kori Bustard is classified as 'Near Threatened' and is particularly vulnerable to collision with powerlines. At these points the placement of *Bird Flight Diverters* (BFD) or bird flappers along the powerlines is advised as a suitable mitigation. Given the paucity of wetlands and open water within that landscape, the impact of the proposed solar PV facility on wetland avifauna is considered negligible. As indicated above, drainage features in the form of gullies show an extremely limited presence of flow or indeed the presence of water. Water fowl in the region are to be considered transitory in nature or associated with times of inundation of the abovementioned drainage features. Finally, given the abundance of habitat surrounding the proposed corridor, the loss of habitat integrity as a consequence of the establishment of the powerline is likely to have a low measurable impact on avifauna. Notwithstanding this observation, the continued and cumulative loss of habitat at a landscape to regional level is a possible matter of concern.

Table 3. Species noted within and adjacent to the study area.

		Observations
Aves		
Cercomela schlegelii	Karoo chat	Observation on route
Cisticola aridulu	Desert cisticola	Observation on route
Corvus albus	Pied crow	Observation off route
Egretta garzetta	Little Egret	Observation off route
Lanius collaris	African fiscal	Observation off route
Melierax gabar	Gabar goshawk	Observation off route
Oena capensis	Namaqua dove	Observation on route
Philetairus socius	Weaver, sociable	Proximal nesting route
Streptopelia capicola	Cape turtle dove	Observation off route
Streptopelia senegalensis	Laughing dove	Observation off route

1.4 APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

The proposed establishment of the 132 kV powerline along the study route is considered to elicit a requirement for compliance with the following legislation.

1. The National Environmental Management: Biodiversity Act (Act 10 of 2004)
2. The National Water Act (Act 36 of 1998)
3. The National Forest Act (Act 84 of 1998)
4. The Northern Cape Nature Conservation Act (Act 9 of 2009)
5. The Conservation of Agricultural Resources Act (Act 43 of 1983)

The potential applicability of the abovementioned acts to the subject site is provided below:

1. The National Environmental Management: Biodiversity Act (Act 10 of 2004)

This Act serves to control the disturbance and land utilisation within certain habitats, as well as the planting and control of certain exotic species. The proposed development, taking place in the identified Bushmanland Arid Grassland environment, may not necessitate any particular application for a change in land use from an ecological perspective, however the effective disturbance and removal of species identified in Tables 1 and 2, as well as possible other species (i.e. TOPS species), will require specific permission from the applicable authorities.

In addition, the planting and management of exotic plant species on route, if and where required, will be governed by the Alien and Invasive Species (AIS) regulations, which were gazetted in 2014. These regulations compel landowners to manage exotic weeds on land under their jurisdiction and control.

2. The National Water Act (Act 36 of 1998)

The National Water Act controls activities in and around water resources, as well as the general management of water resources, including abstraction of groundwater and disposal of water. Authorisation for changes in land use, up to 500 m from a defined water resource / wetland system will require an application for a Water Use Licence from the Department of Water and Sanitation. A Water Use Licence will possibly be required in respect of the proposed development under Section 21 (c) and (i), of the Act, however such license should not preclude this development. The necessity for a Water Use Licence in respect of the proposed powerline will be determined by the Department of Water and Sanitation, however it is noted that the watercourses do not meet the criteria to be termed “wetlands”, while the final routing of the powerline may fall in excess of 500 m from the watercourse (Wolfkopseloop), thus not necessitating a Water Use Licence application.

3. The National Forest Act (Act 84 of 1998)

The National Forest Act (Act 84 of 1998) governs the removal, disturbance, cutting or damage and destruction of identified “protected trees”. Listed species that may be encountered in the area include Boscia spp and possibly *Acacia erioloba*. Neither of these species were identified as falling within the proposed corridor.

It is unlikely that an application for the “clearing of a natural forest”, as defined within the Act, will be required on the route in question.

4. The Northern Cape Conservation Act.

The Northern Cape Conservation Act under its pertinent regulation, governs the disturbance of species listed in Tables 1 and 2 above, or possibly other species not yet identified on route. A permit from the Provincial Department of Environment and Nature Conservation will be required in order to disturb or translocate such species. Species that would require such permitting include *Aloe dichotoma*, which has been identified within the proposed corridor.

5. The Conservation of Agricultural Resources Act

Invasive plant species that should be removed or maintained only under certain commercial situations are identified in terms of the Conservation of Agricultural Resources Act (CARA). This Act will be applicable to the project if and where such plants arise within or adjacent to the project area. Notably most listed alien invasive species are propagated and driven by the disturbance of land during and following construction.

As the proposed corridor does not lie within protected areas, nor within 5 kilometres of a protected area, nor within 10 kilometres of a World Heritage site and does not form part of a critical biodiversity area (CBA), the various regulations within the National Environmental Management Act and the NEM Protected Areas Act are not applicable to this site. It is also noted that the corridor does not fall within any expansion area in terms of a conservation strategy for the Northern Cape.

1.5 IDENTIFICATION OF KEY ISSUES

1.5.1 Key Issues Identified During the BA

As indicated in both this report and the environmental scoping report, the subject site is to be considered a xeric environment, with limitations in the presence of aquatic or wetland environments in both temporal and spatial terms. With this in mind, the consideration of issues arising from the proposed development is considered at an integrated level as they may arise. The following key issues were identified during the BA Process:

Construction Phase:

1. The disturbance of fauna and loss of vegetation/habitat through anthropogenic activities, disturbance of refugia and general change in habitat.

2. Disturbance of vegetation, in particular habitat associations as a consequence of the establishment of the proposed towers of the transmission line.

3. Alteration of surface drainage patterns on account of construction activities leading to change in plant communities and general habitat structure, primarily the establishment of the proposed concrete or steel towers along the transmission line route, which require some level of excavation and the placement of concrete foundations.

4. Alteration of surface water quality on account of construction activities that lead to change in water chemistry.

5. Changes in edaphics (soils) on account of excavation and import of soils, leading to the alteration of plant communities and fossorial species in and around these points.

Operational Phase

1. Operation of the proposed overhead transmission line, as well as subtle changes in habitat, are likely to result in the alteration of avian behaviour in and around the transmission line route/corridor. Possible avian collisions and bird strikes may arise from flying or birds roosting upon the lines. Birds at risk may include the sociable weaver and larger raptors.

To date, the following comments and issues have been raised by I&APs in relation to ecological impacts. Appendix E.3 of the BA Report includes the complete list of comments and responses.

Comment	Commentator and Date	Response from Specialist
Point 3 - The proposed development do not form part of the Strategic Environmental Assessment (SEA) for Eskom's electricity grid upgrades and roll-outs as it falls outside one of the corridors identified by Eskom (i.e. the Western Corridor; one of the five identified corridors; refer to Figure 3). Comprehensive field surveys (within appropriate seasons) should thus be done for this specific area; it didn't form part of Eskom's assessment and the former project's surveys can thus not be used as baseline studies. Caption Figure 3 - Strategic Environmental Assessment (SEA) for ESKOM's electricity grid upgrades and roll-outs (Feb 2014) in relation to the proposed development (black arrow) near Kenhardt The proposed development falls outside one of the corridors identified by ESKOM (i.e. the Western Corridor; one of the five identified corridors), hence, it didn't form part of Eskom's assessment.	• Elsabe Swart (Deputy Director – Research and Development Support) and Samantha De la Fontaine (District Ecologist), Northern Cape Department of Environment and Nature Conservation • 5 November 2015 (Letter via email)	1. Refer to the response provided in Appendix E.3 of the BA Report regarding the SEA for the Eskom Electricity Grid Infrastructure SEA. 2. Field and desktop investigations have been undertaken during November 2015. The primary data collated on site and the sampling regime employed has been extrapolated to consider other seasonal variations.
The Department of Water and Sanitation (DWS) hereby acknowledges receipt of your scoping and environmental impact assessment for the proposed development of three Solar Photovoltaic Facilities (Referred to as Kenhardt PV 1, Kenhardt PV 2 and Kenhardt PV 3) on the remaining extent of Onder Rugzeer Farm 168, north-east of Kenhardt, Northern Cape Province. The department has reviewed the document and the comments are as follows: ▪ Please note that no development should take place within 100 m horizontal distance from a water course or within 1:100 year flood line. Operation and storage of equipment within the riparian zone must be limited as far as possible. ▪ Storm water must be diverted from the construction works and roads and must be managed in such a manner as to disperse runoff and to prevent the concentration of storm water flow. Where necessary, works must be constructed to attenuate the velocity of the storm water discharge and to protect the banks of the watercourse. ▪ Please note that no taking of water or storing of water from the water resource shall be lawful without a water use authorisation. Due to the high number of renewable energy projects that are taking part in the Department of Energy (DOE) bidding process, this Department (DWS) will only process applications for water use authorisations received from developers who have attained preferred bidder status. Developers who wish to submit applications for water use authorisations may however proceed to do so, with the understanding that their applications will be processed as soon as we have confirmation of their status with the DOE. Attached to this letter is Annexure 1 that details information, which must be submitted as part of the application for water use authorisation.	• Ms. Chantèl Schwartz, Orange Proto- CMA, Department of Water and Sanitation • 3 November 2015 (Email)	1. 100m set back has been noted, however given the fact that hydrogeomorphological indicators and vegetation structure have been used to delineate drainage features; a 100m non-development area around such features is considered excessive. The use of the more conservative 32m buffer is appropriate as this incorporates the identified vegetation indicators and provides a cordon around the erosive edges of such hydrological features. Notably, the powerline corridor is generally distal from most drainage features that are considered "major" systems. The corridor does not bisect any major drainage lines. 2. Advisory on dispersal of storm water is noted and it is proposed that engineering and layout of the powerline will accommodate this requirement. 2. Applicant has been advised and is aware of the Water Use Licence requirements.
Point 6 - It is advisable that RE facilities are not proposed for areas that favour local faunal diversity (e.g. endorheic pans, dry river washes, rocky outcrops, etc.).	• Elsabe Swart (Deputy Director – Research and Development Support) and	1. Habitat that favours faunal diversification and increased faunal populations have been

Comment	Commentator and Date	Response from Specialist
The Northern Cape is water scarce province, hence any form of sustained water, has the potential to stimulate vegetative growth and attract faunal species. Above-mentioned areas should be noted as sensitive areas during the EIA phase.	Samantha De la Fontaine (District Ecologist), Northern Cape Department of Environment and Nature Conservation • 5 November 2015 (Letter via email)	identified and should be excluded from the "final line route" 2. Features mentioned have been incorporated into the assessment.
Point 1 - It should be noted that the areas where the proposed developments are to be constructed have been historically poorly surveyed, hence extrapolations from desktop studies for specialist's studies will give an incomplete representation of the biodiversity within the area (refer to Figure 2). Caption Figure 2- South African National Biodiversity Institute's (SANBI) PRECIS database (2013) indicating the number of plant specimens collected for specific Quarter Degree Grid Squares (QDGS). The proposed development falls within QDGS indicative of a very low species count (i.e. 1 – 50 species sampled per grid). Red squares denote zero specimens.	• Elsabe Swart (Deputy Director – Research and Development Support) and Samantha De la Fontaine (District Ecologist), Northern Cape Department of Environment and Nature Conservation • 5 November 2015 (Letter via email)	1. Field reconnaissance was undertaken during assessment. 2. PRECIS data base noted and confirmed.
Point 2 - Large Aloe dichotoma populations are known to occur in the region. The species is protected under the Northern Cape Nature Conservation Act (Act 9 of 2009) and at present there is a moratorium in place in the Northern Cape on the removal of A. dichotoma from the wild due to historic trade related pressures on populations (Proclamation No 968, 1 April 2005). Hence, trees may not be removed until the moratorium is lifted. All trees within the development or close proximity thereof should be mapped and information provided with the EIA documents.	• Elsabe Swart (Deputy Director – Research and Development Support) and Samantha De la Fontaine (District Ecologist), Northern Cape Department of Environment and Nature Conservation 5 November 2015 (Letter via email)	A dichotoma were noted within the corridor and should be considered and excluded from the final powerline route.
Point 5 - The development is proposed for an area that falls within the Bushmanland Arid Grassland, one of the most extensive vegetation types within the Northern Cape (Mucina and Rutherford, 2006). This vegetation types is poorly conserved in formal protected areas and extensive areas have been historically overgrazed. As a result, large areas are currently degraded and drainage lines have been modified as a result of anthropogenic impacts. As a result of the extent of the area, impact would most likely be on landscape connectivity as the site is in close proximity of drainage lines and wetlands (refer to Figure 5). Caption Figure 5 - Several landscape scale connections through drainage lines are evident within the area in question. The two proposed facilities i.e. the Three Solar PV (blue arrow) and Seven Solar PV (black arrow) are to be located in close proximity of drainage lines and wetlands.	• Elsabe Swart (Deputy Director – Research and Development Support) and Samantha De la Fontaine (District Ecologist), Northern Cape Department of Environment and Nature Conservation • 5 November 2015 (Letter via email)	1. Connectivity identified and preserved. 2. Drainage lines that are considered to be major watercourse features are excluded from the corridor.
Point 9 - It is advised that the consultants for this project liaise with the Forestry branch of the Department of Agriculture, Forestry and Fisheries (DAFF) if trees protected under the National Forest Act (Act No. 84 of 1998) are to be impacted by the proposed development.	• Elsabe Swart (Deputy Director – Research and Development Support) and Samantha De la Fontaine (District Ecologist), Northern Cape Department of Environment and Nature Conservation 5 November 2015 (Letter via email)	1. All protected trees identified along the corridor route have been identified and should be accommodated in the final powerline establishment route.
Point A. Specialist's studies: ▪ A thorough baseline survey of the grids 2921AB and 2921AD should be conducted during the EIA phase with at least the following biotic specialists: Ornithologist, Mammologist, Herpetologist (including amphibians) and Botanist. o Surveys for both the faunal and floral specialist reports should be done during the most optimum period for this area i.e. mid-summer to autumn, after the rains and during the growth season when maximum biota can be expected. o This should be done in order to give a good	• Elsabe Swart (Deputy Director – Research and Development Support) and Samantha De la Fontaine (District Ecologist), Northern Cape Department of Environment and Nature Conservation • 5 November 2015 (Letter via email)	1. An ecologist, ornithologist and aquatic specialist comprised part of the team. 2. Timeframes do not allow for February to April period assessment. Drought period and meteorological state is noted at time of assessment. 3. Timeframes do not allow for continued long term assessments. Interpretation of landform, floral and faunal findings and multivariate analysis

Comment	Commentator and Date	Response from Specialist
representation of the ecology in the area. o Due to the extreme variability in time and space of rainfall events, even a once-off survey within the rainy season will not provide a representative picture of the ecology of the area. o The number of plants of conservation concern (e.g. Aloe dichotoma, Aloe spp., Trichocaulon spp., Hoodia spp., Boscia spp. etc. under the Northern Cape Nature Conservation Act No. 9 of 2009 and National Environmental Management: Biodiversity Act No. 10 of 2004, etc.) that may be directly affected by the development must be estimated during the EIA phase. o Large Aloe dichotoma [NCNCA protected spp.] populations are known to occur in the region and any populations in close proximity to the planned facilities must be mapped.		has been used to interpret and compile assessment. Given the findings of the assessment and the general severely grazed nature of the site, the information collated is considered sufficient to draw a conclusion on the nature of the ecology within the area. 4. Identified specimens included under NEMBA have been identified and mapped spatially.
Point C - Ecology and landscape connectivity: ▪ The proponent should include in the EIA an environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process and map combining the final layout plan overlain on the environmental sensitivity map. This map should be adequate in size to determine the extent of the development and to identify all aspects adequately as indicated on the maps. No-Go areas should be clearly identified. ▪ The final layout of the proposed developments (all 3 phases) and its constituents should be designed in such a manner as to enhance ecological value to fauna and flora within the area and to avoid pressures associated with surrounding farmland i.e. natural areas for greening and designing to support ecological corridors and landscape connectivity are strongly encouraged. ▪ The actual footprint for all activities related to the whole project (all Solar Park facilities) must be calculated to determine the total natural vegetation land cover transformation and loss. The collective and residual impact of all developments will be assessed also during permit applications. If the collective impact is assessed early enough the developer can better manage his risks and costs as he/she would know in advance whether a biodiversity offset is triggered also under DENC. ▪ If electrification of the property as security measure is considered, possible electrocution damage to small mammals such as pangolin and tortoises should be taken into consideration. ▪ Existing roads must be used as far as possible. ▪ The EIA should indicate how the Social-Agricultural-Conservation dynamic will change in terms of land use. Will the properties on which the developments occur still be actively farmed or will they become dormant or effectively be converted into conservation land with minimal land use management. Will problem animal control still occur as in standard practice in small livestock farming? How will fencing infrastructure change around the properties which has a bearing on problem animal control, but also on wildlife movement and landscape connectivity. ▪ The application must also be reviewed in the context of cumulative impacts of all RE developments in the region.	• Elsabe Swart (Deputy Director – Research and Development Support) and Samantha De la Fontaine (District Ecologist), Northern Cape Department of Environment and Nature Conservation 5 November 2015 (Letter via email)	1. 'Sensitivity'' map has been included in the assessment (i.e. Appendix A of this report). 2. Recommendations in respect of the proposed layout have been included in report. 3. The proposed project will either make use of the existing unnamed farm road or the Transnet Service Road to gain access to the proposed project site. Should the Transnet Service Road be considered the preferred access road, it is proposed that an internal gravel road will be constructed from the road to the proposed site. This internal gravel road is not expected to exceed 6 m in width. 4. Comment on broader land use change from a conservation – agricultural – socio economic perspective is provided in ecological report. Notable that there is broad long term uncertainty, however consideration of existing PV facilities indicates that parks, under management can act to change or possibly improve habitat at a regional scale, depending upon one's approach to "habitat management". 5. Cumulative impacts are reviewed where data and forecasting permits.
Point 4 - The proposed area does not fall within or close to an Important Bird Area (IBA), yet it does resort within a region of grids classified has being sensitive to Wind Farm facilities (refer to Figure 4). The darker the pendent the	• Elsabe Swart (Deputy Director – Research and Development Support) and Samantha De la Fontaine	1. Project is PV related and not wind power. 2. Avifauna assessment identified impacts on birds and

Comment	Commentator and Date	Response from Specialist
more sensitive the specific area is to Wind Farm facilities. Closer scrutiny regarding bird studies is thus a prerequisite due to possible impacts of birds on grid infrastructure as by implication local or regional migratory species that move around in response to surface water availability may be at risk from infrastructure collisions. It is also critical to point out that bird data for this area is based on the South African Bird Atlas Project 1 (SABAP1); data published in 1997 and recorded at a much broader scale than the SABAP2 data survey. Evidently, one can conclude that data for this area is outdated. This is specifically highlighted as a point of concern as each of the three PV projects will be separately linked to the Eskom grid through its own set of powerlines. Caption Figure 4: The three Solar PV facility (blue arrow) is proposed for an area classified as being sensitive to Wind Farm facilities. The darker the pendent the more sensitive the specific area is to Wind Farm facilities. Though the proposed development is not a Wind Farm facility it poses significant risks to birds through collision with grid infrastructure as each of the three facilities will have its own transmission lines connecting to the Eskom Nieuwehoop grid station north east of the proposed development. A seven Solar PV facility (black arrow) is proposed north east of the proposed three Solar PV facility, each also having its own transmission line.	(District Ecologist), Northern Cape Department of Environment and Nature Conservation 5 November 2015 (Letter via email)	has made recommendations. Electric fencing (for the Solar PV plant, as assessed in the separate EIA Process), rather than overhead powerlines, is considered to be greatest risk to particular species of avifauna. Comment and recommendations on the type of tower is provided.
Section B - Bird Monitoring: ▪ Bird monitoring programmes should form part of the Environmental Management Programme. o Monitoring of birds over a full seasonal period (12 months) is supported. o This will help to support a comparative lack of data on bird species in the study area from the SABAP database. o The information will also provide data on bird flight paths, risk of collision in specific areas, habitat niches etc. o An extensive monitoring area across the study area (i.e. non-resident species) is advised to comprehensively account for the movement of species. ▪ Appropriate bird deterrent devices must be placed around the facility to lessen the impact caused by collision of avifauna with the development infrastructure (Hernandez et al., 2014, Kagan et al., 2014). o All Power lines should be clearly marked with bird flappers / markers. o Bird marker devices must be put on the earth wires (live wires) of the power line as appose to the conductors [Bird Flight Divertor (BFD) as oppose to other bird marker devices are suggested (Anderson, 2001)]. ▪ Relevant Birdlife SA protocols should be consulted to conduct the EIA assessment for birds (Guide to Access Avian Data for Environmental Impact Assessment Reports, Retief et al. 2013; BirdLife South Africa / Endangered Wildlife Trust best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa, Jenkins et al. 2012). Although the Jenkins and others guideline refers specifically to Wind farms, many of the principles apply for a thorough assessment. The electricity grid infrastructure especially remains a significant risk for bird collisions. ▪ Potential impacts on water fowl such as flamingos, ducks and geese as well as large Terrestrial Birds such as bustards and korhaan as well as raptors must be investigated. Potential impacts must speak to the	• Elsabe Swart (Deputy Director – Research and Development Support) and Samantha De la Fontaine (District Ecologist), Northern Cape Department of Environment and Nature Conservation 5 November 2015 (Letter via email)	1. Avian monitoring assessment (post Environmental Authorisation) aligning with Bird life SA guidelines is proposed. 2. BFDs are included into recommendations for establishment of powerline. Use of specific non Delta type towers is recommended. 3. Birdlife SA assessment methods are noted, however time resources do not allow for exact application of these protocols. It is also noted that the methods of assessment do align with general ecological principles for faunal assessment, however a broad range evaluation of species within the region as well as a site specific evaluation was undertaken to garner primary data. Such data was matched with secondary data from the literature. 4. Water fowl populations considered to be minimal by avifaunal specialist 5. IAPs noted.

Comment	Commentator and Date	Response from Specialist
Renewable Energy technologies and infrastructure as well electricity grid infrastructure. ▪ BirdLifeSA must be informed as I&AP to provide comment on the development. ▪ SKA must be consulted as I&AP to provide comment on the development. ▪ SAEON Arid Node must be informed as I&AP to provide comment on the development.		
Section D: Environmental Management Programme: ▪ Training and awareness on the illegal poaching and removal of succulents (e.g. Hoodia gordonii, Euphorbia spp.) and the protected quiver tree, Aloe dichotoma. ▪ The EIA must address how risk of alien plan infestation by predominantly Prosopis will be addressed, since the region is known to be under threat from infestation. ▪ A proper invasive alien management plan should be written into the EMPr. The area should be kept clear of invasive alien species; active management is a prerequisite. ▪ Bird deterrent devices to lessen the impact caused by collision of avifauna with development infrastructure. ▪ Possible electrocution of small mammals should be taken into account if electric fences are considered as a security measure. ▪ Free movement of small mammals if the development property is to be fenced. Rehabilitation plans must be provided as to how post construction rehabilitation will be approached as well as operational phase control measures for protecting equipment, for example cutting/scraping/ herbicide applications underneath solar panels.	• Elsabe Swart (Deputy Director – Research and Development Support) and Samantha De la Fontaine (District Ecologist), Northern Cape Department of Environment and Nature Conservation 5 November 2015 (Letter via email)	1. Assessment provides recommendations on removal of exotic weeds. 2. Avifaunal deterrents are incorporated into EMPr recommendations. 3. Impact of electric fence addressed in EMPr. 4. Recommendations on faunal pathways into and out of fence proposed. 5. Rehabilitation proposals provided in EMPr.

1.5.2 Identification of Potential Impacts

1.5.2.1 Construction Phase

The following potential impacts during the Construction Phase can be summarised:

- Alteration of habitat structure and composition in and around towers and possibly through the stringing phase of the project;
- Changes in the geomorphological state of drainage lines;
- The disturbance of fauna and loss of vegetation/habitat through anthropogenic activities, disturbance of refugia and general change in habitat;
- Disturbance of vegetation, in particular habitat associations as a consequence of the establishment of the proposed towers of the transmission line;
- Alteration of surface drainage patterns on account of construction activities leading to change in plant communities and general habitat structure, primarily the establishment of the proposed concrete or steel towers along the transmission line route, which require some level of excavation and the placement of concrete foundations;
- Alteration of surface water quality on account of construction activities that lead to change in water chemistry;
- Changes in edaphics (soils) on account of excavation and import of soils, leading to the alteration of plant communities and fossorial species in and around these points; and
- Exotic weed invasion.

1.5.2.2 Operation Phase

The following potential impacts during the Operational Phase can be summarised:

- Changes in avian behaviour within increased perch and predation opportunities arising for raptors, which in turn have indirect impacts on prey species in the general locale.
- Bird collisions and mortalities arising from electrocution of birds perching on site and possibly direct collisions with the transmission line.
- Exotic weed invasion as a consequence of regular and continued disturbance of route.

1.5.2.3 Decommissioning Phase

Such alterations and changes will be dependent upon the expectant post-decommissioning land use. However, abandonment of the line route within the corridor would probably see:

- A reversion back to the present seral stage, where continued grazing by livestock and herbivory by game will arise.
- A reversion of present faunal population states within the subject route.
- Exotic weed invasion as a consequence of abandonment of route and cessation of weed control measures.

1.5.2.4 Cumulative Impacts

Cumulative impacts arising from the implementation of this project and other land use changes in the region are likely to exhibit the following:

- Extensive alteration of habitat structure and composition over an extensive and wide area where an increase in powerlines arise;
- Increased change in the geomorphological state of drainage lines on account of long term and extensive change in the nature of the catchment; and
- Exotic weed invasion as a consequence of regular and continued disturbance across an extensive area of the transmission line route.

The cumulative impacts assessed in this specialist study consider certain developments that occur with a 20 km radius of the proposed project, as shown in Section D of the BA Report.

1.6 ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

The proposed development of a powerline route linking the proposed PV facility (i.e. Kenhardt PV 1) near Kenhardt with the Eskom Nieuwehoop Substation indicates that the proposed route will traverse primarily uniform, level land with limited impact on habitat of high ecological significance. Drainage features should be avoided and this can be done through the suitable placement of the proposed towers along the transmission line route as has been identified in Section 1.5.1 above. The potential negative impacts that may arise as a consequence of the establishment of the proposed powerline are given further consideration below, with possible mitigation measures being proposed.

Construction Phase:

1.6.1 Alteration of habitat structure and composition in and around towers and possibly through the stringing phase of the project

During the construction phase, clearance of vegetation and the concomitant ousting or disturbance of fauna may arise. While vegetation cover is sparse and generally intermittent along the proposed corridor line route, some clearance will be necessary. Direct, indirect and cumulative impacts expected to arise as a result of the transmission line are identified below:

Direct Impacts

- Loss of "*less resilient*" plant species and replacement with more *robust* species leading to a change in habitat form and structure around the proposed towers.
- Introduction of exotic vegetation or the invasion of disturbed areas by exotic vegetation through either a physical vector (e.g. machinery, vehicles etc.) or more "natural" dispersion vectors (e.g. wind, avian dispersion).
- The temporary ousting of fauna through disturbance and human presence. Species are likely to return in the short term following the conclusion of construction.

Indirect Impacts

- Some exotic weed invasion may be considered an indirect impact as disturbance levels increase at the proposed tower points, with invasion of other points arising from around the proposed towers.

Cumulative Impacts

- Presently existing powerlines are evident around the Nieuwehoop substation and new lines are being constructed. It is evident that an increase in powerline construction will increase the level of habitat change, where this may arise. However such change should be short term, if mitigation and management measures are implemented at the end of the construction process.

The status of this impact is rated as negative and direct, indirect and cumulative in nature. The direct impact is rated with a site specific spatial extent (i.e. along the proposed route of the transmission line). The impact is rated with a long-term duration (i.e. the impact and risk will occur for the project duration). The consequence and probability are respectively rated as substantial and very likely. The reversibility and irreplaceability of the impact are both rated as low.

The indirect impact is rated with a site specific spatial extent (i.e. along the proposed route of the transmission line). The impact is rated with a long-term duration (i.e. the impact and risk will occur for the project duration). The consequence and probability are respectively rated as substantial and very likely. The reversibility and irreplaceability of the impact are both rated as low.

The cumulative impact is rated with a regional spatial extent. The impact is rated with a long-term duration (if mitigation measures are implemented at the end of the construction phase). The consequence and probability are respectively rated as substantial and very likely. The reversibility and irreplaceability of the impact are both rated as low.

Significance of Impact without Mitigation: Moderate

Mitigation

Proposed mitigation measures that may alleviate the significance of the above direct and indirect impacts include:

1. A second assessment of the route should be undertaken in or around February to March (subsequent to the issuing of an Environmental Authorisation and the completion of the detailed engineering) in order to identify any additional plant specimens of significance that may be evident on route. Undertake plant rescue operations, where such specimens may be relocated/removed (i.e. search and rescue) or avoided (with the relevant permits and approvals in place) prior to the commencement of construction.

2. Detailed design and incorporation of habitat and features into the routing of the proposed transmission line. The detailed design and confirmation of the proposed tower positions along the proposed powerline route should assist with the avoidance of specific vegetation associes and forms.

3. Identification and avoidance of the two Aloe associes identified within the corridor.

4. Avoidance, where possible of the minor drainage lines and any additional significant plant species that may be identified and incorporate other features of the route into the design.

5. An initial pre-construction clearance of all exotic vegetation on route should be undertaken to reduce the possibility of further exotic weed invasion. Continued exotic weed control measures should be implemented during the construction phase encapsulated in an alien eradication plan.

Significance of the impact with Mitigation (Direct and Indirect Impact) Very Low

1.6.2 Changes in the geomorphological state of drainage lines

- Significant drainage features lying to the north of the corridor (Wolfkopseloop) should be avoided in the positioning of the proposed towers along the corridor route. Towers should be positioned outside of the drainage features and the 32m buffer ascribed around major drainage features. It is however evident that some surface flow change will arise on account of excavation, plant and human movement and the placement of structures. Direct, indirect and cumulative surface hydrological impacts expected to arise on route are identified below:

Direct Impacts

- Minor variation in the flow regimen within smaller drainage features, but possibly compounded within larger features will arise as a consequence of the construction phase and the establishment of structures.
- Increased sediment discharge into surface drainage features as a consequence of soils disturbance and moderate to heavy rainfall. This may alter habitat for certain species that are related to the drainage lines.

Indirect Impacts

- Shifts in habitat form and structure as plant – water relations change on account of minor variations in the surface water flow regime and disturbance of vegetation along the line route within the corridor.

Cumulative Impacts

- Sustained changes in the upper drainage pattern and watershed as a consequence of the establishment of structures and their management will see minor changes in the major drainage lines. This will be compounded further downstream in the Wolfkopseloop system, particularly if other, similar developments within the same catchment arise.

The status of this impact is rated as negative and direct, indirect and cumulative in nature. The direct impact is rated with a site specific spatial extent (i.e. along the proposed route of the transmission line). The impact is rated with a medium-term duration (i.e. the impact and risk will occur for 1 – 10 years). The consequence and probability are respectively rated as moderate and likely. The reversibility of the impact is rated as high and irreplaceability of the impact is rated as low.

The indirect impact is rated with a site specific spatial extent (i.e. along the proposed route of the transmission line). The impact is rated with a medium-term duration (i.e. the impact and risk will occur for 1 – 10 years). The consequence and probability are respectively rated as moderate and likely. The reversibility of the impact is rated as high and irreplaceability of the impact is rated as low.

The cumulative impact is rated with a regional spatial extent. The impact is rated with a medium-term duration (i.e. the impact and risk will occur for 1 – 10 years). The consequence and probability are respectively rated as moderate and likely. The reversibility of the impact is rated as high and irreplaceability of the impact is rated as low.

Significance of Impact without Mitigation **Low**

Mitigation

Proposed mitigation measures that may alleviate the significance of the above impacts include:

1. Exclusion of major drainage lines from tower footprints.
2. The undertaking of construction outside of the higher rainfall periods (if possible).
3. High levels of site management and housekeeping on route of the proposed transmission line during construction.
4. Monitoring and management of changes in the drainage features being served by the subject area. Such actions can include removal of solid waste and redress of excessive erosion attributable to construction activities.

Significance of the impact with Mitigation **Very Low**

1.6.3 Exotic Weed Invasion

Increases in the prevalence of exotic and invasive plants (e.g. Datura ferox) is highly probable. Such species are driven by the disturbance of land, often through sustained levels of excavation and the removal of competitive plant species.

Direct Impacts

- Increased levels of exotic plants within or around site. Concomitant invasion of neighbouring areas may arise.

Indirect Impacts

- Shifts in habitat form and structure as species associations change.

Cumulative Impacts

- Large scale presence of exotic and invasive species alters ecological process within the wider region.

The status of this impact is rated as negative and direct, indirect and cumulative in nature. The direct impact is rated with a local spatial extent. The impact is rated with a short-term duration (i.e. the impact and risk will occur for less than one year). The consequence and probability are respectively rated as slight and likely. The reversibility of the impact is rated as high and irreplaceability of the impact is rated as low.

The indirect impact is rated with a local spatial extent. The impact is rated with a short-term duration (i.e. the impact and risk will occur for less than one year). The consequence and probability are respectively rated as slight and likely. The reversibility of the impact is rated as high and irreplaceability of the impact is rated as low.

The cumulative impact is rated with a regional spatial extent. The impact is rated with a short-term duration (i.e. the impact and risk will occur for less than one year). The consequence and probability are respectively rated as slight and likely. The reversibility of the impact is rated as high and irreplaceability of the impact is rated as low.

Significance of Impact without Mitigation **Very Low**

Mitigation

Proposed mitigation measures that may alleviate the significance of the above impacts include:

1. Regular monitoring through visual inspection and redress of exotic weeds in and around site, particularly during construction.
2. Avoidance of excessive earthworks and sculpting of land and maintenance of the general topography of the proposed transmission line route.
3. Erosion control measures to be implemented to stabilize.
4. Exclusion of major drainage lines from the proposed development footprint.
5. Placement of energy dissipaters if identified around tower footings within minor drainage lines to reduce velocity of flow through such features and consequential disturbance.

Significance of the impact with Mitigation **Very Low**

Operational Phase

1.6.4 Overhead transmission lines, as well as subtle changes in habitat are likely to result in the alteration of avian behaviour in and around the route.

Direct Impacts

The proposed overhead line and towers will alter the foraging behaviour of avifaunal species, in particular raptors. An increase in perching opportunities will allow for improved predation amongst birds of prey

Indirect Impacts

None identified

Cumulative Impacts

- As a large area of land will be affected by multiple powerline developments, it is evident that any behavioural changes, as described above, will be compounded by the extent of the facilities in the area.

The status of this impact is rated as negative and direct and cumulative in nature. The direct impact is rated with a local spatial extent. The impact is rated with a long-term duration (i.e. the impact and risk will occur for the duration of the proposed). The consequence and probability are respectively rated as substantial and likely. The reversibility of the impact is rated as moderate and irreplaceability of the impact is rated as low.

The cumulative impact is rated with a local spatial extent. The impact is rated with a long-term duration (i.e. the impact and risk will occur for the duration of the proposed). The consequence and probability are respectively rated as substantial and likely. The reversibility of the impact is rated as moderate and irreplaceability of the impact is rated as low

Significance of impact without Mitigation **Moderate**

Mitigation

1. Detailed design and incorporation of habitat and features into the routing of the proposed transmission line.

1. Implement exotic weed control

Significance of impact with Mitigation **Very Low**

1.6.5 The powerlines may increase the risk of collision and electrocution in some avifauna. Such mortalities will relate primarily to larger birds that may roost upon or near conductors or alternatively collide with lines.

Direct

- The powerlines may have negative consequences for in particular raptors and larger passerines. Individual specimens may collide with powerlines during flight or be affected by powerlines and conductors on towers. Possible avian collisions and bird strikes may arise from flying or birds roosting upon the lines. Birds at risk may include the sociable weaver and larger raptors.

Indirect

None identified

Cumulative

- An increase in towers and powerlines will result in greater mortalities in the region.

The status of this impact is rated as negative and direct and cumulative in nature. The direct impact is rated with a local spatial extent. The impact is rated with a short-term duration (i.e. the impact and risk will occur for less than one year). The consequence and probability are respectively rated as moderate and likely. The reversibility of the impact is rated as moderate and irreplaceability of the impact is rated as low.

The cumulative impact is rated with a local spatial extent. The impact is rated with a short-term duration (i.e. the impact and risk will occur for less than one year). The consequence and probability are respectively rated as moderate and likely. The reversibility of the impact is rated as high and irreplaceability of the impact is rated as low.

Significance of impact without Mitigation Low

Mitigation

1. Placement of bird flight diverters on the proposed powerline along line route.

2. The Delta tower configuration should not be utilised in this line route. A design that avoids any risk of electrocution to birds would be correct for this line route.

Significance of impact with mitigation Low

1.6.6 Exotic Weed Invasion

Increases in the prevalence of exotic and invasive plants (e.g. *Datura ferox*) is highly probable often after the construction phase has concluded and possibly up to 5 years after such date.

Direct Impacts

- Increased levels of exotic plants within or around site. Concomitant invasion of neighbouring areas may arise.

Indirect Impacts

- Shifts in habitat form and structure as species associations change.

Cumulative Impacts

- Large scale presence of exotic and invasive species alters ecological process within the wider region.

The status of this impact is rated as negative and direct, indirect and cumulative in nature. The direct impact is rated with a local spatial extent. The impact is rated with a long-term duration (i.e. the impact and risk will occur for the project duration). The consequence and probability are respectively rated as slight and likely. The reversibility of the impact is rated as moderate and irreplaceability of the impact is rated as low.

The indirect impact is rated with a regional spatial extent. The impact is rated with a long-term duration (i.e. the impact and risk will occur for the project duration). The consequence and probability are respectively rated as slight and likely. The reversibility of the impact is rated as moderate and irreplaceability of the impact is rated as low.

The cumulative impact is rated with a regional spatial extent. The impact is rated with a long-term duration (i.e. the impact and risk will occur for the project duration). The consequence and probability are respectively rated as slight and likely. The reversibility of the impact is rated as moderate and irreplaceability of the impact is rated as low.

Significance of Impact without Mitigation Very Low

Mitigation

Proposed mitigation measures that may alleviate the significance of the above impacts include:

1. Implement intermittent but regular weed control initiatives, as well as regular visual monitoring and redress of exotic weeds in and around site, particularly the summer period.

Significance of the impact with mitigation Very Low

<u>Decommissioning Phase</u>

1.6.7 Removal of overhead transmission lines, as well as subtle changes in habitat, are likely to result in the alteration of avian behaviour following the loss of roosts and perches.

Direct Impacts

In a manner similar to the construction of additional points of purchase for in particular, raptors, it is evident that the loss of such areas will have a concomitant shift in avifaunal populations (particularly prey species) back to a population status akin to that presently encountered.

Indirect Impacts

- Subtle changes in avian populations in and around the site may become evident, depending upon other factors in the region, including the placement of other points of purchase in neighbouring areas.

Cumulative Impacts

- As the establishment and loss of points of purchase are generally unpredictable, it is likely that cumulative impacts will remain indeterminate.

The status of this impact is rated as negative and direct and indirect in nature. The direct and indirect impacts are rated with a local spatial extent. The impacts are rated with a long-term duration (i.e. the impact and risk will occur in perpetuity or until the status quo changes once again). The consequence and probability are respectively rated as slight and likely. The reversibility of the impact is rated as moderate and irreplaceability of the impact is rated as low.

Significance of impact without Mitigation **Very Low**

Mitigation

1. None identified.

Significance of impact with Mitigation **Very Low**

1.6.8 Exotic Weed Invasion

Increases in the prevalence of exotic and invasive plants (e.g. *Datura ferox*) are highly probable following the decommissioning of the powerlines. Such disturbance can be of a short period, with invasive weed impacts arising for periods in excess of 5 years.

Direct Impacts

- Increased levels of exotic plants within or around site. Concomitant invasion of neighbouring areas may arise.

Indirect Impacts

- Shifts in habitat form and structure as species associations change.

Cumulative Impacts

- Large scale presence of exotic and invasive species will alters ecological process within the wider region.

The status of this impact is rated as negative and direct, indirect and cumulative in nature. The direct impact is rated with a local spatial extent. The impact is rated with a long-term duration (i.e. the impact and risk will occur for the project duration). The consequence and probability are respectively rated as slight and likely. The reversibility of the impact is rated as moderate and irreplaceability of the impact is rated as low.

The indirect and cumulative impacts are rated with a local spatial extent. The impacts are rated with medium-term duration. The consequence and probability for the indirect and cumulative impacts are respectively rated as moderate and very likely. The reversibility of the impact is rated as moderate and irreplaceability of the impact is rated as low.

Significance of Impact without Mitigation (Direct Impact): Very Low
Significance of Impact without Mitigation (Indirect and Cumulative Impacts): Low

Mitigation

Proposed mitigation measures that may alleviate the significance of the above impacts include:

1. Implement intermittent but regular weed control initiatives for a period that spans at least two growing seasons.
2. Ensure the stabilization of site, once decommissioning and removal of infrastructure has arisen.

Significance of the impact with mitigation (Direct, Indirect and Cumulative) Very Low

1.6.9 Minor and subtle changes in the geomorphological state of drainage lines as hydraulic changes arise within the catchment

Direct Impacts

- Increased levels of erosion and minor turbidation of drainage features.
- Changes in the geomorphology of drainage lines

Indirect Impacts

- Changes in geomorphological state of watercourses, downstream of site.

Cumulative Impacts

- Overall levels of changes in watercourse morphology with possible change in associated ecologies.

The status of this impact is undefined and direct in nature. The direct impact is rated with a local to regional spatial extent. The impact is rated with a short term duration (i.e. the impact and risk will occur for project decommissioning and a short period thereafter). The consequence and probability are respectively rated as slight and likely. The reversibility of the impact is rated as high and irreplaceability of the impact is rated as low.

Significance of Impact without Mitigation Very Low

Mitigation

Proposed mitigation measures that may alleviate the significance of the above impacts include:

1. Stabilise disturbed grounds following removal of infrastructure.
2. Avoid disturbance to watercourses and points in and around watercourses.

Significance of the impact with mitigation Very Low

1.7 IMPACT ASSESSMENT SUMMARY

Table 4. Direct impacts assessment summary table for the Construction Phase

Construction Phase													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk: Without Mitigation/ Management	Significance of Impact and Risk: With Mitigation/ Management (Residual Impact/ Risk)	Ranking of Residual Impact/ Risk	Confidence Level
Alteration of habitat structure and composition in and around towers and possibly through the stringing phase of the project	Habitat and species loss	Negative	Site Specific (i.e. along the transmission line route)	Long-Term	Substantial	Very likely	Low	Low	Detailed design and incorporation of habitat and features into the routing of the proposed transmission line. Undertake plant rescue operations Implement exotic weed control A second assessment of the route should be undertaken in or around February to March in order to identify any additional plant specimens of significance that may be evident on route. Such specimens may be relocated/removed (i.e. search and rescue) or avoided (with the relevant permits and approvals in place) prior to the commencement of construction. The detailed design and confirmation of the proposed tower positions along the proposed powerline route should assist with the avoidance of specific vegetation associes and forms. Identification and avoidance of the Aloe associes identified. An initial pre-construction clearance of all exotic vegetation on route should be undertaken to reduce the possibility of further exotic weed invasion. Continued exotic weed control measures should be implemented during the construction phase that aligns with an exotic vegetation management plan.	Moderate	Very Low	5	High
Changes in the geomorphological state of drainage lines	Habitat change through changes in topographic drivers	Negative	Site Specific (i.e. along the transmission line route)	Medium-Term	Moderate	Likely	High	Low	Undertaking and completion of earthworks outside of the high rainfall period (if possible). Maintenance of a high level of housekeeping on route of the proposed transmission line during the construction phase. Inspection of drainage features immediately outside of the footprint of the proposed transmission line and undertake removal of solid waste and litter on a regular basis. Exclusion of major drainage lines from tower footprints.	Low	Very low	5	Medium

Construction Phase													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Increases in the prevalence of exotic and invasive plants	Water quality change and general pollution of resource	Negative	Local	Short term	Slight	Likely	High	Low	Exclusion of major drainage lines from the proposed development footprint. Avoidance of significant sculpting of land and maintenance of the general topography of the proposed transmission line route. Erosion control measures to be implemented to stabilize. Placement of energy dissipaters if identified around tower footings within minor drainage lines to reduce velocity of flow through such features and consequential disturbance Undertake regular visual monitoring and redress of exotic weeds in and around site, particularly during construction.	Low	Very low	5	High

Table 5. Indirect impacts assessment summary table for the Construction Phase

Construction Phase													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Alteration of habitat structure and composition in and around towers and possibly through the stringing phase of the project	Habitat and species loss	Negative	Site Specific (i.e. along the transmission line route)	Long-Term	Substantial	Very likely	Low	Low	Implement exotic weed control A second assessment of the route should be undertaken in or around February to March (subsequent to the issuing of an Environmental Authorisation and the completion of the detailed engineering) in order to identify any additional plant specimens of significance that may be evident on route. Undertake plant rescue operations, where such specimens may be relocated/removed (i.e. search and rescue) or avoided (with the relevant permits and approvals in place) prior to the commencement of construction. Detailed design and incorporation of habitat and features into the routing of the proposed transmission line. The detailed design and confirmation of the proposed tower positions along the proposed powerline route should assist with the avoidance of specific vegetation associes and forms (where applicable). An initial pre-construction clearance of all exotic vegetation on route should be undertaken to reduce the possibility of further exotic weed invasion. Continued exotic weed control measures should be implemented during the construction phase that aligns with an exotic vegetation management plan.	Moderate	Very Low	5	High
Changes in the geomorphological state of drainage lines	Habitat change through changes in topographic drivers	Negative	Site Specific (i.e. along the transmission line route)	Medium-Term	Moderate	Likely	High	Low	Undertaking and completion of earthworks outside of the high rainfall period (if possible). Maintenance of a high level of housekeeping on route of the proposed transmission line during the construction phase. Inspection of drainage features immediately outside of the footprint of the proposed transmission line and undertake removal of solid waste and litter on a regular basis. Exclusion of major drainage lines from tower footprints.	Low	Very low	5	Medium

Construction Phase													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Increases in the prevalence of exotic and invasive plants (leading to shifts in habitat form and structure as species associations change)	Water quality change and general pollution of resource (including habitat and behavioural changes)	Negative	Local	Short term	Slight	Likely	High	Low	Exclusion of major drainage lines from the proposed development footprint. Avoidance of significant sculpting of land and maintenance of the general topography of the proposed transmission line route. Erosion control measures to be implemented to stabilize. Placement of energy dissipaters if identified around tower footings within minor drainage lines to reduce velocity of flow through such features and consequential disturbance Undertake regular visual monitoring and redress of exotic weeds in and around site, particularly during construction.	Low	Very low	5	High

Table 6. Cumulative impacts assessment summary table for the Construction Phase

Construction Phase													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Alteration of habitat structure and composition in and around towers and possibly through the stringing phase of the project	Habitat and species loss	Negative	Regional	Long-Term	Substantial	Very likely	Low	Low	None identified	Moderate	Not Applicable	3	High
Changes in the geomorphological state of drainage lines	Habitat change through changes in topographic drivers	Negative	Regional	Medium-Term	Moderate	Likely	High	Low	Broadscale management of drainage systems in the region	Low	Very low	5	Medium
Increases in the prevalence of exotic and invasive plants (leading to alteration of ecological processes within the wider region)	Water quality change and general pollution of resource	Negative	Regional	Short term	Slight	Likely	High	Low	Undertake regular visual monitoring and redress of exotic weeds in and around site.	Low	Very low	5	High

Table 7. Direct impact assessment summary table for the Operation Phase

Operation Phase													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Overhead transmission lines, as well as subtle changes in habitat are likely to result in the alteration of avian behaviour in and around the route	Habitat and species loss	Negative	Local	Long-Term	Substantial	Likely	Moderate	Low	Detailed design and incorporation of habitat and features into the routing of the proposed transmission line. Implement exotic weed control.	Moderate	Very Low	5	High
The powerlines may increase the risk of collision and electrocution in some avifauna.	Habitat change through changes in topographic drivers	Negative	Local	Short term	Moderate	Likely	High	Low	Placement of bird flight diverters on the proposed powerline along line route. The Delta tower configuration should not be utilised in this line route. A design that avoids any risk of electrocution to birds would be correct for this line route.	Low	Low	4	High
Increases in the prevalence of exotic and invasive plants	Habitat change	Negative	Local	Long term	Slight	Likely	Moderate	Low	Implement intermittent but regular weed control initiatives	Very Low	Very Low	5	High

Table 8. Indirect impact assessment summary table for the Operation Phase

Operation Phase													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk: Without Mitigation/ Management	Significance of Impact and Risk: With Mitigation/ Management (Residual Impact/ Risk)	Ranking of Residual Impact/ Risk	Confidence Level
Increases in the prevalence of exotic and invasive plants	Habitat change	Negative	Regional	Long term	Slight	Likely	Moderate	Low	Implement intermittent but regular broadscale weed control initiatives	Very Low	Very Low	5	High

Table 9. Cumulative impact assessment summary table for the Operation Phase

Operation Phase													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Overhead transmission lines, as well as subtle changes in habitat are likely to result in the alteration of avian behaviour in and around the route	Habitat and species loss	Negative	Local	Long-Term	Substantial	Likely	Moderate	Low	Detailed design and incorporation of habitat and features into the routing of the proposed transmission line.	Moderate	Very Low	5	High
The powerlines may increase the risk of collision and electrocution in some avifauna. An increase in towers and powerlines will result in greater mortalities in the region.	Habitat change through changes in topographic drivers	Negative	Local	Short term	Moderate	Likely	High	Low	Placement of bird flight diverters on the proposed powerline along line route. The Delta tower configuration should not be utilised in this region	Low	Low	4	High
Increases in the prevalence of exotic and invasive plants	Habitat change	Negative	Regional	Long term	Slight	Likely	Moderate	Low	Implement intermittent but regular broadscale weed control initiatives	Very Low	Very Low	5	High

Table 10. Direct impact assessment summary table for the Decommissioning Phase

Decommissioning Phase													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk: Without Mitigation/ Management	Significance of Impact and Risk: With Mitigation/ Management (Residual Impact/ Risk)	Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Removal of overhead transmission lines, as well as subtle changes in habitat are likely to result in the alteration of avian behaviour following the loss of roosts and perches	Habitat and species loss	Negative	Local	Long-Term	Slight	Likely	Moderate	Low	None identified	Very Low	Very Low	5	High
Minor and subtle changes in the geomorphological state of drainage lines as hydraulic changes arise within the catchment	Changes in hydrology and water quality	Undefined	Local to regional	Short term	Slight	Likely	High	Low	Stabilisation of disturbed grounds and avoidance of undue disturbance in and around watercourses	Very low	Very Low	5	High
Increases in the prevalence of exotic and invasive plants	Habitat change	Negative	Local	Long term	Slight	Likely	Moderate	Low	Implement intermittent but regular weed control initiatives for a period of two growing seasons. Ensure the stabilization of site, once decommissioning and removal of infrastructure has arisen.	Very Low	Very Low	5	High

Table 11. Indirect impact assessment summary table for the Decommissioning Phase

Decommissioning Phase													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Removal of overhead transmission lines, as well as subtle changes in habitat are likely to result in the alteration of avian behaviour following the loss of roosts and perches	Habitat and species loss	Negative	Local	Long-Term	Slight	Likely	Moderate	Low	None identified	Very Low	Very Low	5	High
Increases in the prevalence of exotic and invasive plants	Habitat change	Negative	Local	Medium term	Moderate	Very likely	Moderate	Low	Medium term exotic weed and vegetation control interventions	Low	Very low	5	High

Table 12. Cumulative impact assessment summary table for the Decommissioning Phase

Decommissioning Phase													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Increases in the prevalence of exotic and invasive plants	Habitat change	Negative	Local	Medium term	Moderate	Very likely	Moderate	Low	Medium term exotic weed and vegetation control interventions	Low	Very low	4	High

1.8 INPUT TO THE ENVIRONMENTAL MANAGEMENT PROGRAMME

Utilising the above information the following broad issues are considered within the Environmental Management Programme that would be associated with the proposed development.

Pre-Construction Phase:

- Pre-construction evaluation and possible plant rescue operations;
- Identification of the proposed tower positions and design to be utilised along line route;
- Identification of laydown areas, roadways etc. along route and evaluation of affected points within route, particularly in respect of floral and faunal presence.
- Permitting requirements in terms of the National Water Act and Northern Cape Conservation Act if identified as a requirement.

Construction Phase:

- Induction and interaction within management on ecological aspects;
- Route inspection and sweep of any fauna within the construction area;
- Monitoring of construction activities and operations, including species presence within the proposed transmission line route, mortalities and sitings;
- Maintenance of vegetation and avoidance of unnecessary clearance of route;
- Exotic weed management; and
- Erosion control measures to be implemented where applicable.

Post Construction Phase:

- Monitoring of avifaunal presence – nesting of species (e.g. *Philetairus socius)* as well as mortalities that may have arisen;
- Vegetation management along route – consideration of redress methods of growth and habitat form around towers if required;
- Exotic weed management; and
- Erosion control measures if required along the proposed transmission line route.

1.9 CONCLUSION AND RECOMMENDATIONS

The ecological evaluation of the proposed corridor included consideration of the bio physical state of drainage systems, topographical features and a holistic review of all components within the ecological landscape. The evaluation of the results of desktop and field reconnaissance identified and served to develop a plan for the exclusion of particular areas from the proposed development. Included in the assessment was consideration of terrestrial and hydrological systems, as well as fauna (including avifauna). Major impacts identified as a consequence of the development proceeding relate to, inter alia;

- Alteration of habitat structure and composition in and around towers and possibly through the stringing phase of the project;
- Changes in the geomorphological state of drainage lines, where affected;
- Increases in the prevalence of exotic and invasive plants, where disturbance arises;

- Alteration of avian behaviour in and around the proposed corridor route due to the operation and existence of the overhead transmission lines, as well as subtle changes in habitat; and
- The powerlines may increase the risk of collision and electrocution in some avifauna.

None of the above impacts have been identified as being of high significance (with the implementation of mitigation measures). Most impacts arising can be considered to be of low to very significance in a holistic evaluation.

Given the above information, it is evident that with the judicious placement of the proposed transmission line towers and the use of the proposed corridor route as envisaged, that little negative ecological ramifications will arise, with the *proviso* that the proposed mitigation measures are implemented.

Evidently, the proposed corridor:

- Excludes or spans any drainage features within the powerline corridor.
- Avoidance of the Aloe consocies identified. This may be achieved, preferentially by locating the final route proximal to the existing railway line / roadway, or less favourably by spanning over the associes. The relocation of these specimens is possible; however this method should be avoided.
- Management of exotic weed invasion that may arise. This is discussed in the EMPr and should be incorporated into a final programme for vegetation management.
- Management of avifauna impacts along the powerline route by the establishment of bird flight diverters and the use of appropriate tower design; and
- General land management practices to avoid excessive erosion, dust emissions and possible sources of pollution to ground and surface water resources.

Sound planning and management would include:

- Avoidance of excessive clearance of vegetation within the proposed transmission line corridor, particularly around towers;
- Management of exotic weed invasion that may arise. This is discussed in the EMPr and should be incorporated into a final programme for vegetation management;
- Management of avifauna impacts along the powerline route by the establishment of bird flight diverters and the use of appropriate tower design; and
- General land management practices to avoid excessive erosion, dust emissions and possible sources of pollution to ground and surface water resources.

There is in our opinion no necessity for a Water Use Licence in respect of the proposed powerline at this point however this will be determined by the Department of Water and Sanitation. It is noted that the watercourses do not meet the criteria to be termed “wetlands”, while the final routing of the powerline may fall in excess of 500 m from the watercourses, thus not necessitating a Water Use Licence application.

The above, along with the various mitigation measures espoused in this report should be incorporated as conditions, into any authorisation granted by the relevant authority.

It is our opinion that with the implementation of the above, the powerline corridor, subject to final design and adherence to the above recommendations, should be authorised.

1.10 REFERENCES

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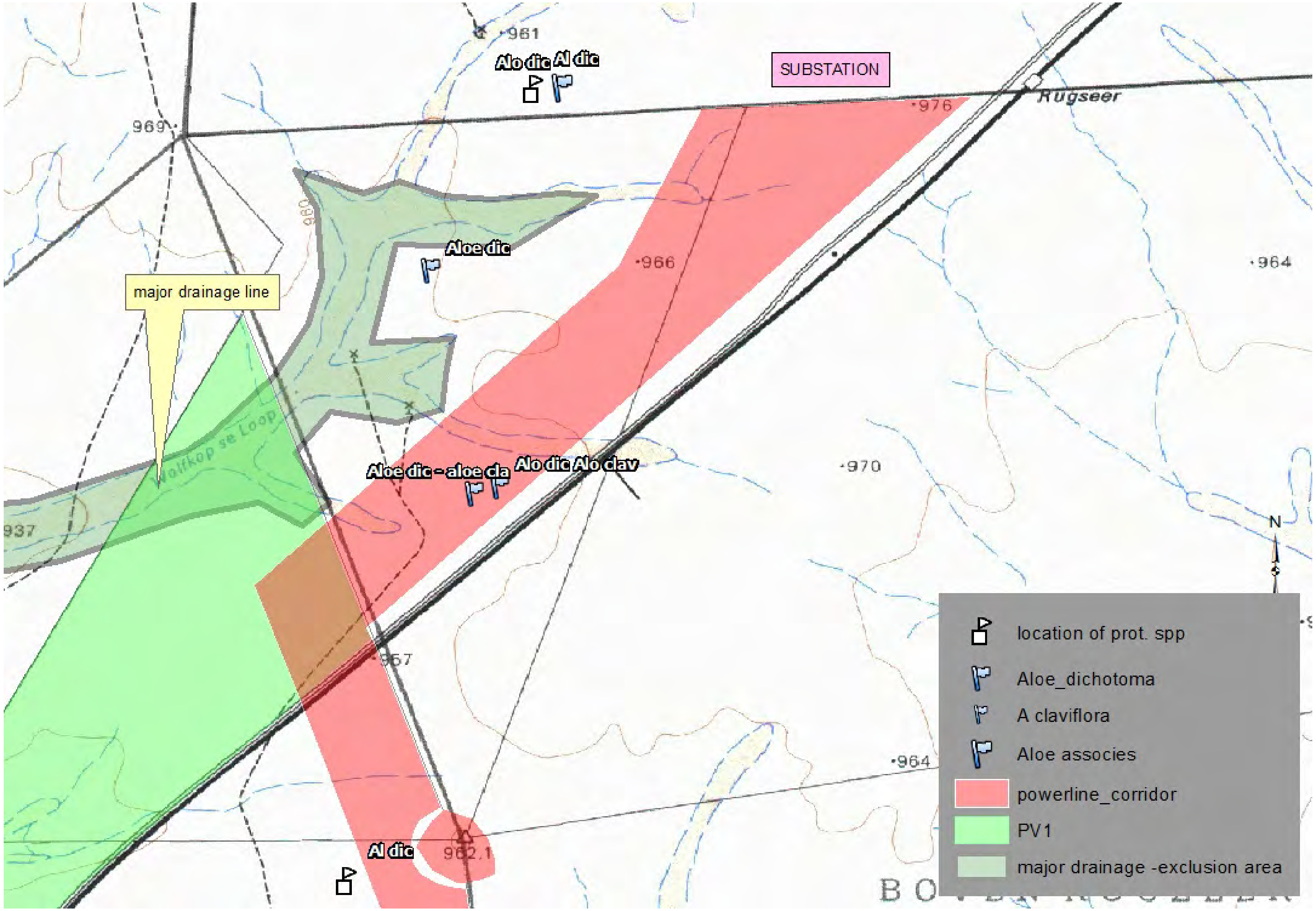
1.11 APPENDICES

1.11.1 Sensitivity mapping overlays of corridor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SUBSTATION
976
Rugseer
969
Aloe dic
966
964
major drainage line
Volfkop se Loop
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Alo dic Alo clav
970
937
N
957
964
Al dic
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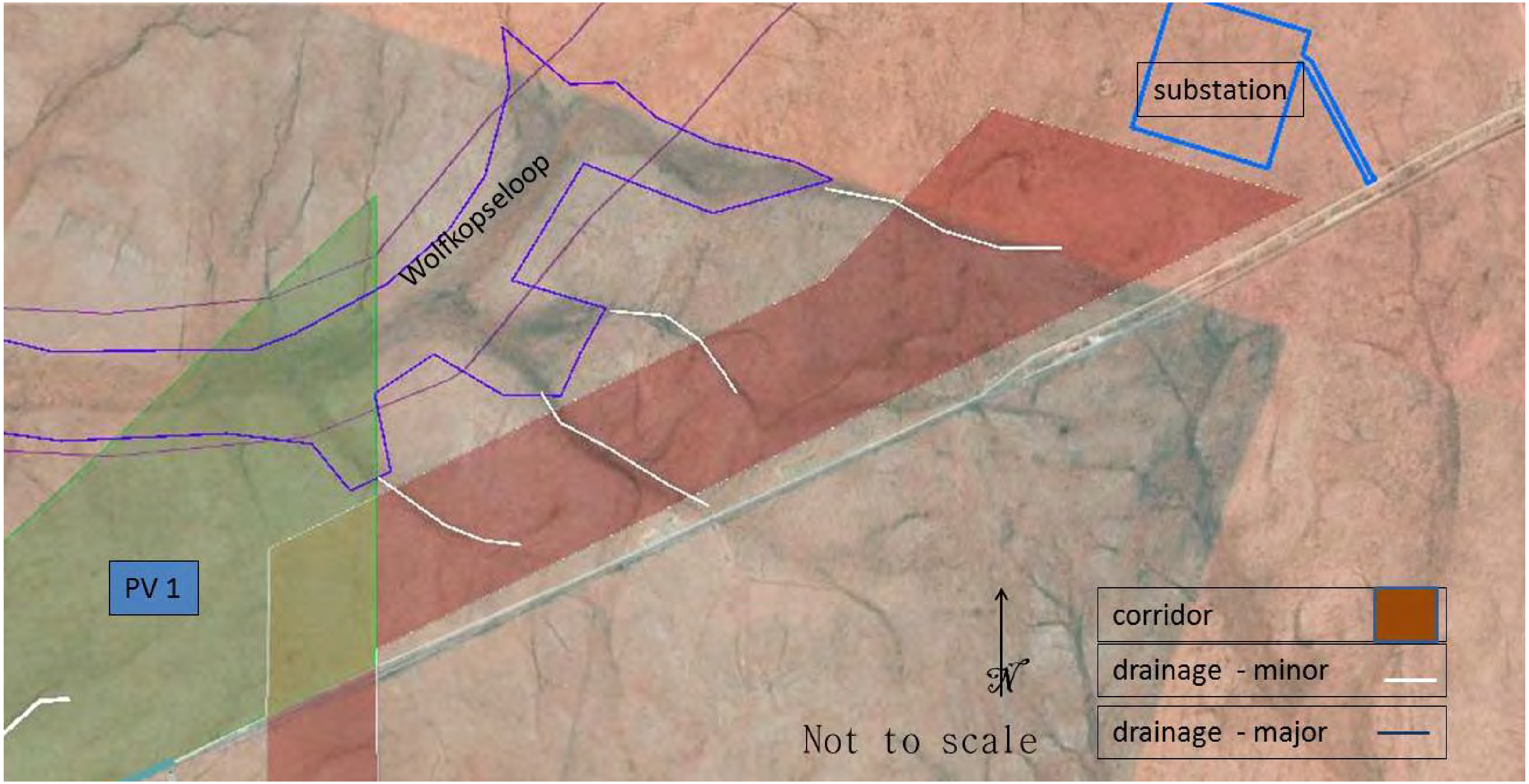
A claviflora
Aloe associes
powerline_corridor
PV1
major drainage -exclusion area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Wolfkopseloop
PV 1
corridor
drainage - minor
drainage - major
N
Not to scale

BASIC ASSESSMENT REPORT

Appendix D.2:
Visual Impact Assessment

VISUAL IMPACT ASSESSMENT

Basic Assessment for the Proposed Development of a 132 kV Transmission Line (Kenhardt PV 1 – Transmission Line) to service the proposed 75 MW Solar Photovoltaic Facility (Kenhardt PV 1) on the remaining extent of Onder Rugzeer Farm 168, north-east of Kenhardt, Northern Cape Province

Report prepared for:

CSIR – Environmental Management Services

P O Box 17001

Congella, Durban, 4013

South Africa

Report prepared by:

Henry Holland

8 Cathcart Street

Grahamstown, 6139

South Africa

March 2016

SPECIALIST EXPERTISE

CURRICULUM VITAE – HENRY HOLLAND

Profession: GIS Consultant
Date of Birth: 26 December 1968

BIOGRAPHICAL SKETCH

Henry has been doing GIS related work since 1992 when he started his M.Sc. in Geology. Since finishing his Masters he worked in Angola establishing a GIS department for a diamond exploration company, after which he worked on a freelance basis for eight years doing GIS related work and computer programming. In 2005 he established the Mapthis Trust which provides geospatial services for a range of environmental and geological companies and projects. Henry has been involved in Visual Impact Assessments (VIAs) since 1997.

TERTIARY EDUCATION

1996	M. Sc. Geology/GIS	Rhodes University
1986	B.Sc. Hons	UOFS

KEY EXPERIENCE

The table below presents an abridged list of Henry's project experience relevant to this project:

Completion Date	Project Description	Role	Client
2015	Umgeni Water Lovu and Tongaat Desalination Plants EIAs, KwaZulu-Natal	Author	CSIR
2015	Inyanda-Roodeplaat WEF, Uitenhage, EC	Author	SRK
2015	OTGC Oil Storage Terminal BA – Visual Impact, Durban, KZN	Author	CSIR
2014	Mainstream Dealesville Solar Plants VIA, Freestate Province	Author	CSIR
2014	Mulilo Solar Plants VIA, Northern Cape	Author	CSIR
2014	Frontier SRMOP EIA, Saldanha, WC	Author	CSIR
2013	Ishwati Emoyeni Wind Energy Facility VIA, Western Cape	Author	CSIR
2013	Venter Fert Composting and Fertiliser Plant	Author	Public Process Consultants
2013	Kipeto Power Line, Kenya	Author	Kipeto Energy Ltd.
2012	Ngqura Manganese Export Facility VIA, Coega, Eastern Cape	Author	CSIR
2012	Toliara Sands Mining Project VIA, Toliara, Madagascar	Author	CES
2012	Mkuze Biofuel Power Plant VIA, Mkuze, KwaZulu-Natal	Author	CSIR
2012	Vleesbaai WEF VIA, Western Cape	Author	CSIR
2012	Saldanha Desalination Plant VIA, Saldanha Bay, Western Cape	Author	CSIR
2012	Mossel Bay WEF, Western Cape	Author	CES
2012	Keimoes Solar Energy Facility, NC	Author	CSIR
2012	Douglas Solar Energy Facility, NC	Author	CSIR
2012	Richards Bay WEF VIA, KZN	Author	CES
2012	Hluhluwe WEF VIA, KZN	Author	CES

Completion Date	Project Description	Role	Client
2012	Plan8 Grahamstown Wind Farm VIA, Eastern Cape	Author	CES
2012	Kipeto Wind Farm VIA, Kenya	Author	Galetech Energy Developments Ltd.
2011	Coega IDZ Zone 12 Wind Farm	Author	CSIR
2011	Haverfontein Wind Farm, Mpumalanga	Author	CES
2011	Middleton Wind Farm, Cookhouse	Author	CES
2011	Broadlands PV Plant, Humansdorp	Author	CSIR
2011	Ubuntu Wind Farm, Jeffrey's Bay	Author	CSIR
2011	Lushington Park Wind Farm, East London	Author	CES
2011	Chaba Wind Farm, Komga	Author	CES
2010	Thomas River Wind Farm and PV Park VIA, Stutterheim	Author	CES
2010	Eskom Power Line VIA, Kouga	Author	CES
2010	Laguna Bay Resort VIA	Author	CES
2010	Kouga Wind Farm VIA	Author	Arcus GIBB
2010	Electrawinds Coega Wind Farm VIA	Author	CSIR
2010	Innowind Coega Wind Farm VIA	Author	CES
2010	Jeffrey's Bay Wind Farm VIA, Jeffrey's Bay	Author	CSIR
2010	Cookhouse Wind Farm VIA, Cookhouse	Author	CES
2009	Waainek Wind Farm VIA, Grahamstown	Author	CES
2009	Coega Wind Turbine BA (Visual Input)	Author	CSIR
2009	Sierra Leone Ethanol Plant VIA	Author	CSIR
2009	NamWater Desalination Plant VIA, Swakopmund, Namibia	Author	CSIR
2009	Nooitgedagt/Coega Water Supply VIA, Motherwell	Author	SRK
2009	CDM Brewery VIA, Nampula, Mozambique	Author	CES
2009	TankaTara Preliminary Visibility Analysis, Addo	Author	CES
2008	Kouga Wind Energy Project VIA, Jeffreys Bay	Author	CSIR
2008	Aston Bay VIA	Author	CES
2008	NPA Boundary Wall VIA, Port Elizabeth	Author	CSIR
2008	Elitheni Coal Mining VIA, Indwe	Author	Savannah Environmental (PTY) Ltd.
2008	Coegakamma Chicken Broiler Housing VIA	Author	Public Process Consultants
2008	Amanzi Country Lifestyle Estate VIA, Uitenhage	Author	Public Process Consultants

I, the undersigned, certify that to the best of my knowledge and belief, these data correctly describe my qualifications, my experience, and me, and that I am available to work on this project.

H. Holland.

Date: 12/03/16

[Signature of staff member and authorized representative of the firm] Day/Month/Year

Full name of staff member: Henry Holland

SPECIALIST DECLARATION

I, Henry Holland, as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

- I act as the independent specialist in this application;
- I perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I have no vested interest in the proposed activity proceeding;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist: H. Holland.

Name of Specialist: Henry Holland

Date: 15 February 2016

EXECUTIVE SUMMARY

The Visual Impact Assessment specialist study compiled for the proposed 132 kV powerline connecting the proposed Kenhardt PV 1 Solar Photovoltaic (PV) plant near Kenhardt, Northern Cape, to the Eskom grid at the Nieuwehoop Substation was conducted by Henry Holland.

The landscape surrounding the proposed route has a rural agricultural character which has been transformed by extensive stock farming and large scale infrastructure in the form of the Sishen-Saldanha ore railway line and Eskom Nieuwehoop Substation.

The following sensitive visual receptors will potentially be affected by the introduction of the proposed 132 kV powerline into the landscape:

- Residents and viewpoints on farms surrounding the proposed development site. These are highly sensitive visual receptors since they have an active interest in their surrounding landscape; and
- Motorists using the R383 and the Transnet Service Road (i.e. Loop 14) adjacent to the ore railway line. Motorists are classified as low sensitivity visual receptors since they pass through the landscape and their attention is mostly focused on the road.

In terms of the proposed transmission line which will support the Kenhardt PV 1 project, there are unlikely to be highly sensitive visual receptors that will be highly exposed to the power line.

Visual intrusion will be low for visual receptors on surrounding farms since the landscape is already transformed by structures similar to those of the proposed power line.

Motorists using the gravel road adjacent to the Sishen-Saldanha railway line will experience low visual intrusion since their views are already severely impacted by the railway line and substation.

The significance of the potential visual impact of construction activities on existing views of sensitive visual receptors will be low before and after mitigation since the consequence of the impact is rated as moderate and its extent is rated as local.

The significance of the impact that the proposed development will potentially have on the landscape during the operational phase is rated as very low since its consequence is rated as slight (the landscape already contains large scale electrical infrastructure) and its extent is local.

The significance of the visual intrusion of the proposed development on the views of sensitive visual receptors during the operational phase is rated as very low since very few sensitive visual receptors are likely to be affected by the development and its visual intrusion on their views is low. The consequence of the impact is expected to be slight, its duration long term and its extent local.

The significance of the potential visual impact of decommissioning activities is rated as low before mitigation since these activities are very similar to construction activities but should be shorter in duration.

The cumulative landscape impact of various solar energy projects and their associated electrical infrastructure in the surrounding landscape will have a slight consequence since the landscape character has been extensively altered by the railway line and Nieuwehoop Substation. The significance of the cumulative impact is very low since the landscape is rapidly changing due to the introduction of large scale and highly visible rail and electrical infrastructure.

The significance of the cumulative visual impact on existing views of sensitive visual receptors is rated as very low due to the existing and new structures which have severely limited potential scenic views in the region.

Overall, the proposed transmission line will fit in with the landscape as it exists now as well as with plans for the future of the surrounding landscape. The overall significance of the visual impact of the proposed 132 kV powerline is low.

COMPLIANCE WITH THE APPENDIX 6 OF THE 2014 EIA REGULATIONS

Requirements of Appendix 6 – GN R982	**Addressed in the Specialist Report**
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Preliminary Section of this report
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Appendix I of the BA Report, Preliminary Section of this report and Section 1.1.6
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1.1
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1.1.3
e) a description of the methodology adopted in preparing the report or carrying out the specialised process;	Section 1.1.3
f) the specific identified sensitivity of the site related to the activity and its associated structures and infrastructure;	Section 1.3
g) an identification of any areas to be avoided, including buffers;	Section 1.3
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Figure 1.1 and Section 1.3
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.1.4
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment;	Section 1.7
k) any mitigation measures for inclusion in the EMPr;	Section 1.9
l) any conditions for inclusion in the environmental authorisation;	None
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 1.9
n) a reasoned opinion- i. as to whether the proposed activity or portions thereof should be authorised; and ii. if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 1.10
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	None
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Not Applicable
q) any other information requested by the competent authority.	None

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LIST OF ABBREVIATIONS

DEA	Department of Environmental Affairs
EIA	Environmental Impact Assessment
CPV	Concentrated Photovoltaic
DEM	Digital Elevation Model
GIS	Geographic Information System
PV	Photovoltaic
VIA	Visual Impact Assessment

GLOSSARY

Definitions	
Cumulative viewshed	A viewshed which indicates in some way how much of a development is visible from a particular viewpoint. In a raster based cumulative viewshed each pixel value will indicate how many points within the development area are visible. A power line development could, for example, use pylons as points to generate a cumulative viewshed for the development. Each pixel value in the viewshed will be a count (accumulation) of the number of pylons that will potentially be visible from that pixel.
Digital Elevation Model (DEM)	A digital or computer representation of the topography of an area.
Landscape baseline	A description of the existing elements, features, characteristics, character, quality and extent of the landscape (GLVIA, 2002).
Landscape character	The distinct and recognisable pattern of elements that occurs consistently in a particular type of landscape, and how this is perceived by people. It reflects particular combinations of geology, landform, soils, vegetation, land use and human settlement. It creates the particular sense of place of different areas of the landscape (GLVIA, 2002).
Landscape impacts	Change in the elements, characteristics, character and qualities of the landscape as the result of development (GLVIA, 2002). These effects can be positive or negative, and result from removal of existing landscape elements, addition of new elements, or the alteration of existing elements.
Sense of place	That distinctive quality that makes a particular place memorable to the visitor, which can be interpreted in terms of the visual character of the landscape. The unique quality or character of a place, whether natural, rural or urban. Relates to uniqueness, distinctiveness or strong identity (Oberholzer 2005).
Viewer sensitivity	The assessment of the receptivity of viewer groups to the visible landscape elements and visual character and their perception of visual quality and value. The sensitivity of viewer groups depends on their activity and awareness within the affected landscape, their preferences, preconceptions and their opinions.
Viewshed	A viewshed is an area of land, water, and other environmental elements that is visible from a fixed vantage point. In digital imaging, a viewshed is a binary raster indicating the visibility of a viewpoint for an area of interest. A pixel with a value of unity indicates that the viewpoint is visible from that pixel, while a value of zero indicates that the viewpoint is not visible from the pixel.
Visual exposure	Visual exposure refers to the relative visibility of a project or feature in the landscape (Oberholzer, 2005). Exposure and visual impact tend to diminish exponentially with distance.

Definitions	
Visual impact assessment	A specialist study to determine the visual effects of a proposed development on the surrounding environment. The primary goal of this specialist study is to identify potential risk sources resulting from the project that may impact on the visual environment of the study area, and to assess their significance. These impacts include landscape impacts and visual impacts.
Visual intrusion	Visual intrusion indicates the level of compatibility or congruence of the project with the particular qualities of the area – its 'sense of place'. This is related to the idea of context and maintaining the integrity of the landscape (Oberholzer 2005).
Visual receptors	Visual receptors include viewer groups such as the local community, residents, workers, the broader public and visitors to the area, as well as public or community areas from which the development is visible.
Visual resource	Visual resource is an encompassing term relating to the visible landscape and its recognisable elements which, through their coexistence, result in a particular landscape and visual character

VISUAL IMPACT ASSESSMENT

This report presents the findings of the Visual Impact Assessment that was prepared by Mr. Henry Holland as part of the Basic Assessment (BA) for the proposed Kenhardt PV 1 – Transmission Line project within the Northern Cape Province.

1.1 INTRODUCTION AND METHODOLOGY

1.1.1 Scope and Objectives

As noted in Section A of the BA Report, the Project Applicant intends to develop three 75 Megawatt (MW) Solar Photovoltaic (PV) Facilities (referred to as Kenhardt PV 1, Kenhardt PV 2, and Kenhardt PV 3) on the remaining extent of Onder Rugzeer Farm 168. The farm is located 30 km north-east of Kenhardt and 80 km south of Upington within the Kheis Local Municipality, Northern Cape Province. These three 75 MW Solar PV Facilities require a Scoping and Environmental Impact Assessment (EIA). An EIA Process is being conducted separately for each proposed PV facility. However, a separate BA Process is being conducted to assess the proposed construction of transmission lines for each proposed 75 MW Solar PV facility. The proposed transmission lines will extend from the proposed Kenhardt PV 1, Kenhardt PV 2 and Kenhardt PV 3 projects to Portion 3 of Farm Gemsbok Bult 120. The proposed transmission lines will also traverse (aboveground) the Remainder of Boven Rugzeer 169 and Portion 4 of Onder Rugzeer Farm 168. As noted above, this Visual Impact Assessment is being undertaken as part of the requisite BA Process for the proposed transmission line to service the proposed Kenhardt PV 1 project.

The overall scope and objectives of this Visual Impact Assessment are to:

- Determine the current conditions in sufficient detail so that there is a baseline against which impacts can be identified and measured;
- Identify potential impacts that may occur during the construction, operational and decommissioning phases of development, as well as impacts associated with future environmental changes if the “no-go” option is implemented (both positive and negative);
- Assess the impacts, in terms of direct, indirect and cumulative impacts;
- Provide recommendations with regards to potential monitoring programmes;
- Determine mitigation and/or management measures which could be implemented to as far as possible reduce the effect of negative impacts and enhance the effect of positive impacts; and
- Incorporate and address all issues and concerns raised by I&APs and the public.

1.1.2 Terms of Reference

The Terms of Reference for the Visual Impact Assessment are as follows:

- Review detailed information relating to the project description and precisely define the environmental risks to the landscape and the risks to sensitive viewers, as well as the consequences thereto.
- Conduct a site visit and undertake a Photographic Survey of the surrounding region from which the landscape and visual baselines can be prepared.

- Compile a baseline description of the visual character/baseline and the landscape of the affected area.
- Undertake data preparation and the visibility analysis, which includes the calculation of viewsheds for various elements of the proposed development. Identify principal viewpoints and sensitive visual receptors.
- Identify and rate potential direct, indirect and cumulative impacts on the landscape and on sensitive viewers/receptors for the construction, operation and decommissioning phases of the proposed project. Study the cumulative impacts of the project by considering the impacts of existing industries within the area, together with the impact of the proposed project.
- Provide input to the Environmental Management Programme (EMPr), including mitigation and monitoring requirements to ensure that the visual impacts on the principal viewpoints and sensitive viewsheds are mitigated.
- Compile an assessment report (i.e. this report) qualifying the results of the fieldwork, risks and potential visual impacts, and impact evaluations, including potential mitigation measures, monitoring requirements as well as relevant recommendations.

1.1.3 Approach and Methodology

This Visual Impact Assessment (VIA) is based on guidelines for visual assessment specialist studies as set out by South Africa's Western Cape Department of Environmental Affairs and Development Planning (DEA&DP) (Oberholzer, 2005), as well as guidelines provided by the Landscape Institute of the UK (GLVIA 2002).

A visibility analysis was conducted for the region surrounding the proposed development site and components of the development relevant to the assessment of the potential visual impact (10 km radius) to identify key representative viewpoints and sensitive visual receptors. A site visit and photographic survey of this region followed to establish a baseline for visual resources to compare the proposed developments against. Spatial Development Frameworks (SDF) and Integrated Development Plans (IDP) for the relevant municipalities were studied to align the VIA with municipal objectives in terms of landscape and visual resources.

The key steps followed in the VIA are presented below:

Site Visit and Photographic Survey

The field survey (conducted on 23-25 October 2015) provided an opportunity to:

- Determine the actual or practical extent of potential visibility of the proposed development, by assessing the screening effect of landscape features;
- Conduct a photographic survey of the landscape surrounding the development;
- Take photos for use in photomontage images;
- Identify sensitive landscape and visual receptors;
- Viewpoints were chosen using the following criteria:
    - High visibility – sites from where most of the solar facility will be visible;
    - High visual exposure – sites at various distances from the proposed site; and
    - Sensitive areas and viewpoints such as nature reserves and game farms from which power lines will potentially be seen.
- Additionally, photo sites were chosen to aid in describing the landscape surrounding, and potentially affected by, the proposed development.

Field work was conducted in Spring but seasonal differences in vegetation cover and atmospheric conditions are slight and contrasts in texture and colour between development structures and landscape background will not change enough due to seasonal changes to invalidate this assessment.

Landscape Description

A desktop study was conducted to establish and describe the landscape character of the receiving environment. A combination of data analysis using a Geographic Information System (GIS), literature review and photographic survey was used to identify land cover, landforms and land use in order to gain an understanding of the current landscape within which the development will take place (GLVIA 2002). Areas of scenic interest, potential sensitive receptors (viewpoints, residences), preliminary zone of visual influence, and principal representative viewpoints were also identified. Landscape features of special interest were identified and mapped, as were landscape elements that may potentially be affected by the development.

VIA

A GIS (TNTmips[1]) is used to calculate viewsheds for various components of the proposed development. The viewsheds and information gathered during the field survey were used to define criteria such as visibility, viewer sensitivity, visual exposure and visual intrusion for the proposed development. These criteria were, in turn, used to determine the intensity of potential visual impacts on sensitive viewers. All information and knowledge acquired as part of the assessment process was then used to determine the potential significance of the impacts according to the standardised rating methodology as described in Section D of the BA Report for the project.

1.1.4 Assumptions and Limitations

1.1.4.1 Assumptions

Mitigation Measures

Mitigation measures in this report will assume that construction activities are managed and performed in such a way as to minimise its impact on the receiving environment. The following assumptions, in particular, apply since they are relevant to minimising visual impact during the construction phase:

- The contractor will maintain good housekeeping on site to avoid litter and minimise waste;
- Project developers will demarcate construction boundaries and minimise areas of surface disturbance;
- Vegetation and ground disturbance will be minimised and take advantage of existing clearings;
- Construction of new roads will be minimised and existing roads will be used where possible;
- Topsoil from the site will be stripped, stockpiled, and stabilised before excavating earth for the construction of the proposed transmission line;

[1] http://www.microimages.com/products/tntmips.htm

- Vegetation material from vegetation removal will be mulched and spread over fresh soil disturbances to aid in the rehabilitation process;
- Plans will be in place to control and minimise erosion risks;
- Plans will be in place to minimise fire hazards and dust generation; and
- Plans will be in place to rehabilitate cleared areas as soon as possible.

Cumulative Impacts

Cumulative impacts are assessed by adding expected impacts from this proposed development to existing and proposed developments with similar impacts in a 20 km radius (of the proposed Kenhardt PV projects). The existing and proposed developments that were taken into consideration for cumulative impacts include (CSIR 2015):

- Nieuwehoop 400/50 kV Substation located in close proximity to the proposed Solar Energy Facility (under construction);
- 2 x 400 kV power lines from Aries to the Solar CSP near Upington (under construction);
- 400 kV power line from Nieuwehoop Substation to the Solar CSP near Upington;
- Proposed Scatec Solar Kenhardt PV projects (i.e. Kenhardt PV 1, Kenhardt PV 2, and Kenhardt PV 3);
- Proposed Transmission Line to connect the proposed 75 MW Solar PV Facility (Kenhardt PV 2) to the Eskom Nieuwehoop Substation (i.e. Kenhardt PV 2 – Transmission Line);
- Proposed Transmission Line to connect the proposed 75 MW Solar PV Facility (Kenhardt PV 3) to the Eskom Nieuwehoop Substation (i.e. Kenhardt PV 3 – Transmission Line);
- Proposed Mulilo Renewable Project Developments (Pty) Ltd Solar PV projects: Phase 1 (i.e. Boven Solar PV 1 (on the remaining extent of the Farm Boven Rugzeer 169, Kenhardt), Gemsbok Solar PV 1 (on the remaining extent of Portion 3 of the Farm Gemsbok Bult 120, Kenhardt) and Gemsbok Solar PV 2 (on the remaining extent of Portion 3 of the Farm Gemsbok Bult 120, Kenhardt));
- Proposed Mulilo Renewable Project Developments (Pty) Ltd Solar PV projects: Phase 2 (i.e. seven 75 MW PV OR Concentrated PV Solar Energy Facilities and associated infrastructure near Kenhardt); and
- Proposed Straussheim Solar project (initial phases of EIA Process).

All the developments that have been considered in the assessment of cumulative impacts are also listed in Section D of the BA Report.

1.1.4.2 Limitations

Spatial Data Accuracy

Spatial data used for visibility analysis originate from various sources and scales. Inaccuracy and errors are therefore inevitable. Where relevant these will be highlighted in the report. Every effort was made to minimize their effect.

Viewshed Calculations

Calculation of the viewsheds does not take into account the potential screening effect of vegetation and buildings. Due to the relatively low vegetation cover in the region and the size and extent of the solar energy facility, the screening potential of vegetation is likely to be minimal over most distances.

Viewsheds are calculated using a Digital Elevation Model (DEM) which is derived from 1:50000 scale contour lines with a 20 m vertical distance between contours. The DEM has a pixel resolution of 20 m x 20 m and covers a 70 km x 30 km area (within which a study area is located at 5 km radius around the development site).

1.1.5 Source of Information

The VIA is based on the following information:

- Documentation supplied by the client and the CSIR;
- Digital topocadastral data at 1:50 000 scale from the National Geo-spatial Information database[2];
- 1:250000 Geology map sheets covering the region;
- Google Earth software and data;
- South African digital land cover dataset of 2002;
- Renewable Energy EIA Application Database for SA, 2015 Quarter 3[3];
- Protected Areas Data Release - Third Quarter 2015[3];
- Eskom SPOT Building Count data set (de la Rey 2008); and
- 2013 Garmin map data for 'points of interest' layer.

1.1.6 Declaration of Independence of Specialist

Refer to the preliminary section of this report for the Curriculum Vitae of Mr. Henry Holland, which highlights his experience and expertise. The declaration of independence by the specialist is provided in Box 1.1 below (with a full declaration included in the preliminary sections of this report and included in Appendix I of the BA Report).

BOX 1.1: DECLARATION OF INDEPENDENCE

I, Henry Holland, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed Kenhardt PV 1 – Transmission Line Project, application or appeal in respect of which I was appointed, other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.

HENRY HOLLAND

1.2 DESCRIPTION OF PROJECT ASPECTS RELEVANT TO VISUAL IMPACTS

This section describes the aspects of the proposed project that are relevant in terms of potential visual impacts. Figure 1-1 below shows the proposed locality of the Kenhardt PV 1 Solar Facility, the powerline corridor for the PV 1 facility as well as the proposed powerline corridor for all three PV projects.

[2] http://www.ngi.gov.za

[3] http://egis.environment.gov.za/frontpage.aspx?m=27

All maps provided in this report are included in A3 format in Appendix A of this report.

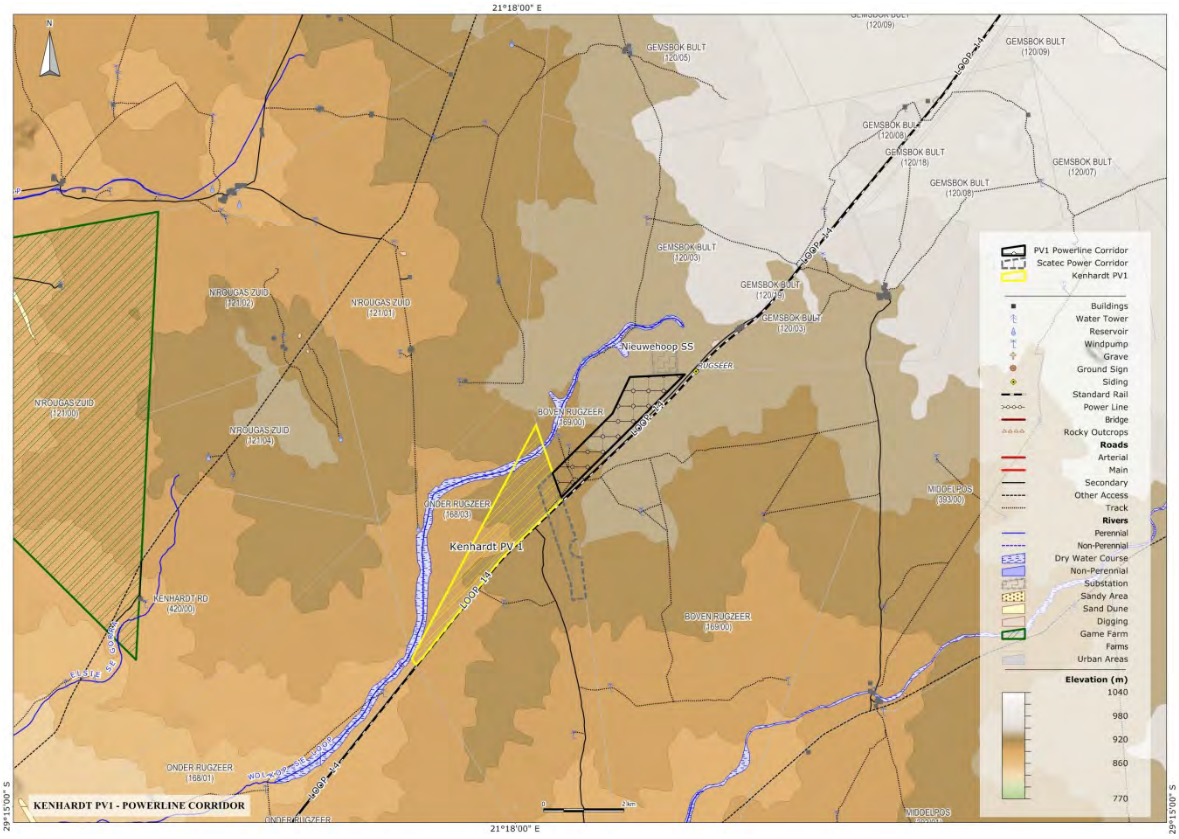

Figure 1-1 Proposed Kenhardt PV 1 solar energy facility site and the proposed power line corridor from the facility to the Eskom grid at the Nieuwehoop Substation.

1.2.1 Construction and Decommissioning Phases

Elements of the construction and decommissioning phases of the proposed powerline that will have a potential visual impact include:

- Some construction activities will potentially be exposed above the skyline due to the height of the pylons, and as such it is likely to be more intrusive on views;
- Laydown areas for equipment will be required, although these will be temporary;
- Access roads, maintenance roads and power line servitudes will potentially require clearing of vegetation;
- Soil stockpiles and removed vegetation heaps will be visible;
- Alien invasive plant species may contrast strongly with surrounding vegetation;
- An increase in human activity in a remote area is likely to be noticed even by only a small number of visual receptors. Relatively large construction equipment and vehicles will be operating during these phases of development, and an increase in traffic on roads in the region is likely;
- Exposure of large areas of soil, and worker and equipment traffic will increase dust generation which will increase construction visibility; and
- Construction or improvement of access roads will be more visible than the operational roads.

1.2.2 Operational Phase

The proposed power line pylons are expected to extend up to 30 m high for 132 kV lines (as a maximum height – they are most often between 22 m and 28 m high). The power lines can potentially intrude on scenic views and due to the linear nature of the development the potential for scenic views can be affected for a large region. The proposed power line for Kenhardt PV 1 will only be approximately 4 km long. Maintenance of the servitude is unlikely to happen often since vegetation cover within the general area is low.

It is important to note that a complete, detailed project description is included in Section A of the BA Report. The proposed transmission line and electrical infrastructure BA project will include the following connectivity options:

- The construction of a single 132 kV transmission line from each Kenhardt PV facility to the Eskom Nieuwehoop Substation; or
- Connect the Kenhardt PV 2 and Kenhardt PV 3 projects via separate 22 kV/33 kV transmission lines to the proposed Kenhardt PV 1 on-site substation which will link via a 132 kV line to the Eskom Nieuwehoop Substation; or
- Construct one 132 kV transmission line from the Kenhardt PV 1 project to the Eskom Nieuwehoop Substation and connect the Kenhardt PV 2 and Kenhardt PV 3 facilities together via medium voltage transmission lines to either the on-site substation of Kenhardt PV 2 or PV 3, followed by the construction of one 132 kV transmission line from the on-site substation to the Eskom Nieuwehoop Substation.

The above proposed transmission lines will be constructed within an electrical infrastructure corridor (as shown in Figure 1-1), which has been assessed in this report. Viewsheds were calculated for points over the whole corridor even though not all of the corridor will be used. The assessment was therefore done for a worst case scenario.

1.3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

The topography in the region surrounding the proposed development site is relatively flat with low open hills (Figure 1-2). Outcrops of erosion resistant rocks form occasional steep low hills which are distinctive in the landscape and often form a distant backdrop to views. The Hartbees River, a tributary of the Orange River, passes just south of Kenhardt. Wolfkop Se Loop and Rugseer River are tributaries of the Hartbees River which pass through the study area (Figure 1-3 b and c). Rivers in this region only flow during heavy rain and are normally dry riverbeds.

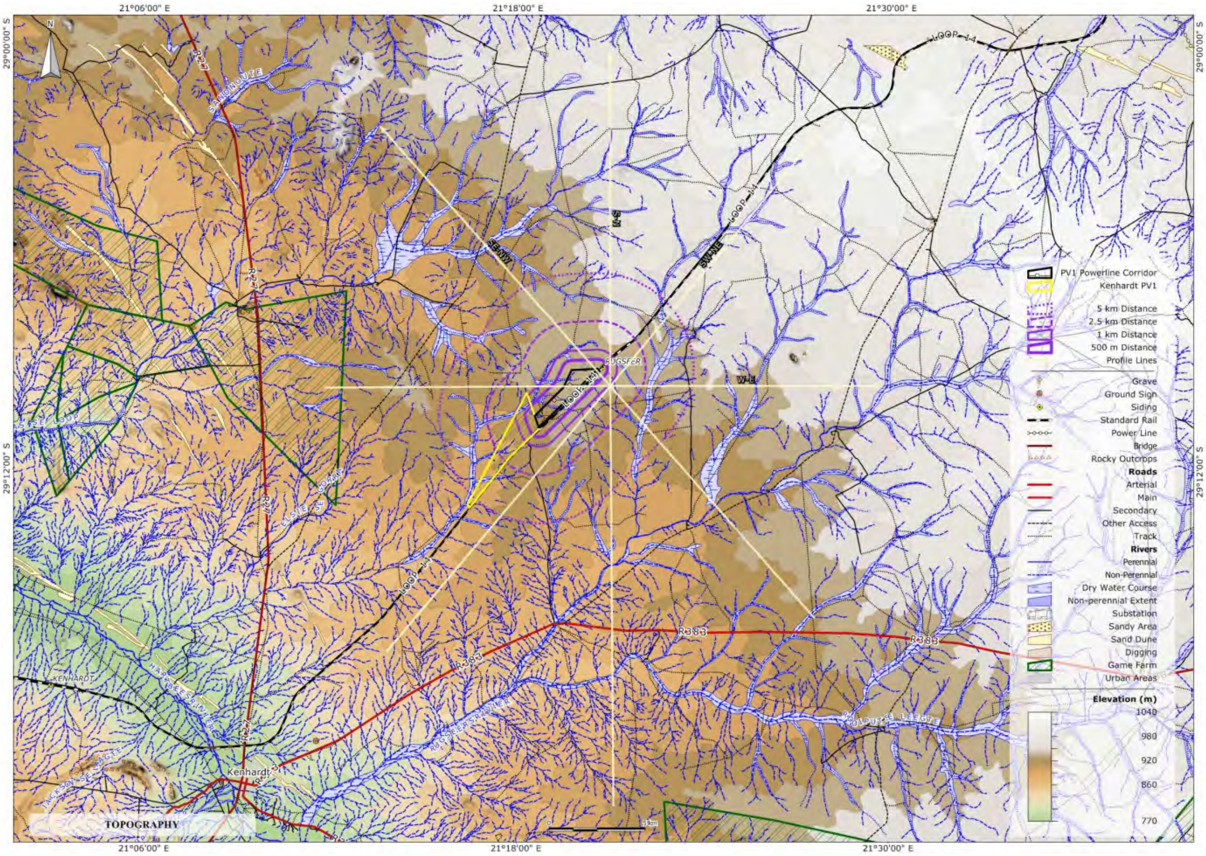

Figure 1-2 Topographic Map of the Region.

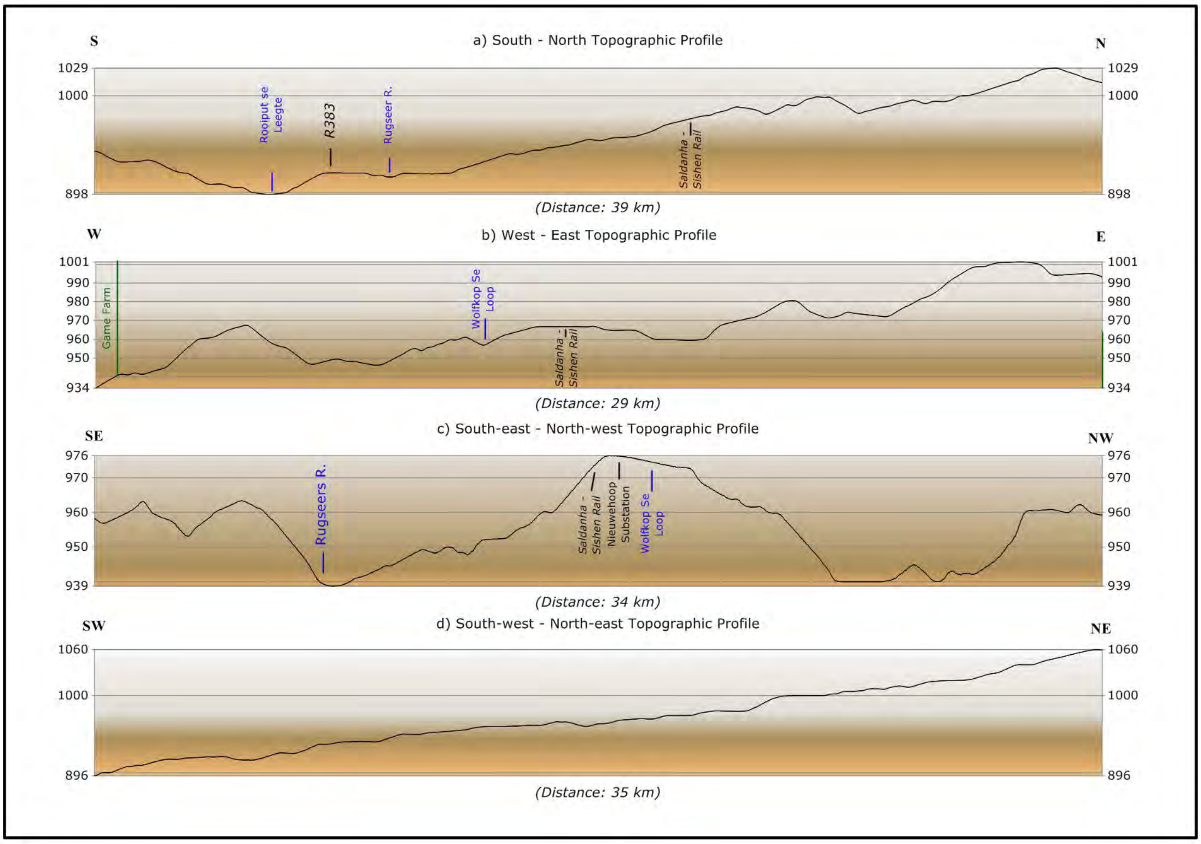

Figure 1-3 a) South-North Topographic Profile, b) East-West Topographic Profile, c) South-east North-west Topographic Profile, d) South-west – North-east Topographic Profile. Topographic profiles as indicated on the topographic map above.

The geological history of the region is complex with multiple metamorphic and deformation events (Figure 1-4). The region is therefore underlain by sedimentary and igneous rocks which were transformed into their metamorphic equivalents. The study area is located on migmatite (Kenhardt Migmatite) which is mostly overlain by more recent sediments of the Gordonia Group (Kalahari sands). A large number of pegmatites are found in the region and in some cases are mined for semi-precious stones. The steep, dark coloured hills around Kenhardt are quartzites which are relatively erosion-resistant rocks.

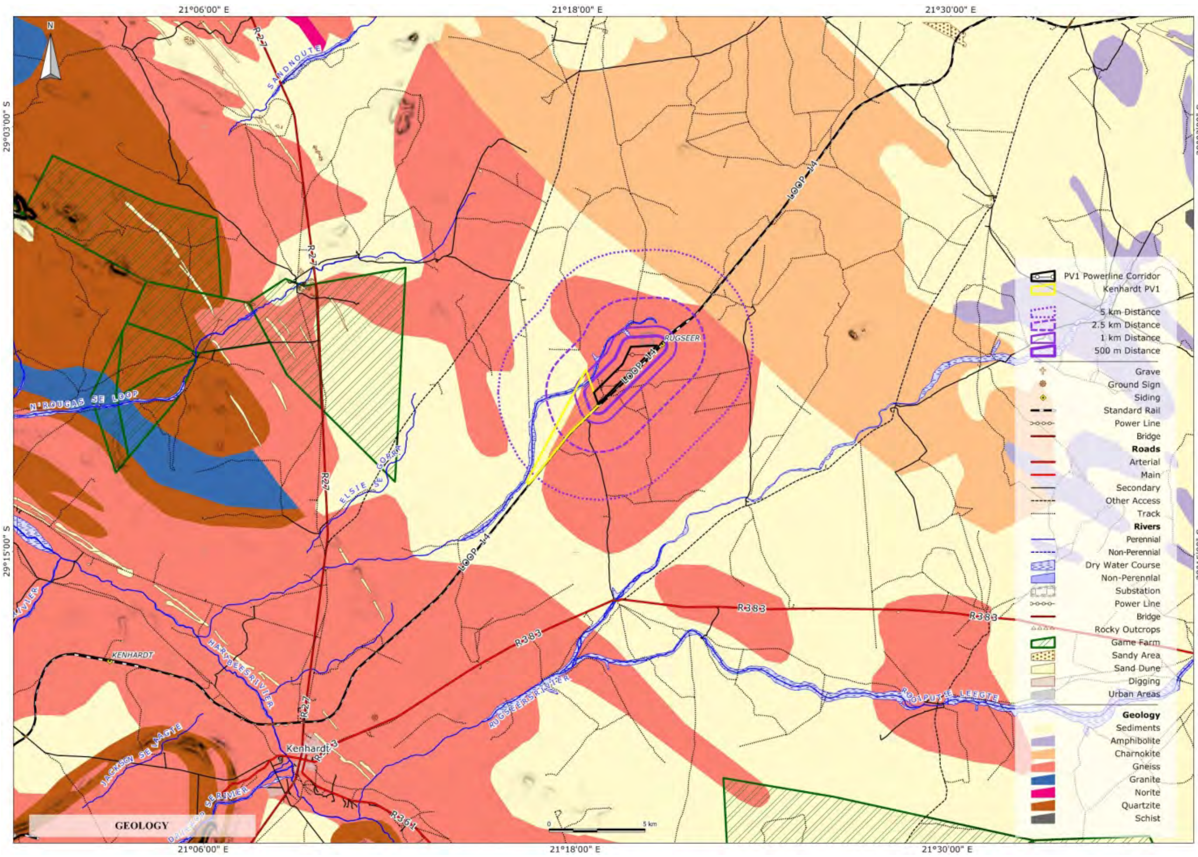

Figure 1-4 Simplified geology of the region.

The study area is covered in grassland with low shrubs (Bushmanland Arid Grassland) which has been transformed by live-stock grazing (Figure 1-5). Sheep farming is the main agricultural activity. The vegetation produces a mottled background to most views which is relatively effective at making some development types such as power lines and pylons blend in with the background. There are no protected areas in the region and none are planned by the ZF Mgcawu District Municipality (Siyanda DM 2012) but there are a number of game farms in the surrounding landscape.

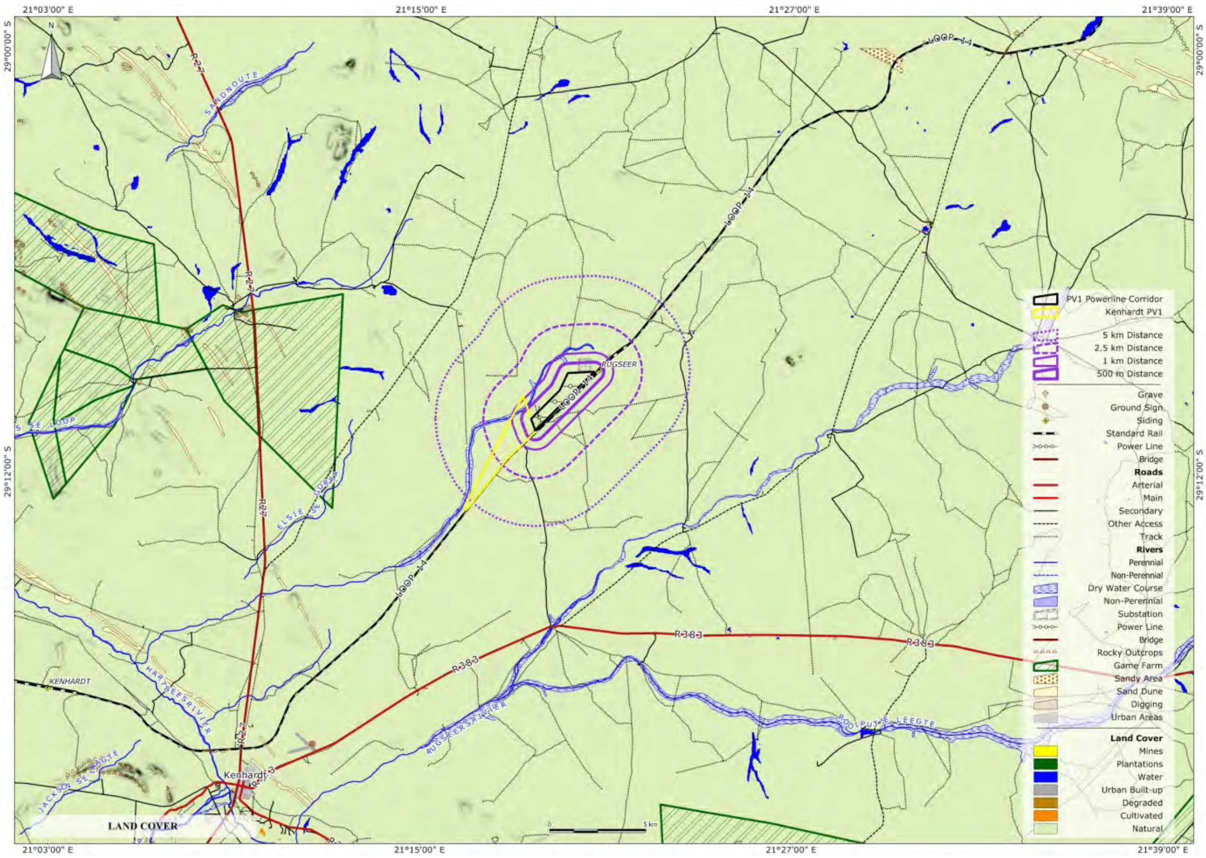

Figure 1-5 Land cover map of the region.

Kenhardt provides a service centre for the surrounding agricultural community (Figure 1-6). It is located approximately 30 km south-west of the proposed development site on the R27 provincial road. The road is often used by motorists travelling from Cape Town to the Northern Cape tourist destinations along the Orange River. The R383 is a gravel road between Kenhardt and Marydale. The Sishen-Saldanha railway passes through the property on which the proposed Kenhardt PV plants (subject to a separate EIA Process) and the proposed transmission lines will be built and is a major feature in the landscape. A private (Transnet) gravel road runs adjacent to the rail tracks and provides limited access to the proposed site. A railway siding, Rugseer, is located near the proposed project site. The Eskom Nieuwehoop Substation is being constructed on a site just west of the Rugseer siding. Proposed 400 kV transmission lines from Ferrum Substation near Upington and from Aries Substation southwest of Kenhardt will connect to Nieuwehoop Substation and will potentially become highly visible features of the landscape.

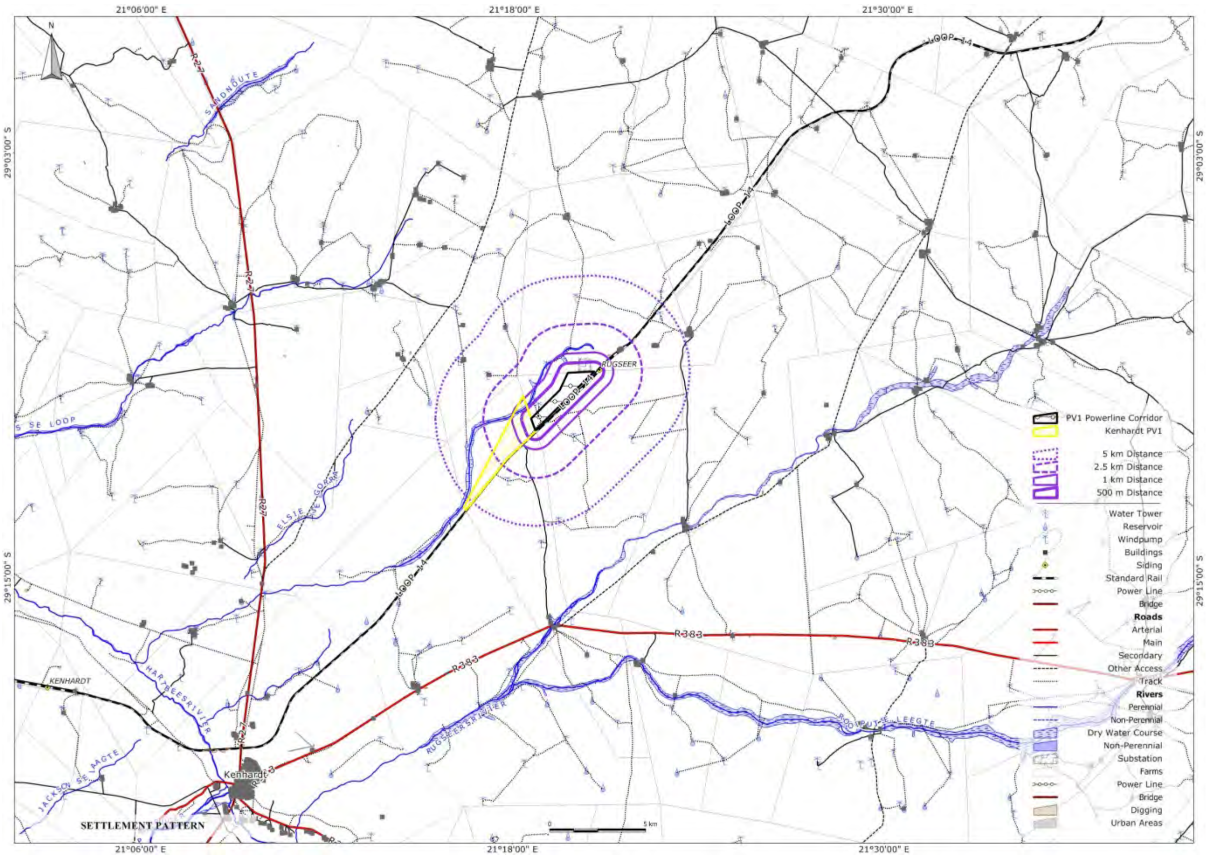

Figure 1-6 Prominent man-made structures and settlement patterns in the landscape.

The landscape surrounding the proposed site has a rural agricultural character. It is in a remote part of the country and is sparsely populated, but it has been transformed to some extent by extensive stock farming as well as by large scale infrastructure in the form of the Sishen-Saldanha ore railway line.

The topography and vegetation of the region is such that opportunities for screening the proposed development from public views are very limited. The specific location of the powerline within the corridor will not affect the visibility of the development enough to alter the significance of the potential visual impact. The Transnet road adjacent to the Sishen-Saldanha ore railway line will bring motorists into areas where they will be highly exposed to the proposed development (i.e. in close proximity to the powerline). However, there are very few motorists using this road – it is a private road that belongs to Transnet but it is also used by farmers to access their properties.

In light of the above there are no specific areas on the proposed site that should be avoided in terms of visual considerations.

1.4 APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

The following legislation and local and district municipal plans are applicable to the proposed project:

- The National Environmental Management Act (NEMA) and the Regulations in terms of Chapter 5 of NEMA. (Act 107 of 1998);
- The Protected Areas Act (PAA) (Act 57 of 2003, Section 17) which refers to the conservation and protection of natural landscapes;
- The Provincial Spatial Development Framework for the Northern Cape (Office of the Premier of the Northern Cape 2012) - The PSDF identifies a Solar Corridor where solar projects will be given priority – the Kenhardt PV projects do not fall within this corridor;
- ZF Mgcawu SDF (Siyanda DM 2012) – The Solar Corridor is seen as an initiative that "*should be pursued vigorously.*" The corridor follows the main routes from Prieska to Upington and further along the N10 although the SDF map on p.221 of the SDF the corridor is extended along the N14 west. There are also a number of solar energy projects outside these corridors. Proposal SB7 for Southern Bushmanland relates to solar projects: "*Sensitively place solar projects within the Solar Corridor with due regard to the visual impact of these facilities and the siting principles in Section 6.3.7.*" Siting principles address wind farms rather than solar plants;
- !Kheis Rural SDF (!Kheis Municipality 2014) – Natural scenic beauty of the municipality and production of solar energy are both seen as opportunities based on its existing bio-physical conditions. Tourism opportunities for this municipality potentially relevant to the proposed development include agricultural tourism, landscape tourism and game farms. Solar energy projects are suggested for the remote areas of the municipality although no indication is given where this should be (other than the Solar Corridor);
- Kai !Garib SDF (Kai !Garib Municipality 2012) – Kenhardt and its surrounding rural area is seen as an agricultural region with a scenic environment and important cultural heritage. Dust pollution is seen as a factor that "*must be taken into consideration with future developments.*" Solar projects are mainly located along the Orange River and within the Solar Corridor, but there are projects south-west of Kenhardt indicated on the resources map. This is presumably the Aries solar plant;
- Renewable Energy Development Zones (REDZ) (CSIR 2014) – The Kenhardt PV and transmission line projects are located in Focus Area 7 – Upington Solar which was identified by the Strategic Environmental Assessment (SEA) as a potential development zone for solar energy. Landscape and visual specialists were involved in the Scoping Assessments of the Focus Areas.

1.5 IDENTIFICATION OF KEY ISSUES

1.5.1 Key Issues Identified During the BA Process

The potential visual issues identified during the BA Process include:

- Construction Phase: Visual intrusion of construction activities on existing views of sensitive visual receptors in the surrounding landscape.
- Operational Phase: Landscape impact of the proposed 132 kV powerline on a rural agricultural landscape;
- Operational Phase: Visual intrusion of the proposed 132 kV powerline on the views of sensitive visual receptors; and
- Decommissioning Phase: Visual intrusion of decommissioning activities on existing views of sensitive visual receptors.

To date, no specific comments have been raised by I&APs that relate to visual impacts. The comments regarding glare from the PV panels (raised by Transnet Freight Rail) are addressed in the separate EIA Reports.

1.5.2 Identification of Potential Impacts

Features at risk of impact in a VIA are the landscape and sensitive visual receptors in the landscape.

1.5.2.1 Landscape

A landscape impact occurs when a development alters the existing landscape character. If the landscape character is highly sensitive to the development type then the intensity of the impact will be high. A high intensity landscape impact, for instance, will be highly significant if the landscape character type is scarce as well as highly valued by the community (local, regional, national and international). The landscape impact does not depend only on the existing sensitive visual receptors since it can also affect future visual receptors and communities beyond the local or regional context.

As noted above, the existing landscape character of the surrounding region is rural-agricultural with large scale infrastructure such as the Sishen-Saldanha railway and the Eskom Nieuwehoop Substation. The remote sense of place has been severely impacted by the railway, Rugseer Siding and substation. As a result the landscape character has a low sensitivity to the proposed development.

1.5.2.2 Sensitive Visual Receptors

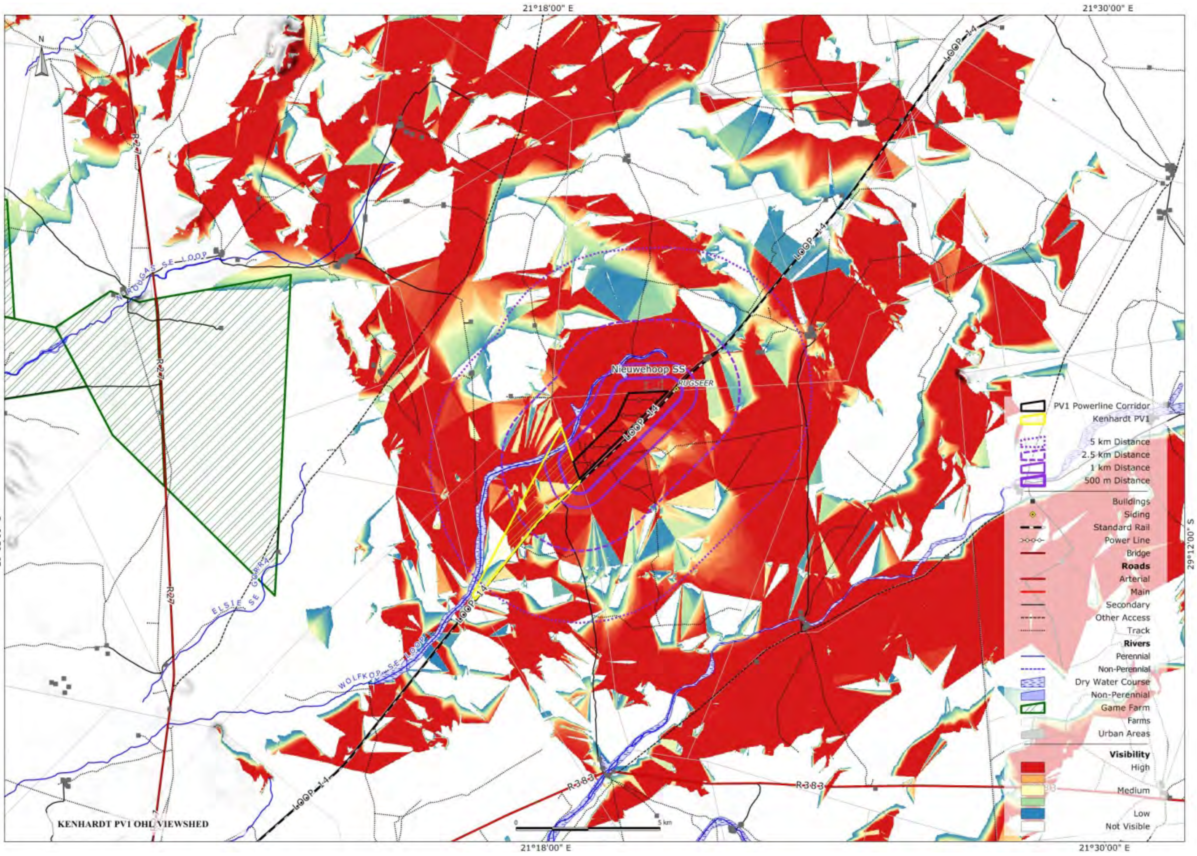

Figure 1-7 Viewshed of the proposed power line corridor between the Kenhardt PV 1 facility and the Eskom Nieuwehoop Substation.

The viewshed map (Figure 1-7) shows that potentially affected sensitive visual receptors are mainly limited to farmsteads, dwellings and viewpoints on farms surrounding the proposed powerline route. Motorists using the R27 are unlikely to have views of the power lines, and the settlement of Kenhardt is located outside the viewsheds. Approximately 5 km of the R383 (4 minutes at 80 km/h) will be within the viewshed but these sections are more than 10 km from the proposed transmission line route. Motorists using the gravel road adjacent to the Sishen-Saldanha railway line (i.e. the Transnet Service Road – Loop 14) will potentially be in the viewshed for 24 km and will potentially pass within 100 m of the proposed transmission line route.

Sensitive visual receptors therefore include:

- Residents and viewpoints on farms surrounding the proposed transmission line route;
- Motorists using the Transnet road adjacent to the Sishen-Saldanha railway line.

Residents on surrounding farms are highly sensitive to changes in their views since they have an active interest in the landscape. Viewpoints are unlikely to be valued for their scenic views (towards the proposed development) since the landscape has been affected by large structures such as the railway line and substation. Viewpoints on surrounding farms are therefore seen as moderately sensitive.

Traffic on the R383 and Loop 14 (i.e. Transnet Road adjacent to the Sishen-Saldanha railway line) are very limited and these roads are unlikely to be used often by tourists. Motorists will consist mostly of residents and workers on farms along the routes. They will be focusing their attention on the road and are seen as low sensitivity visual receptors.

1.5.2.3 Potential Impacts Identified for the Construction Phase

- Potential visual intrusion of construction activities (discussed in Section 1.2.1) on existing views of sensitive visual receptors.

1.5.2.4 Potential Impacts Identified for the Operational Phase

- Potential landscape impact of the proposed 132 kV powerline on a rural agricultural landscape; and
- Potential visual intrusion of the proposed 132 kV powerline on the views of sensitive visual receptors.

1.5.2.5 Potential Impacts Identified for the Decommissioning Phase

- Potential visual intrusion of decommissioning activities (discussed in Section 1.2.1) on views of sensitive visual receptors.

1.5.2.6 Cumulative Impacts

- Cumulative impact of solar energy generation projects and large scale electrical infrastructure on the existing rural-agricultural landscape; and
- Cumulative visual impact of solar energy generation projects and large scale electrical infrastructure on existing views of sensitive visual receptors in the surrounding landscape.

1.6 VISUAL IMPACT CONCEPTS AND ASSESSMENT CRITERIA

The assessment of potential impacts for the proposed Kenhardt PV 1 – Transmission Line project is conducted in the following steps:

- Identification of visual impact criteria (key theoretical concepts);
- Conducting a visibility analysis; and
- Assessment of impacts of the project on the landscape and on receptors (viewers) taking into consideration factors such as viewer sensitivity, visual exposure and visual intrusion.

Potential visual impacts are assessed using a number of criteria which provide the means to measure the intensity of the impacts. The intensity or consequence and other criteria such as spatial extent and duration of the impact are then used to determine its potential significance (Oberholzer, 2005). The visibility of the project is an indication of where in the region the development will potentially be visible from. The rating is based on viewshed area size and is an indication of how much of a region will potentially be visually affected by the development. A high visibility rating does not necessarily signify a high visual impact, although it can if the region is densely populated with sensitive visual receptors. Viewer (or visual receptor) sensitivity is a measure of how sensitive potential viewers of the development are to changes in their views. Visual receptors are identified by looking at the viewshed of the proposed development, and include scenic viewpoints, residents, motorists and recreational users of facilities within the viewshed. Their distance from the development (visual exposure) and the composition of their existing views (visual intrusion) will determine impact intensity/consequence.

1.6.1 Visibility Ratings

Visibility is the geographic area from which the proposed project will be visible, or view catchment area (Figure 1-7). The number of visual receptors in the viewshed has an influence on the visibility rating (Oberholzer, 2005).

- *High* - visible from a large area (e.g. several square kilometres).
- *Moderate* – visible from an intermediate area (e.g. several hectares).
- *Low* – visible from a small area around the project site.

The visibility of the project is high in terms of the definition above since the viewshed area is approximately 26 km^2 (within 5 km of the proposed transmission line corridor). The actual viewshed is likely to be similar to the calculated viewshed since existing vegetation in the region is low and will not affect the visibility of the proposed development. However, there are only 17 buildings within 5 km of the proposed transmission line corridor that will be affected (not all of which are residences), which indicate a low number of potentially affected visual receptors. Visibility for this project is therefore **low**.

1.6.2 Visual Exposure

Visual exposure refers to the relative visibility of a project or feature in the landscape and is related to the distance between the observer and the project (Oberholzer 2005). Exposure and visual impact tend to diminish exponentially with distance since the observed element comprises a smaller part of the view. Visual exposure is classified as follows:

- *High* – dominant or clearly noticeable;
- *Moderate* – recognisable to the viewer; and
- *Low* – not particularly noticeable to the viewer

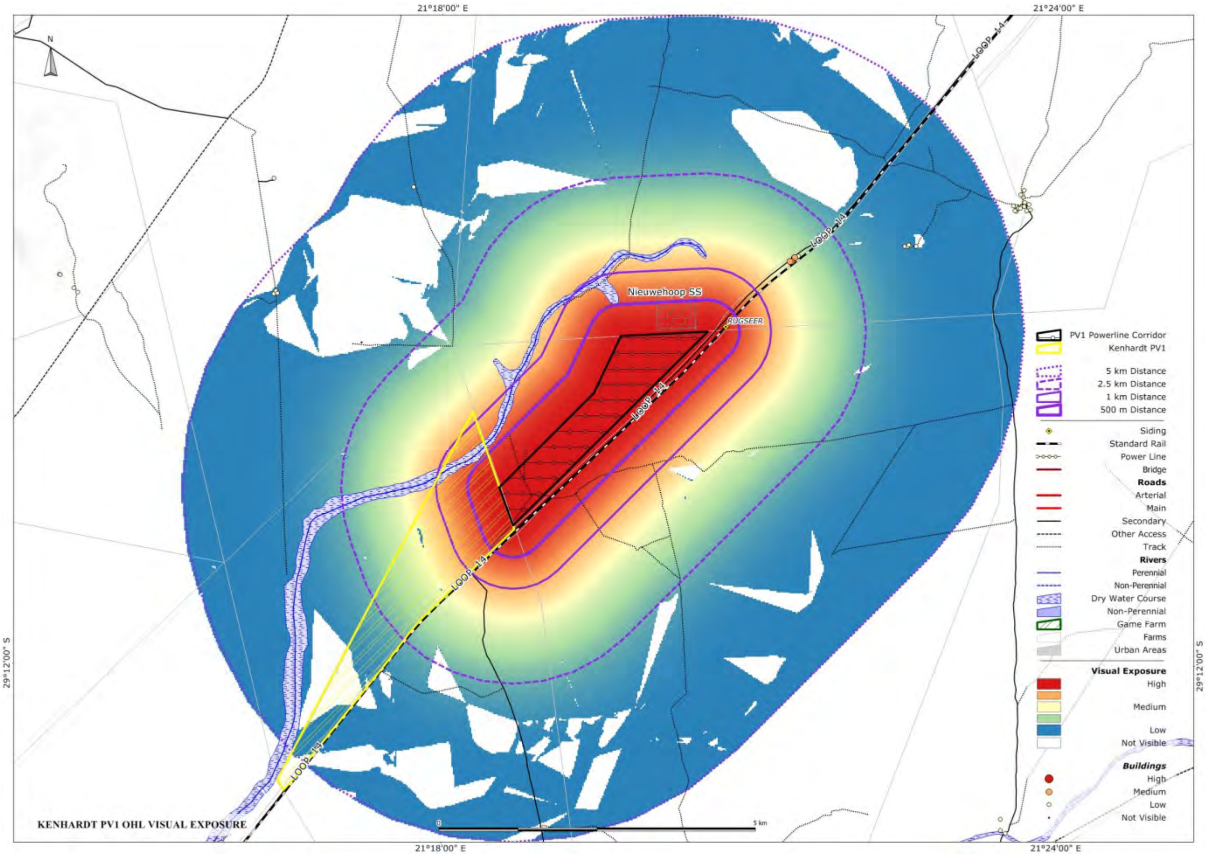

Figure 1-8 Visual exposure for sensitive visual receptors within 5 km of the proposed transmission line route.

1.6.2.1 Residents and Viewpoints on Surrounding Farms

There are no buildings that will be highly exposed to the proposed powerline and most high visual exposure is limited to parts of the immediately surrounding farms (within 1.5 km of the proposed powerline route) (Figure 1-8). There are 5 buildings, all at the Rugseer Siding, that are in moderately exposed areas of the viewshed.

1.6.2.2 Motorists

The R383 is more than 5 km from the development site and motorists using this road will experience low visual exposure to the proposed powerline when they are in the viewshed. A 7 km (approximately 5 minutes at 80 km/h) section of the Transnet Service Road (Loop 14) will be highly exposed to the development.

1.6.3 Visual Intrusion

Visual intrusion indicates the level of compatibility or congruence of the project with the particular qualities of the area – its *sense of place*. This is related to the idea of context and maintaining the integrity of the landscape (Oberholzer, 2005). It can be ranked as follows:

- *High* – results in a noticeable change or is discordant with the surroundings;
- *Moderate* – partially fits into the surroundings, but is clearly noticeable; and
- *Low* – minimal change or blends in well with the surroundings.

1.6.3.1 Photographic Survey

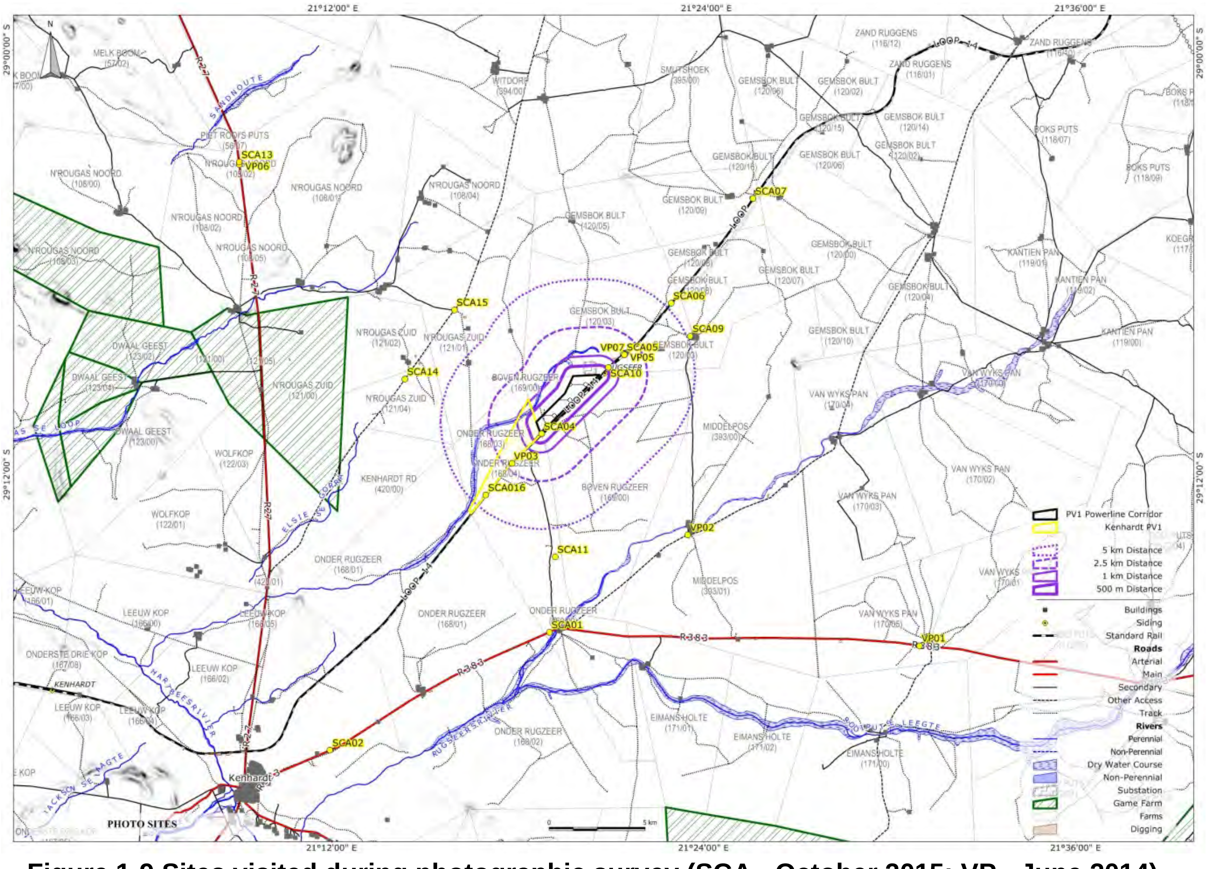

Figure 1-9 Sites visited during photographic survey (SCA - October 2015; VP - June 2014)

Sites from which landscape photographs were taken are shown in Figure 1-9. Sites with the prefix 'VP' refers to a photographic survey done in June 2014 for a different project in the same region, while 'SCA' refers to the survey done in October 2015 for this project. The discussion below refers to photograph sites on the map.

The landscape surrounding the proposed power line route is agricultural, with sheep farming the predominant land use. It is not pristine wilderness and the natural landscape has been affected by grazing as well as a number of man-made structures not normally associated with agricultural landscapes. The proposed power line corridor runs parallel and adjacent to the Sishen-Saldanha railway line (Figure 1-10). The railway line is an enormous structure and several very long (up to 4 km) ore trains pass through the landscape daily. Rail wagons are 4 m high and locomotives up to 5 m (Figure 1-11). The siding at Rugseer is a relatively large structure and its tower is highly visible in the landscape (Figure 1-12 and Figure 1-13). The Eskom Nieuwehoop Substation is currently under construction. It is another large structure and is a prominent new element in the landscape (Figure 1-14).

Figure 1-10 View north-west from viewpoint SCA04 along the proposed transmission line route The new Eskom Nieuwehoop Substation is central in view and the tower at Rugseer Siding is tc the right.

Figure 1-11 Empty ore train (Photo site VP03)

Figure 1-12 The tower at the Rugseer Siding as seen from photo site SCA011.

Figure 1-13 View from photo site SCA014 eastwards. The tower at Rugseer Siding is visible on the left and the new substation more towards the centre.

Figure 1-14 Eskom Nieuwehoop Substation currently under construction (Photo site SCA010)

1.6.3.2 Residents and Viewpoints on Surrounding farms

The proximity of the proposed development to the railway line and the substation means that existing views towards the development are already impacted. The number of highly sensitive visual receptors that will potentially be affected by the proposed transmission line is very low. They will experience **low** visual intrusion on existing views since the substation and railway line have structures similar to those of the proposed development.

1.6.3.3 Motorists

Motorists using the R383 are unlikely to notice the proposed power line at the distances they will be from it when within its viewshed. Views from Loop 14 will experience **low** visual intrusion since the other structures in views along the road are similar to those of the proposed power line and the power line will not seem discordant with the surrounding landscape.

Table 1-1 Visual Impact Criteria and Impact Intensity for the Kenhardt PV 1 – Transmission Line project.

Development Alternative	Sensitive Viewer	Criteria	Rating	Reasoning
Kenhardt PV 1 – Transmission Line	Residents and viewpoints on surrounding farms.	Visual Sensitivity	High	Residents are actively interested in their surrounding landscape and spend much of their time there.
		Visual Exposure	Low	There are no buildings in high visual exposure areas of the viewshed.
		Visual Intrusion	Low	The proposed power line will fit in with other large structures in the landscape.
		Impact Intensity	Low	Low visual exposure to the power line and low visual intrusion on existing views.
	Motorists	Visual Sensitivity	Low	They pass through a landscape and their attention will not be focused on the landscape.
		Visual Exposure	High	For motorists using the gravel road adjacent to the Sishen-Saldanha railway line (Loop 14). They will be highly exposed to the proposed development for approximately 7 km (or 5 minutes at 80 km/h)
		Visual Intrusion	Low	Low visual intrusion on views due to other large structure in existing views that are similar to the power line.
		Impact Intensity	Low	Low visual intrusion on existing views for low sensitivity visual receptors.

1.7 ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

1.7.1 Construction Phase: Potential visual intrusion of construction activities on existing views of sensitive visual receptors

1.7.1.1 Significance Statement

The spatial extent of the potential impact will be **local** since sensitive visual receptors further than 2 km from the proposed transmission line route will at most experience low visual exposure. The consequence of the potential impact will be **moderate** since construction will introduce activities and elements that are incongruent with the quiet rural nature of the region. The impact will be of **very short-term** duration since the proposed transmission line is only approximately 4 km long. Reversibility of the impact will be **high** and its irreplaceability **low**. The impact status will be **negative** since construction is normally viewed as cluttered and untidy. The probability of the impact occurring is **likely** since there are very few sensitive visual receptors that will be affected.

The significance of the potential impact without the implementation of mitigation measures is rated as **low** since the impact is predicted to be very short term in nature and there are very few highly sensitive visual receptors that will be affected.

1.7.1.2 Mitigation Measures

Assumptions regarding the management of construction activities are discussed in Section 1.1.4.1 of this report. Mitigation measures in addition to the best practice guidelines are:

- Night time construction should be avoided where possible; and
- Night lighting of the construction sites should be minimised within requirements of safety and efficiency.

The significance of the impact after mitigation will remain **low** with the implementation of mitigation measures.

1.7.2 Operational Phase: Potential landscape impact of the proposed 132 kV powerline on a rural agricultural landscape

1.7.2.1 Significance Statement

The spatial extent of the potential impact will be **local** since it is unlikely to affect the landscape beyond 2 km from the proposed transmission line route. The consequence of the potential impact will be **slight** since the landscape character is impacted by the Sishen-Saldanha railway line and existing large scale electrical infrastructure in the form of the Eskom Nieuwehoop Substation. The impact will be **long term** and will cease only once the power line has been removed. The potential impact will diminish over time as other power lines to the substation are built and the electrical infrastructure becomes a more dominant element of the landscape. The reversibility of the impact is **high**. The irreplaceability of the landscape character type is **low** because it is a compromised landscape and other areas where the rural agricultural landscape is less altered exist in the region. The impact status will be **negative** since the rural sense of place of the region will change. The probability of the impact occurring is **likely** depending on how far development of the power lines planned for the Eskom Nieuwehoop Substation has progressed by the time the proposed 132 kV line is built.

The significance of the potential impact before mitigation is rated as **very low** since the impact is localized and has a slight consequence. No mitigation measures are recommended.

1.7.3 Operational Phase: Potential visual intrusion of the proposed 132 kV power line on the views of sensitive visual receptors

1.7.3.1 Significance Statement

The spatial extent of the potential impact will be **local** since only sensitive visual receptors within 2 km of the proposed development are likely to be affected and there are very few within this distance of the proposed transmission line route. The consequence of the impact will be rated as **slight** since very few highly sensitive visual receptors will potentially be affected and visual intrusion is expected to be low. The potential impact is rated with **long term** duration since it will only end once the project ends. The reversibility of the potential impact is rated as **high** since it is unlikely that vegetation will have to be removed for the servitude (considering the sparse vegetative cover within the general area). The visual resources of the region are already impacted by stock farming activities, the ore railway line passing through it and the Eskom Nieuwehoop Substation. The irreplaceability of the visual resources is therefore seen as **low**. The impact status will be **negative** since powerlines detract from the scenic potential of views. The probability of the impact occurring is **likely** since there are motorists that will pass within 1 km of the proposed transmission line route.

The significance of the impact (without the implementation of mitigation measures) is rated as **very low** since very few sensitive visual receptors are likely to be affected by the proposed development.

1.7.3.2 Mitigation Measures

It is recommended that the type of power line towers used for the proposed power line should be similar to existing power line towers in the landscape where possible.

The significance of the impact after mitigation will remain **very low** with the implementation of mitigation measures.

1.7.4 Decommissioning Phase: Potential visual intrusion of decommissioning activities on views of sensitive visual receptors

1.7.4.1 Significance Statement

The spatial extent of the potential impact will be **local** since sensitive visual receptors further than 2 km from the proposed transmission line route will at most experience low visual exposure. The consequence of the impact will be **moderate** since activities similar to those during the construction phase will intrude on views of sensitive visual receptors. The impact duration should be shorter than for the construction phase – **very short-term**. The reversibility of the impact is **high** and the irreplaceability **low**. The impact status will be **negative** since this phase will be perceived as cluttered and untidy. The probability of the impact occurring is **likely** since there are very few sensitive visual receptors that will be affected.

The significance of the impact without the implementation of mitigation measures is rated as **low** since the impact is temporary and there are very few highly sensitive visual receptors that will be affected.

1.7.4.2 Mitigation Measures

The following mitigation measures have been recommended:

- Disturbed and transformed areas should be contoured to approximate naturally occurring slopes to avoid lines and forms that will contrast with the existing landscapes;
- Stockpiled topsoil should be reapplied to disturbed areas and these areas should be re-vegetated using a mix of indigenous species in such a way that the areas will form as little contrast in form, line, colour and texture with the surrounding undisturbed landscape;
- Edges of re-vegetated areas should be feathered to reduce form and line contrasts with surrounding undisturbed landscape;
- Working at night should be avoided, where possible; and
- Night lighting of reclamation sites should be minimised within requirements of safety and efficiency.

The significance of the impact after mitigation will remain **low** with the implementation of mitigation measures.

1.7.5 Cumulative impact of solar energy generation projects and large scale electrical infrastructure on the existing rural-agricultural landscape

1.7.5.1 Significance Statement

The introduction of a large railway line, siding and tower has changed the landscape character of the region by reducing its sense of remoteness. This is further changing with the addition of a large substation and a network of high-voltage power lines which are highly visible structures due to their height and linear extent. The substation and powerlines are being constructed and therefore represent a definite change in landscape character. Several large solar energy facilities and associated electrical infrastructure (such as transmission lines) are being proposed for the region immediately surrounding the proposed Kenhardt PV 1 – Transmission Line project area (within 20 km of the site – as described in Section 1.1.4.1 of this report and Section D of the BA Report). In the event that some of them are built, large areas of natural vegetation and stock farming land will be transformed into fields covered in thousands of solar panels. Solar fields and their associated electrical infrastructure will become a common feature of the landscape and the rural-agricultural landscape character will have a significant power generation component (as well as large scale electrical infrastructure). Additional power lines in the same region will cause a cumulative impact of **slight** consequence since the landscape character will already contain large scale electrical infrastructure.

The spatial extent of the cumulative impact is **regional** (within 20 km of the Kenhardt PV 1 – Transmission Line development). The duration of the potential impact is rated as **long term** since the cumulative impact will last for as long as the transmission line is in the landscape. The **status** of the impact is neutral since the overall change in landscape character will be negligible and the probability of it occurring is **unlikely** (assuming that several solar energy projects and associated electrical infrastructure are built in the surrounding landscape).

The significance of this cumulative impact (without the implementation of mitigation measures) on the landscape is rated as **very low**. No mitigation is recommended.

1.7.6 Cumulative visual impact of solar energy generation projects and large scale electrical infrastructure on existing views of sensitive visual receptors in the surrounding landscape

1.7.6.1 Significance Statement

The original visual resources of the region under assessment were represented by open, long distance views of arid landscape with low hills and sparse vegetation cover. There were limited opportunities for scenic vistas but the sense of place was remote wilderness. Subsequent stock farming practices have reduced the visual resources by impacting on the vegetation and wilderness. The railway line and associated infrastructure (including the new substation and electrical infrastructure), have further altered the sense of place of the region and reduced the opportunities for scenic views. The addition of large fields covered in structures will similarly reduce existing visual resources and solar fields will become common elements of views in the region. The proposed power line will cause low visual intrusion on views since it will not seem out of place in the landscape and the cumulative visual impact is rated with a **slight** consequence.

The spatial extent of the cumulative impact is **regional** (within 20 km of the Kenhardt PV 1 – Transmission Line development). The duration of the impact is rated as **long term** since the cumulative impact will last for as long as the transmission line is in the landscape. The **status** of the impact is negative since the visual resources of the region are reduced, and the probability of it occurring is **likely** since there may still be highly sensitive visual receptors that will be affected.

The significance of the cumulative impact (without the implementation of mitigation measures) is rated as **very low**. No mitigation is recommended.

1.8 IMPACT ASSESSMENT SUMMARY

Table 1-2 Impact assessment summary table for the Construction Phase

Construction Phase													
Direct Impacts													
										Significance of Impact and Risk			
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)	Ranking of Residual Impact/ Risk	Confidence Level
Construction activities	Loss of visual resources	Negative	Local	Very Short Term	Moderate	Likely	High	Low	Mitigation measures associated with construction activities. Night time construction should be avoided where possible. Night lighting of the construction sites should be minimised within requirements of safety and efficiency.	Low	Low	5	High

Table 1-3 Impact assessment summary table for the Operational Phase

Operational Phase													
Direct Impacts													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Landscape impact	Change of landscape character	Negative	Local	Long Term	Slight	Likely	High	Low	None specified	Very Low	Not Applicable	5	High
Visual intrusion of the proposed 132 kV powerline on views of sensitive visual receptors	Change in existing views of sensitive visual receptors.	Negative	Local	Long Term	Slight	Likely	High	Low	Towers should be similar to those in existing landscape.	Very Low	Very Low	5	High

Table 1-4 Impact assessment summary table for the Decommissioning Phase

Decommissioning Phase													
Direct Impacts													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Visual impact of decommissioning activities on existing views of sensitive visual receptors	Impact on visual resources.	Negative	Local	Very Short-Term	Moderate	Likely	High	Low	Rehabilitation of cleared and disturbed areas. Working at night should be avoided, where possible. Night lighting of reclamation sites should be minimised within requirements of safety and efficiency	Low	Low	4	High

Table 1-5 Cumulative impact assessment summary table

Cumulative Impacts													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Cumulative impact on the landscape of the region.	Change in landscape character	Neutral	Regional	Long term	Slight	Unlikely	High	Low	None	Very Low	Not Applicable	5	High
Cumulative impact on sensitive visual receptors.	Visual intrusion	Negative	Regional	Long Term	Slight	Likely	High	Low	None	Very Low	Not Applicable	5	High

1.9 INPUT TO THE ENVIRONMENTAL MANAGEMENT PROGRAMME

1.9.1 Planning and Design

There are some mitigation measures that require input during the design and planning phase of the project in order to reduce visual intrusion of construction activities. These include plans to minimize fire hazards and dust.

1.9.2 Construction Phase

Adherence to the erosion, dust, fire and light plans is necessary to minimise visual intrusion of construction activities and should be monitored regularly by the construction manager. Construction boundaries should be clearly demarcated and monitored, and good housekeeping on site should be maintained. Rehabilitation of temporary cleared areas should commence as soon as possible and the rehabilitation process should be regularly monitored by the Environmental Officer.

1.9.3 Operational Phase

Powerline pylons should be similar to those existing in the landscape already if possible.

1.9.4 Decommissioning Phase

The decommissioning phase of the project will potentially cause similar visual impacts as that during the construction phase and as such similar mitigation measures apply. The successful completion of this phase should leave the project site in a similar condition, visually, as before construction commenced. This can be accomplished by appropriate landscaping and revegetation of disturbed areas.

1.10 CONCLUSION AND RECOMMENDATIONS

The landscape surrounding the proposed site has a rural agricultural character which has been transformed by extensive stock farming and large scale infrastructure in the form of the Sishen-Saldanha ore railway line and the Eskom Nieuwehoop Substation. The significance of the landscape impact of the proposed power line (during the operational phase) is rated as very low since its extent is local and the consequence of the impact is rated as slight.

Very few sensitive visual receptors will potentially be affected by the proposed power line:

- Residents and viewpoints on farms surrounding the proposed development site. These are highly sensitive visual receptors since they have an active interest in their surrounding landscape; and
- Motorists using the R383 and the Transnet Service Road (Loop 14) adjacent to the Sishen-Saldanha ore railway line. Motorists are classified as low sensitivity visual receptors since they pass through the landscape and their attention is mostly focused on the road.

Visual intrusion on the existing views of highly sensitive visual receptors will be low since the proposed power line will fit into the existing landscape which already contains the Eskom Nieuwehoop Substation and Sishen-Saldanha railway line which contain similar structures. The significance of the potential visual impact (during the operational phase) is rated as very low since it has local extent and slight consequence.

The significance of cumulative impacts on the surrounding landscape character is rated as very low since the landscape is rapidly changing due to the introduction of large scale and highly visible rail and electrical infrastructure.

The significance of the cumulative visual impact on sensitive visual receptors is similarly rated as very low due to the existing and new structures which have severely limited potential scenic views in the region.

The proposed power line will fit in with the landscape as it exists now as well as with plans for the future of the surrounding landscape. The overall significance of the visual impact of the proposed 132 kV powerline is low. The specific location of the powerlines within the proposed corridor will not alter the significance of their potential visual impact on sensitive visual receptors and from a visual impact perspective there is no reason for this corridor not to be used and no conditions are recommended for inclusion in the environmental authorisation.

1.11 REFERENCES

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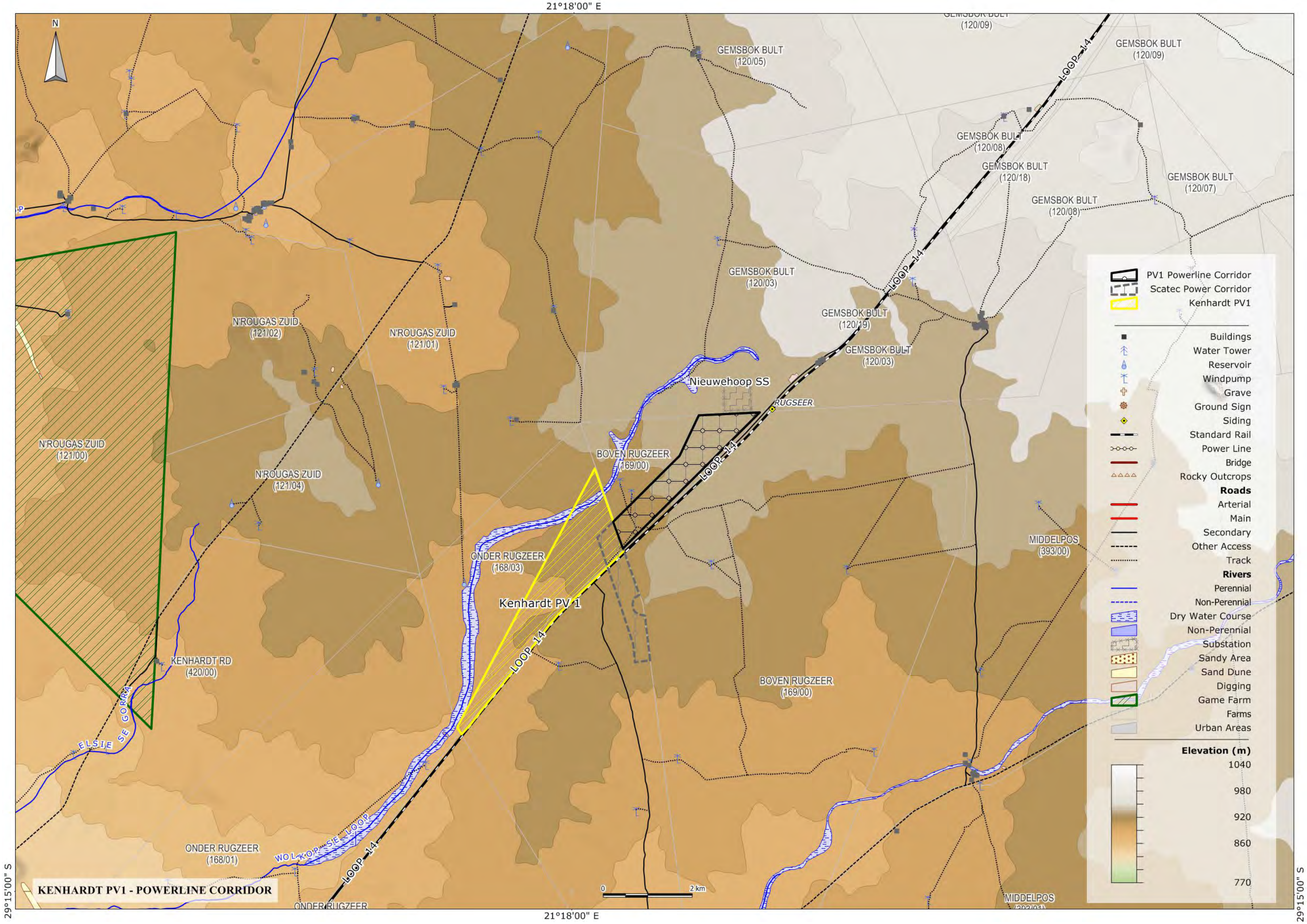
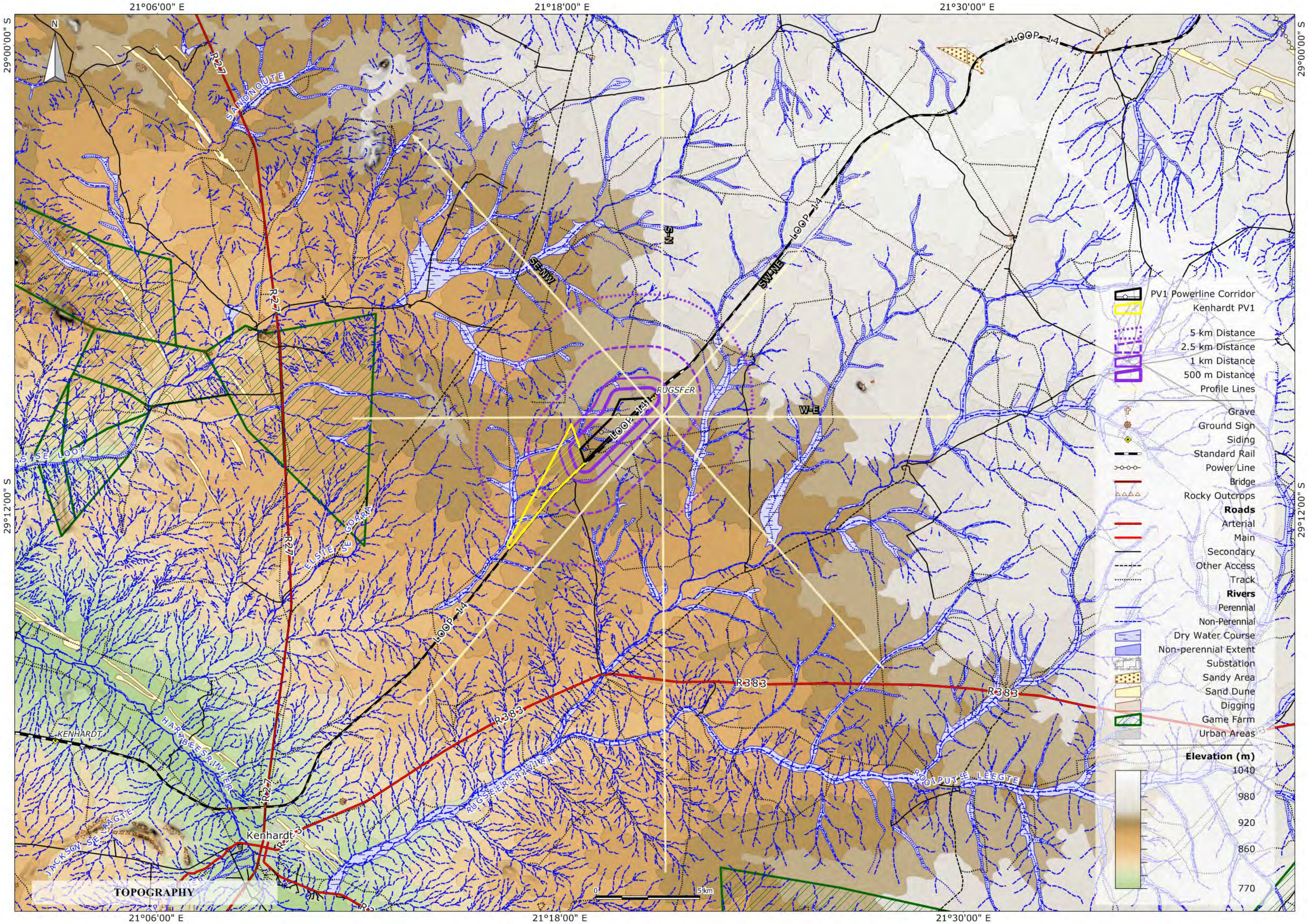
1.12 APPENDICES

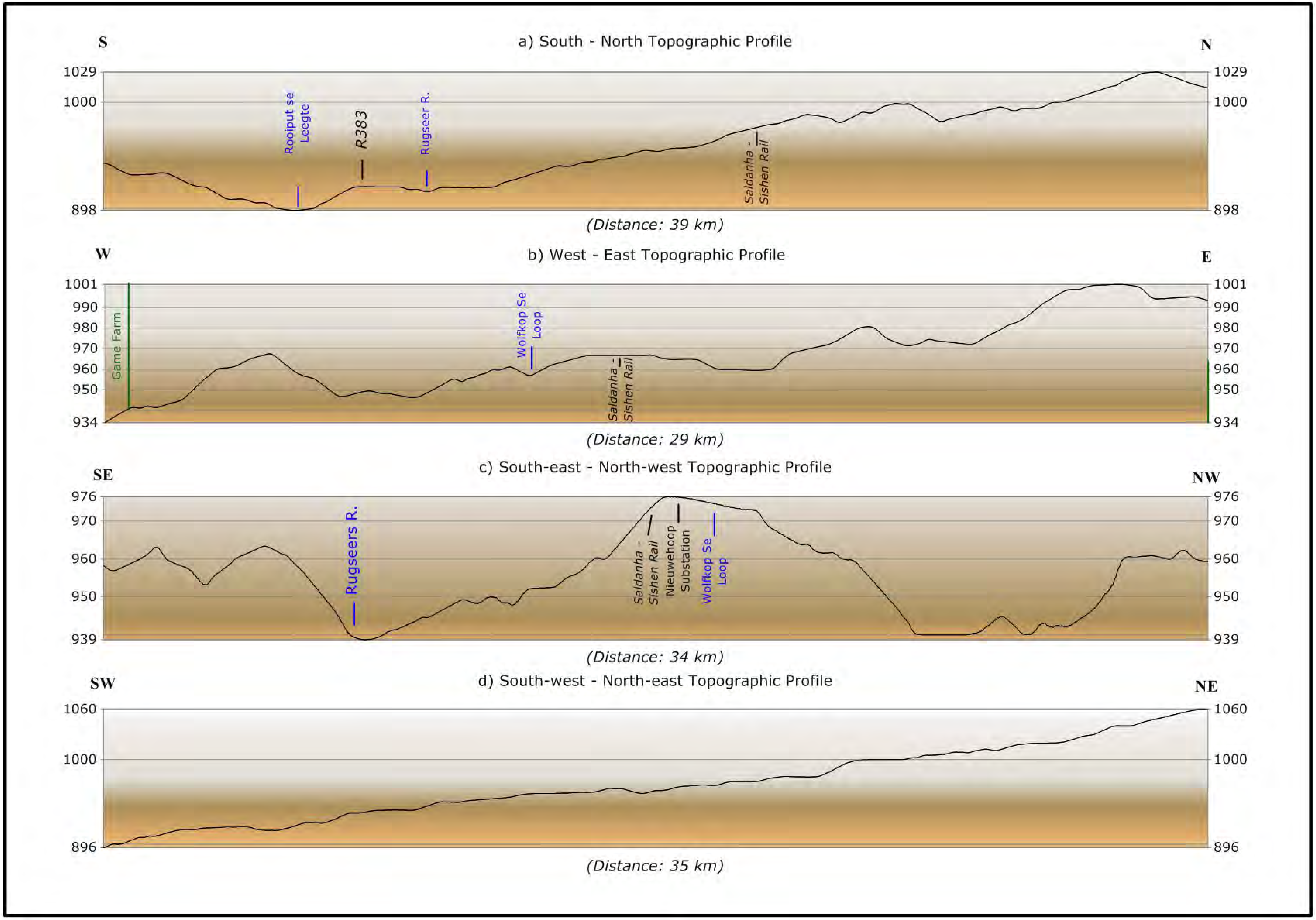
1.12.1 Appendix A – Maps in A3 Format



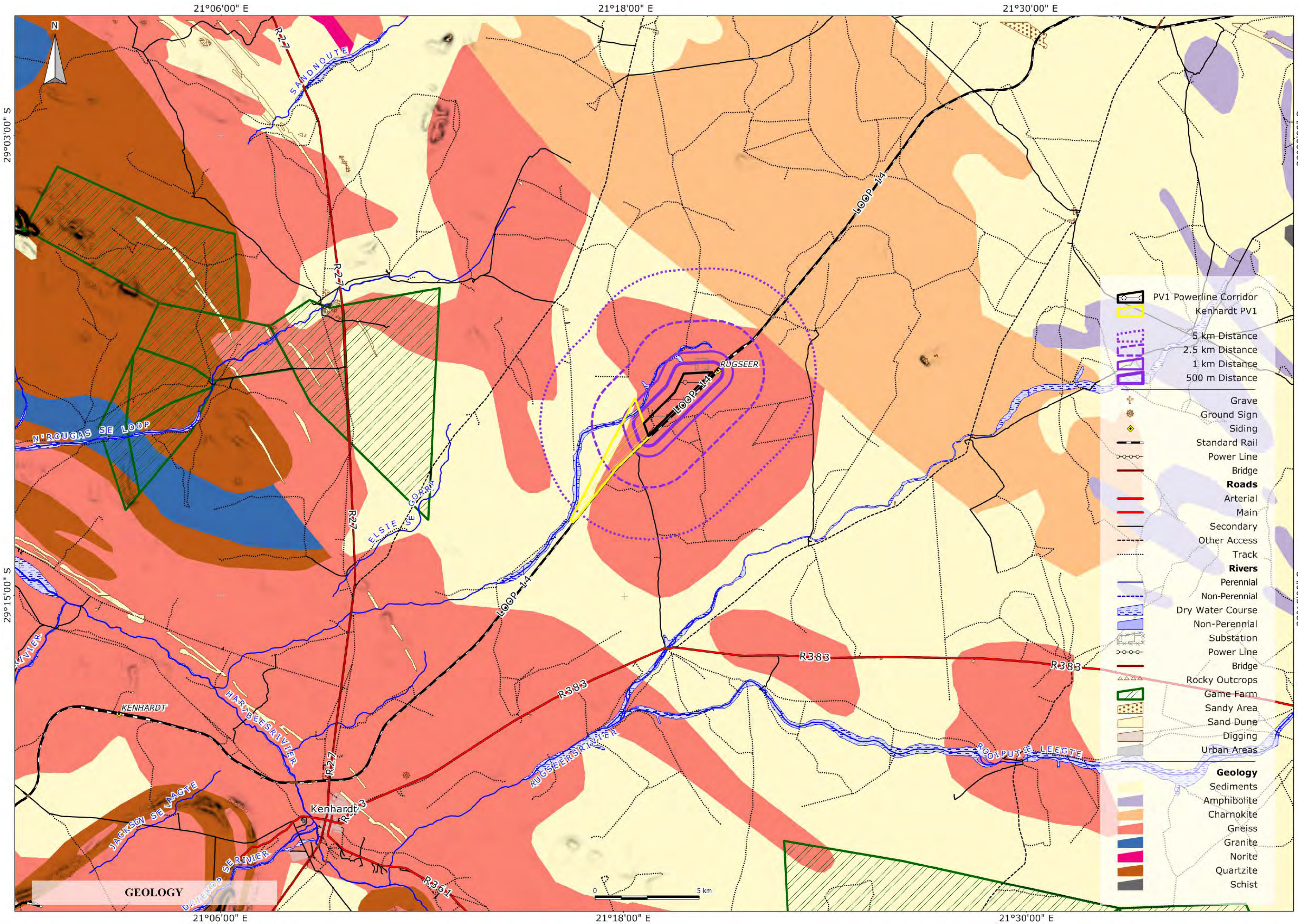
Map 1 Proposed Kenhardt PV 1 solar energy facility site and the proposed 132 kV overhead power line corridor connecting from the facility with to the Eskom grid at the Nieuwehoop Substation.



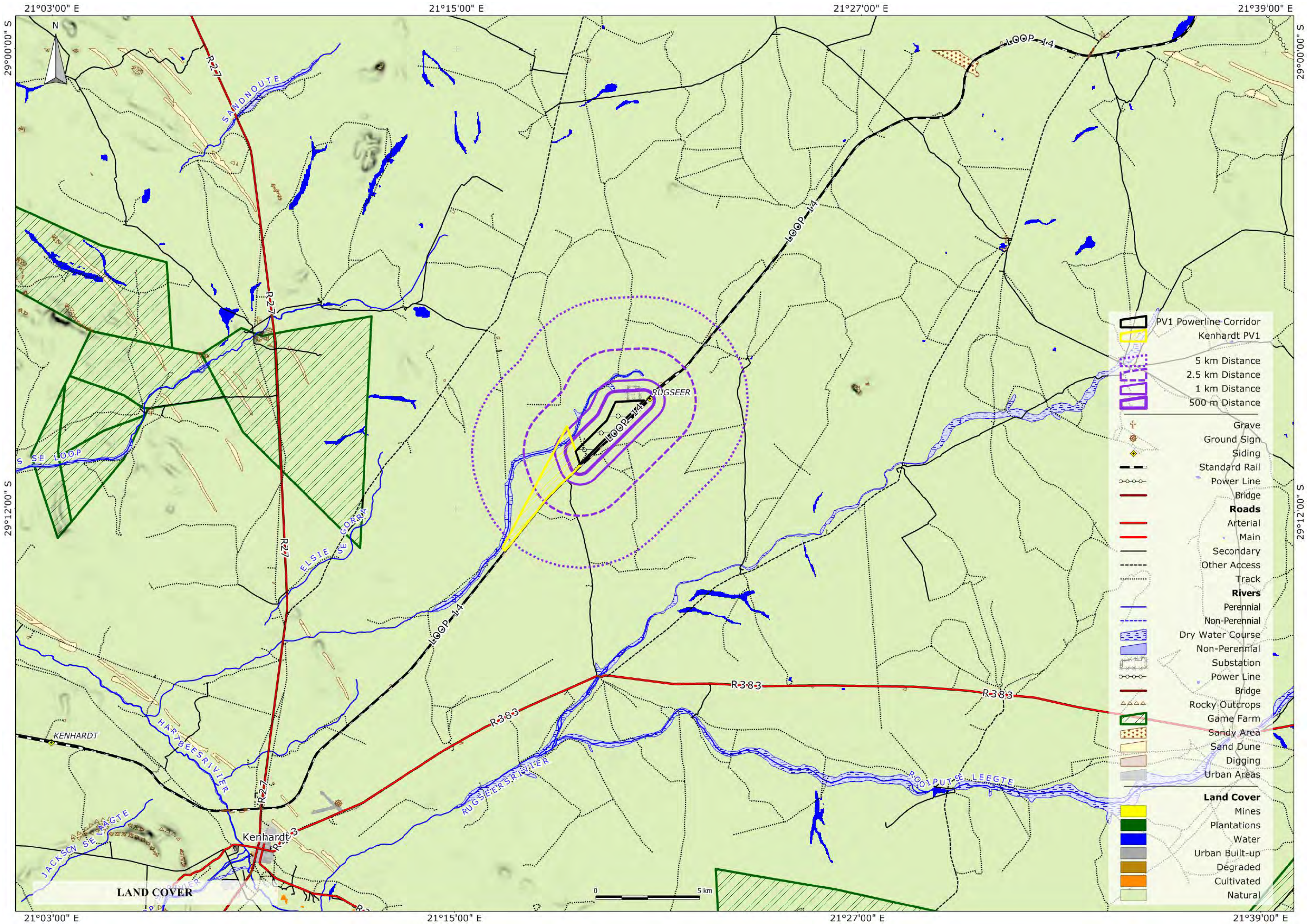
Map 2 Topographic Map of the Region.



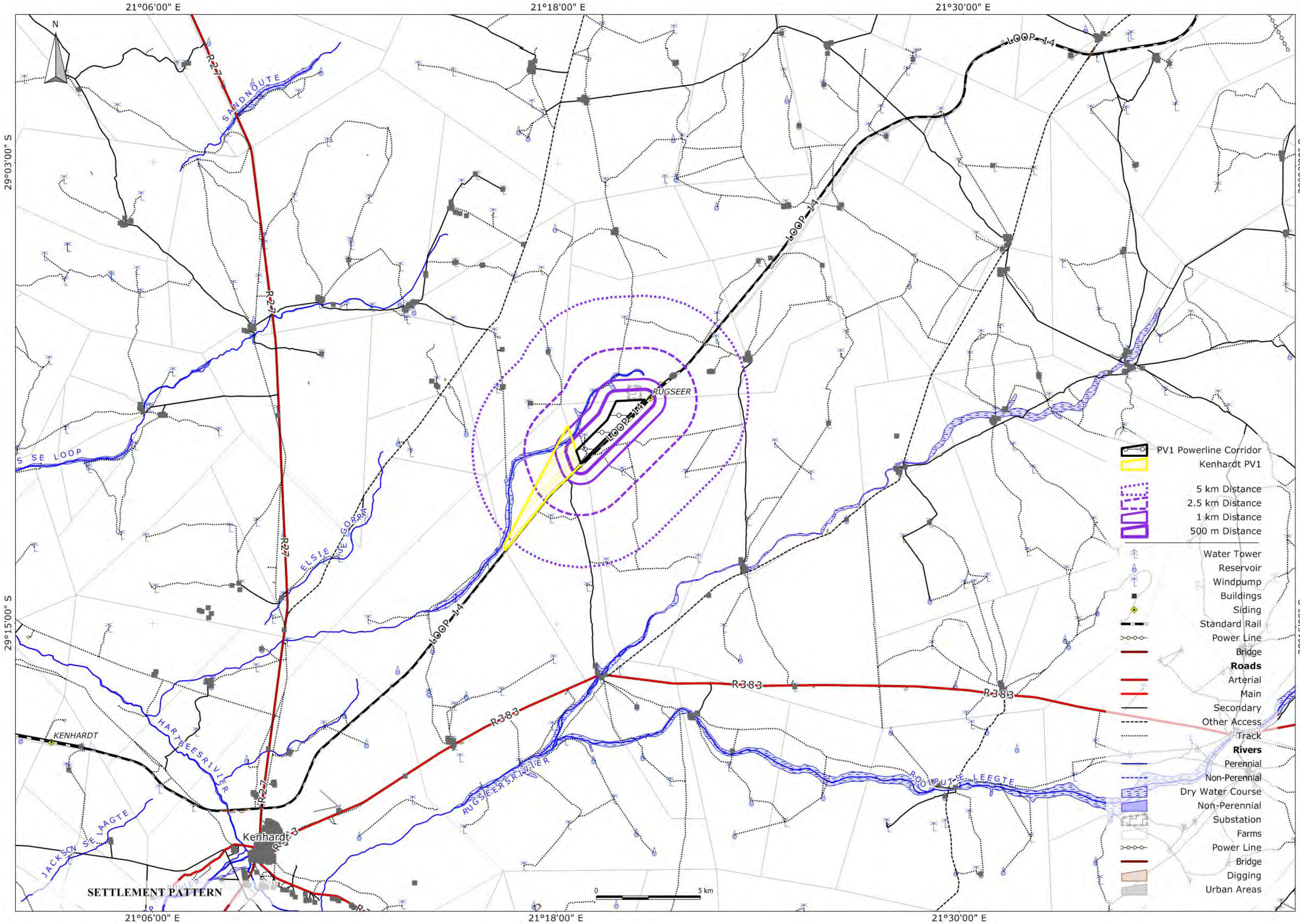
Map 3 a) South-North Topographic Profile, b) East-West Topographic Profile, c) South-east – North-west Topographic Profile, d) South-west – North-east Topographic Profile. Topographic profiles as indicated c the topographic map above.



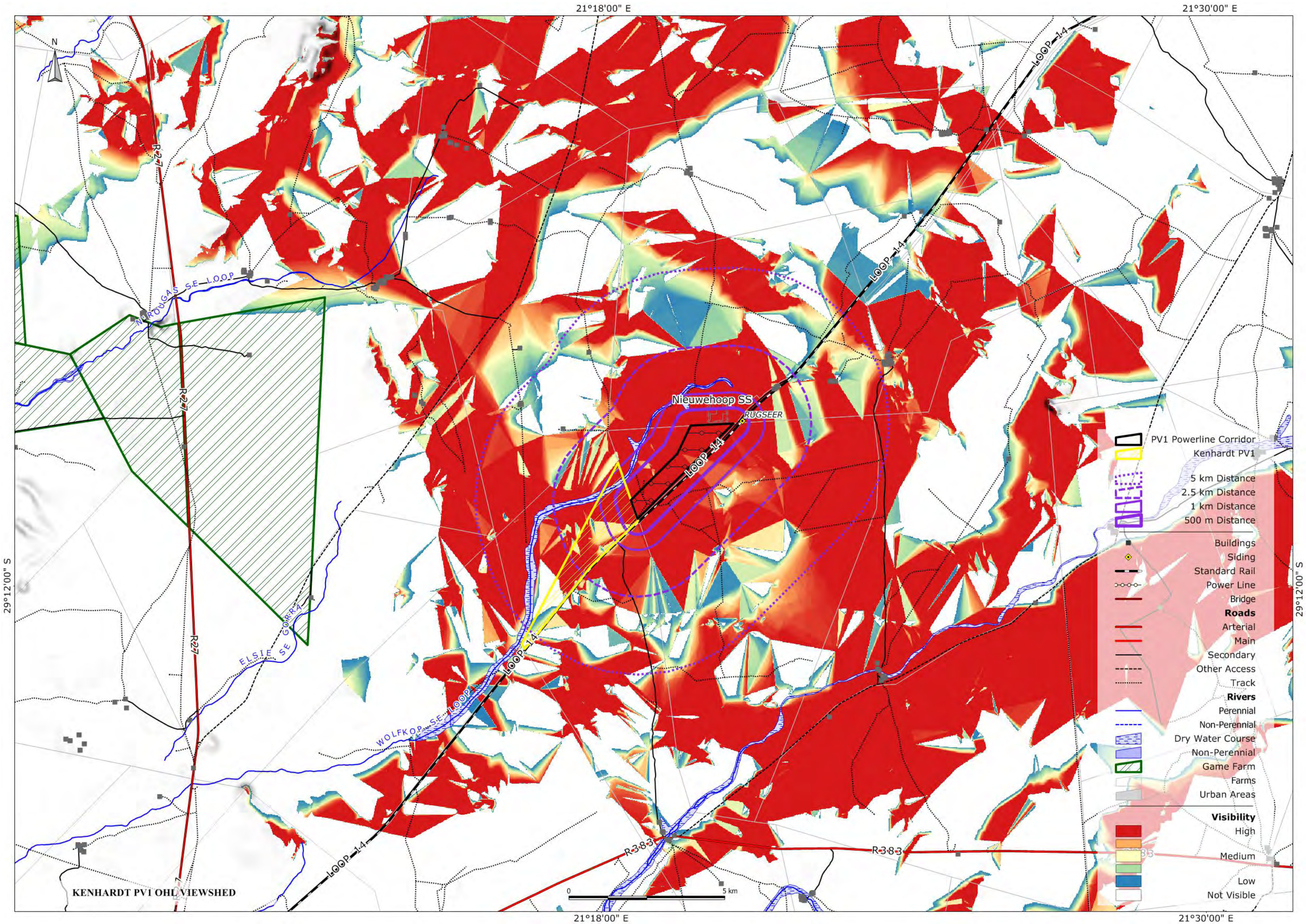
Map 4 Simplified geology of the region.



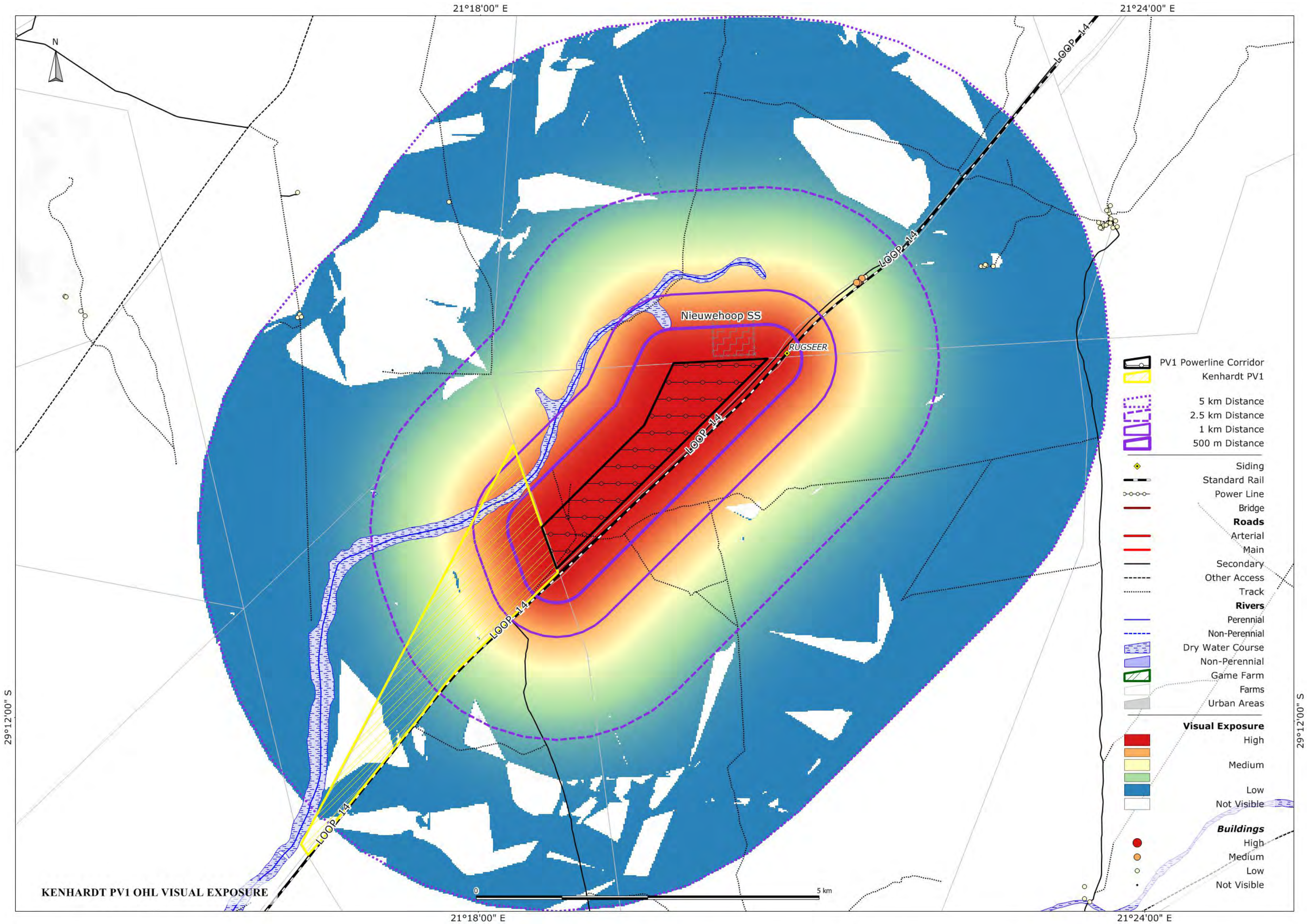
Map 5 Land cover map of the region.



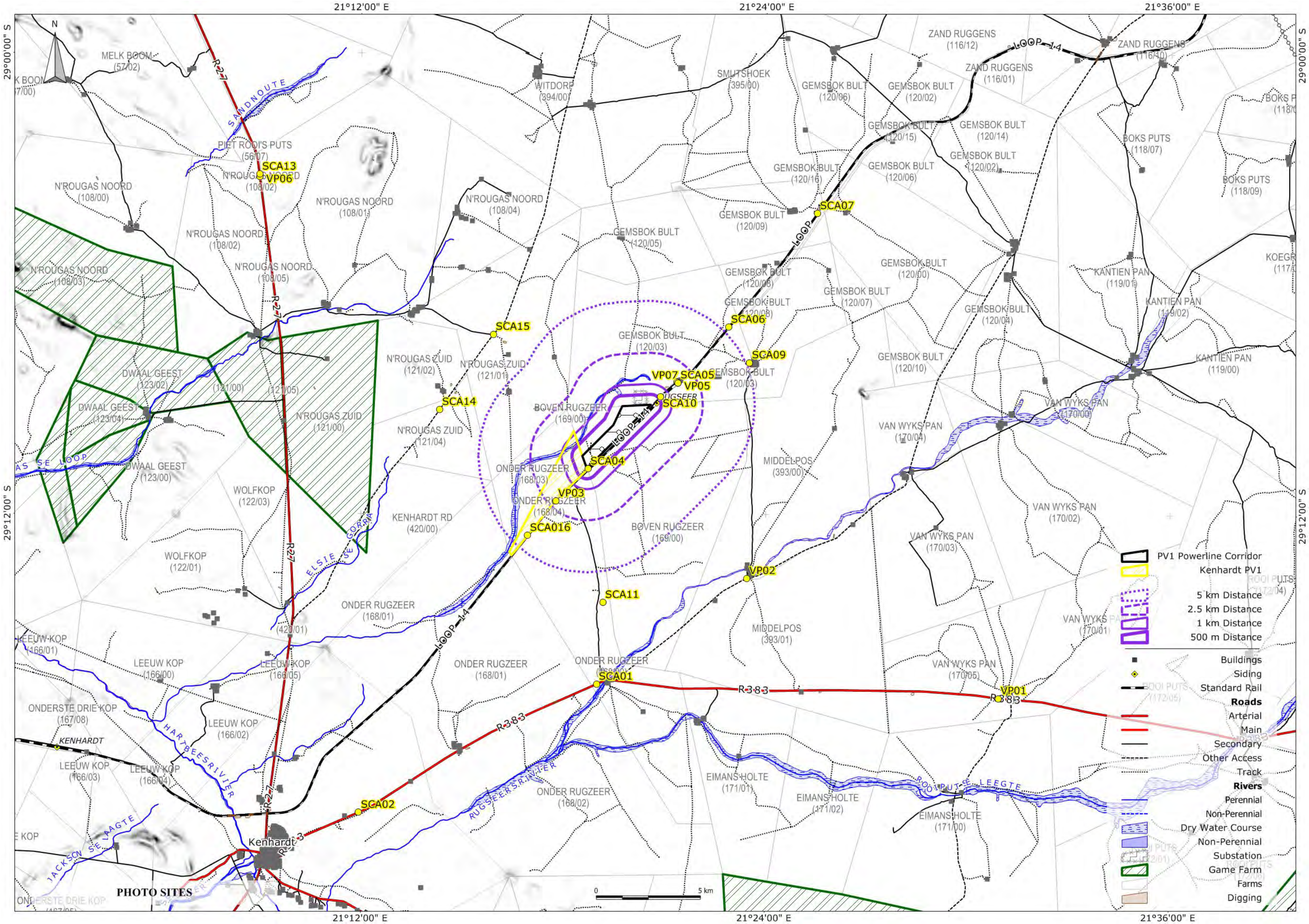
Map 6 Prominent man-made structures and settlement patterns in the landscape.



Map 7 Viewshed of the 132 kV proposed power line corridor between the proposed Kenhardt PV 1 facility and the Eskom grid at the Nieuwehoop Substation.



Map 8 Visual exposure for sensitive visual receptors within 5 km of the proposed transmission line route.



Map 9 Sites visited during photographic survey (SCA - October 2015; VP - June 2014)

BASIC ASSESSMENT REPORT

Appendix D.3:
Heritage Impact Assessment
(Archaeology and Cultural Landscape)

HERITAGE IMPACT ASSESSMENT FOR A PROPOSED 132 kV POWER LINE (KENHARDT PV 1 – TRANSMISSION LINE) ON FARMS 168/REM, 169/2, 169/REM and 120/3, KENHARDT MAGISTERIAL DISTRICT, NORTHERN CAPE

Required under Section 38 (8) of the National Heritage Resources Act (No. 25 of 1999).

Report for:

CSIR Environmental Management Services
P.O. Box 17001, Congella, Durban, 4013
Tel: 031 242 2300
Email: RAbed@csir.co.za

On behalf of:

Scatec Solar SA 330 (Pty) Ltd

Dr Jayson Orton
ASHA Consulting (Pty) Ltd
6A Scarborough Road, Muizenberg, 7945
Tel: (021) 788 8425 | 083 272 3225
Email: jayson@asha-consulting.co.za

First Draft: 10 November 2015
Final Report: 03 February 2016

EXECUTIVE SUMMARY

ASHA Consulting (Pty) Ltd was appointed by the Council for Scientific and Industrial Research (CSIR) to conduct an assessment of the potential impacts to heritage resources that might occur through the proposed construction of electrical infrastructure (including transmission lines) stretching over parts of the remainder of farm Onder Rugzeer 168, the Remainder of Boven Rugzeer 169, Portion 2 of Boven Rugzeer 169 and Portion 3 of farm Gemsbok Bult 120, in the Kenhardt Magisterial District. The proposed infrastructure will serve to link the proposed Kenhardt PV 1 solar energy facility (being assessed under a separate Environmental Impact Assessment (EIA) Process) with the Eskom Nieuwehoop Substation presently under construction on Gemsbok Bult 120/3. This Heritage Impact Assessment (HIA) is being undertaken as part of the Basic Assessment (BA) for a transmission corridor that would accommodate the proposed electrical infrastructure (referred to as the Kenhardt PV 1 – Transmission Line project).

The area is relatively flat, although gently undulating terrain occurs in places. A pan occurs at the northern end of the proposed corridor, while a small rocky koppie occurs in the southern part of the corridor. Vegetation is low and sparse with ground visibility being excellent.

Archaeological material in the form of background scatter was located across much of the general area but impacts to this material would be of very low significance. No archaeological sites or graves were found along the alignment of the proposed transmission line corridor but sites may be expected in association with the pan and koppie which, because of a change to the project, were not covered by the survey. Although sites of high significance are unlikely to occur, these two areas should be avoided with buffers of 75 m radius from the centre of the pan and 120 m radius from the summit of the koppie as a precautionary measure. The landscape was identified as a heritage resource but, because of the presence of electrical and other infrastructure in the area, the significance of new impacts is considered to be very low and no mitigation is suggested.

The significance of the potential impacts to archaeological resources and graves was rated as being very low, while the impacts to the landscape are also rated with a very low significance (without the implementation of mitigation measures). Aside from avoiding the pan and koppie, no mitigation measures are suggested.

The proposed project should be allowed to proceed but subject to the following conditions:

- The pan and koppie should be avoided with buffers of 75 m from the centre of the pan and 120 m from the summit of the koppie;
- The construction crew should be informed of the possibility of encountering graves and should be encouraged to report any suspicious-looking stone features prior to disturbance; and
- If any archaeological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

Glossary

Background Scatter: Artefacts whose spatial position is conditioned more by natural forces than by human agency

Early Stone Age: Period of the Stone Age extending approximately between 2 million and 200 000 years ago.

Later Stone Age: Period of the Stone Age extending over the last approximately 20 000 years.

Middle Stone Age: Period of the Stone Age extending approximately between 200 000 and 20 000 years ago.

Abbreviations

ASAPA: Association of Southern African Professional Archaeologists

BAR: Basic Assessment Report

CRM: Cultural Resources Management

CSIR: Council for Scientific and Industrial Research

EMPr: Environmental Management Programme

ESA: Early Stone Age

GPS: Global Positioning System

HIA: Heritage Impact Assessment

LSA: Later Stone Age

MSA: Middle Stone Age

NEMA: National Environmental Management Act (No. 107 of 1998)

NHRA: National Heritage Resources Act (No. 25) of 1999

NID: Notification of Intent to Develop

SAHRA: South African Heritage Resources Agency

SAHRIS: South African Heritage Resources Information System

COMPLIANCE WITH THE APPENDIX 6 OF THE 2014 EIA REGULATIONS

Requirements of Appendix 6 – GN R982	Addressed in the Specialist Report
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Section 1.4 & Appendix 1
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Section 1.5 & Appendix 2
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.3
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 3.2
e) a description of the methodology adopted in preparing the report or carrying out the specialised process;	Section 3
f) the specific identified sensitivity of the site related to the activity and its associated structures and infrastructure;	Section 6.2
g) an identification of any areas to be avoided, including buffers;	Sections 7 & 11
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 11
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 3.5
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment;	Sections 7 & 8
k) any mitigation measures for inclusion in the EMPr;	Section 11
l) any conditions for inclusion in the environmental authorisation;	Sections 11 & 13
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 11
n) a reasoned opinion- i. as to whether the proposed activity or portions thereof should be authorised; and ii. if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Sections 12 & 13
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 6.1
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Section 6.1
q) any other information requested by the competent authority.	n/a

Contents

1. INTRODUCTION

ASHA Consulting (Pty) Ltd was appointed by the Council for Scientific and Industrial Research (CSIR) to conduct an assessment of the potential impacts to heritage resources that might occur through the proposed construction of electrical infrastructure (including transmission lines) stretching over parts of the remainder of farm Onder Rugzeer 168, the Remainder of Boven Rugzeer 169, Portion 2 of Boven Rugzeer 169 and Portion 3 of farm Gemsbok Bult 120, in the Kenhardt Magisterial District (Figures 1 & 2). The proposed infrastructure will serve to link the proposed Kenhardt PV 1 solar energy facility (being assessed under a separate Environmental Impact Assessment (EIA) Process) with the Eskom Nieuwehoop Substation presently under construction on Gemsbok Bult 120/3. This Heritage Impact Assessment (HIA) is being undertaken as part of the Basic Assessment (BA) for a transmission corridor that would accommodate the proposed electrical infrastructure (referred to as the Kenhardt PV 1 – Transmission Line project).

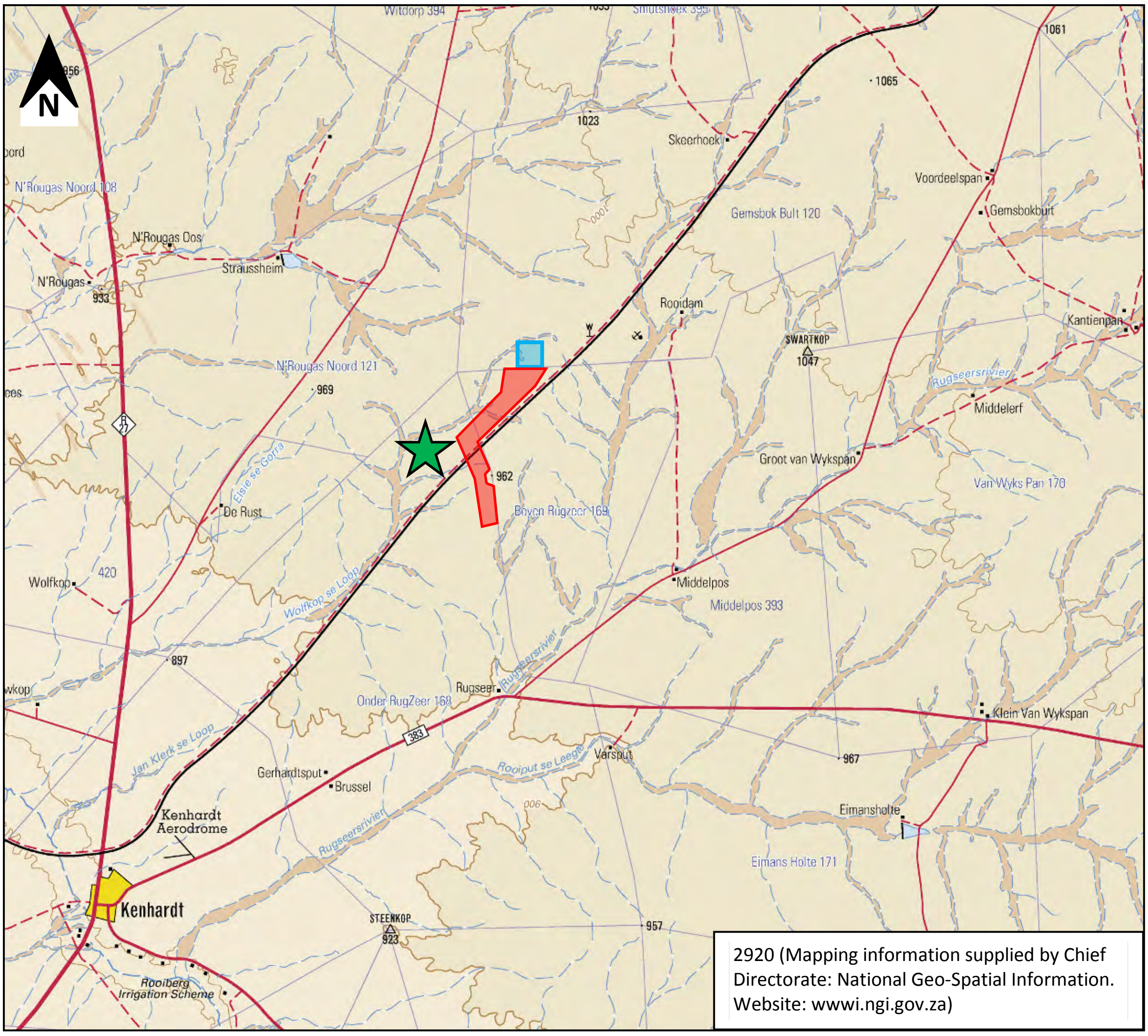


Figure 1: *Map showing the location of the proposed transmission line corridor (red) as well as the PV facility (green star) and substation (blue polygon) that it would link to.*

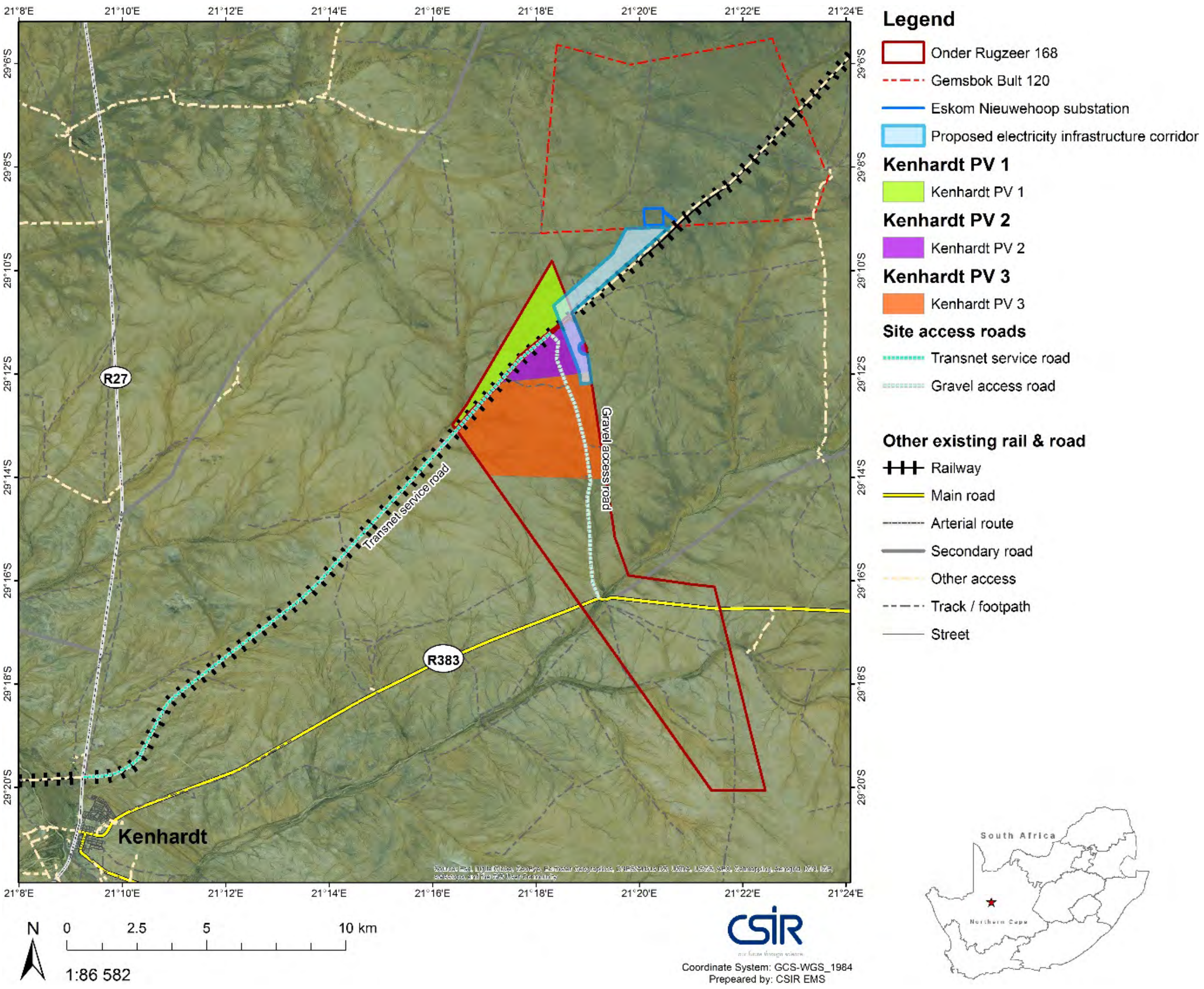


Figure 2: *Map showing the location of the proposed transmission line corridor (blue) in relation to the three proposed PV facilities and the Eskom Nieuwehoop Substation.*

1.1. Project Description

The following proposed transmission line and electrical infrastructure connectivity options have been considered in the BA Processes for the three transmission line projects:

- Each PV facility will be connected by a separate short 132 kV transmission line to the Eskom Nieuwehoop Substation that is currently being constructed on Farm Gemsbok Bult (remaining extent of Portion 3 of Farm 120); or
- Connect the Kenhardt PV 2 and Kenhardt PV 3 projects via separate 22/33 kV transmission lines to the proposed Kenhardt PV 1 on-site substation which will link via a 132 kV line to the Eskom Nieuwehoop Substation; or
- Construct one 132 kV transmission line from the Kenhardt PV 1 project to the Eskom Nieuwehoop Substation and connect the Kenhardt PV 2 and Kenhardt PV 3 facilities together via medium voltage transmission lines to either the on-site substation of Kenhardt PV 2 or PV 3, followed by the construction of one 132 kV transmission line from the on-site substation to the Eskom Nieuwehoop Substation.

All transmission lines and connectivity options (as described above) for the Kenhardt PV 1, PV 2 and PV 3 transmission line projects will be constructed within an electrical infrastructure corridor (as shown in Figure 1), which has been assessed in this report.

The proposed transmission lines are expected to be overhead, with concrete foundations and steel tower structures. The BA Process also includes the construction of associated electrical infrastructure at the Eskom Nieuwehoop Substation (including but not limited to an additional feeder bay, Busbars, transformer bay and extension to the platform at the substation).

A detailed project description is provided in Section A of the BA Report. Any aspect of the development as proposed might have a negative impact on heritage resources and thus the entire project is relevant to the HIA.

1.2. Terms of Reference

ASHA Consulting (Pty) Ltd was requested to conduct a field study and produce a HIA that would meet the requirements of the heritage authorities.

The HIA was based on the following broad Terms of Reference:

- Describe the affected environment and determine the status quo in terms of its heritage sites, heritage features and archaeology.
- Undertake a desktop study on the archaeology, cultural landscape and heritage sites within the proposed project area. Highlight any gaps in the baseline data.
- Based on the project description, define the environmental risks to the archaeology and heritage features.
- Undertake a detailed field examination of the archaeological sites and heritage features within or in the region of the development area. Record sites of archaeological relevance (photos, maps, aerial or satellite images, Global Positioning System (GPS) co-ordinates, and stratigraphic columns).
- Provide a sensitivity map indicating the presence of sensitive areas, “no-go” areas, setbacks/buffers, as well as the identification of red flags or risks associated with heritage and archaeological impacts.
- Evaluate the potential for occurrence of archaeological features within the study area.
- Identify relevant protocols, legal and permit requirements relating to heritage and archaeological impacts likely to be generated as a result of the proposed project.
- Identify and rate potential direct, indirect and cumulative impacts of the proposed project on the archaeological heritage during the construction, operational and decommissioning phases of the project.
- Comply with the requirements of the relevant heritage authority in order to obtain a letter of approval, in terms of the National Heritage Resources Act (Act 25 of 1999).
- Compile a report providing a review of heritage resources within the study area based on the desktop study and data from fieldwork and analysis.
- Provide input to the Environmental Management Programme (EMPr), including mitigation and monitoring requirements to ensure that the impacts on the

archaeological features and heritage features are limited. Provide recommendations and suggest appropriate mitigation measures (if required), for the recording, sampling and dating of any archaeological sites that could potentially be destroyed as a result of the proposed project.

1.3. Scope and Purpose of the Report

An HIA is a means of identifying any significant heritage resources before development begins so that these can be managed in such a way as to allow the development to proceed (if appropriate) without undue impacts to the fragile heritage of South Africa. This HIA report aims to fulfil the requirements of the heritage authorities such that a comment can be issued for consideration by the National Department of Environmental Affairs (DEA) who will review the BA and grant or withhold authorisation. The HIA report will outline any mitigation requirements that will need to be complied with from a heritage point of view and that should be included in the conditions of authorisation should this be granted.

1.4. The Author

Dr Jayson Orton has an MA (UCT, 2004) and a D.Phil (Oxford, UK, 2013), both in archaeology, and has been conducting HIAs and archaeological specialist studies in the Western Cape and Northern Cape provinces of South Africa since 2004 (Please refer to the Curriculum Vitae included as Appendix 1 of this report). He has also conducted research on aspects of the Later Stone Age in these provinces and published widely on the topic. He is accredited with the Association of Southern African Professional Archaeologists (ASAPA) Cultural Resources Management (CRM) section (Member #233) as follows:

- Principal Investigator: Stone Age, Shell Middens & Grave Relocation; and
- Field Director: Colonial Period & Rock Art.

1.5. Declaration of Independence

The declaration of independence by the specialist is provided below with a full declaration included in Appendix 2 of this HIA Report.

DECLARATION OF INDEPENDENCE I, Dr Jayson Orton, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed Kenhardt PV 1 – Transmission Line Project, application or appeal in respect of which I was appointed, other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work. JAYSON ORTON

2. HERITAGE LEGISLATION AND PREMIT REQUIREMENTS

The National Heritage Resources Act (NHRA) No. 25 of 1999 protects a variety of heritage resources as follows:

- Section 34: structures older than 60 years;
- Section 35: palaeontological, prehistoric and historical material (including ruins) more than 100 years old;
- Section 36: graves and human remains older than 60 years and located outside of a formal cemetery administered by a local authority; and
- Section 37: public monuments and memorials.

Following Section 2, the definitions applicable to the above protections are as follows:

- Structures: “any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith”;
- Palaeontological material: “any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace”;
- Archaeological material: a) “material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures”; b) “rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation”; c) “wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the Republic, as defined respectively in sections 3, 4 and 6 of the Maritime Zones Act, 1994 (Act No. 15 of 1994), and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation”; and d) “features, structures and artefacts associated with military history which are older than 75 years and the sites on which they are found”;
- Grave: “means a place of interment and includes the contents, headstone or other marker of such a place and any other structure on or associated with such place”; and
- Public monuments and memorials: “all monuments and memorials a) “erected on land belonging to any branch of central, provincial or local government, or on land belonging to any organisation funded by or established in terms of the legislation of such a branch of government”; or b) “which were paid for by public subscription, government funds, or a public-spirited or military organisation, and are on land belonging to any private individual.”

While landscapes with cultural significance do not have a dedicated Section in the NHRA, they are protected under the definition of the National Estate (Section 3). Section 3(2)(c) and (d) list “historical settlements and townscapes” and “landscapes and natural features of cultural significance” as part of the National Estate. Furthermore, Section 3(3) describes the reasons a place or object may have cultural heritage value; some of these speak directly to cultural landscapes.

Section 38 (2a) states that if there is reason to believe that heritage resources will be affected then an impact assessment report must be submitted. This report fulfils that requirement.

Under the National Environmental Management Act (No. 107 of 1998; NEMA), as amended, the project is subject to a BAR. Ngwao-Boswa Ya Kapa Bokoni (Heritage Northern Cape; for built environment and cultural landscapes) and the South African Heritage Resources Agency (SAHRA; for archaeology and palaeontology) are required to provide comment on the proposed project in order to facilitate final decision making by the DEA.

3. METHODS

3.1. Literature Survey and Information Sources

A survey of available literature was carried out to assess the general heritage context into which the development would be set. This literature included published material, unpublished commercial reports and online material, including reports sourced from the South African Heritage Resources Information System (SAHRIS). The 1:250 000 map was sourced from the Chief Directorate: National Geo-Spatial Information.

3.2. Field Survey

The corridor was surveyed in the field along with the proposed PV facilities on 28 to 31 October 2015. This was during late Spring, although in this dry area seasonality has no effect on the visibility of heritage resources – visibility was excellent. The survey sought to conduct a landscape survey where certain landscape features known to be more sensitive were located and searched. During the survey, the positions of finds were recorded on a hand-held GPS receiver set to the WGS84 datum. Photographs were taken at times in order to capture representative samples of both the affected heritage and the landscape setting of the proposed development.

The survey was conducted by the author in the company of Mr Matthew Shaw, an archaeology Masters student.

3.3. Impact Assessment

For consistency, the impact assessment was conducted through application of a scale supplied by the CSIR as shown in Section D of the BA Report.

3.4. Grading

Section 7 of the NHRA provides for the grading of heritage resources into those of National (Grade 1), Provincial (Grade 2) and Local (Grade 3) significance. Grading is intended to allow for the identification of the appropriate level of management for any given heritage resource. Grade 1 and 2 resources are intended to be managed by the national and provincial heritage resources authorities, while Grade 3 resources would be managed by the relevant local planning authority. These bodies are responsible for grading, but anyone may make recommendations for grading.

It is intended that the various provincial authorities formulate a system for the further detailed grading of heritage resources of local significance but this is generally yet to happen. Heritage Western Cape (2012), however, uses a system in which resources of local significance are divided into Grade 3A, 3B and 3C. These approximately equate to high, medium and medium-low local significance, while sites of low or very low significance (and generally not requiring mitigation or other interventions) are referred to as ungradeable. For convenience, the Heritage Western Cape system is employed here.

3.5. Assumptions and Limitations

The study is carried out at the surface only and hence any completely buried archaeological sites will not be readily located. Similarly, it is not always possible to determine the depth of archaeological material visible at the surface. Another limitation was introduced by a change to the project description after the fieldwork had been completed. This meant that only part of the currently proposed corridor was surveyed. Given the nature of the surface geology, and types of heritage resources typically encountered in the landscape, none of these limitations are likely to have significantly affected the outcome of the report.

With regards to cumulative impacts, various other solar energy facilities, electrical transmission lines have been proposed in the immediate area. A new substation is presently under construction, while three solar energy facilities have been granted Environmental Authorisation, although it is unknown when/if they will be built. The list of developments considered in the cumulative impact assessment is provided in Section D of the BA Report.

4. PHYSICAL ENVIRONMENTAL CONTEXT

4.1. Site Context

The site is located in a remote area some 23 km northeast of Kenhardt. It is located along the Sishen-Saldanha Railway Line and its gravel service road. Although major power lines are not currently present in the area, a large substation is currently under construction at the north-eastern end of the proposed electrical corridor – this is the Eskom Nieuwehoop Substation (Figure 3). Three PV facilities have already been granted authorisation in close proximity to the substation setting a precedent for electrical development in the area, although it is unknown when/if they will be built. The land is otherwise generally undeveloped and used for small stock grazing. Farm tracks and fences criss-cross the general area and occasional wind pumps occur.

Figure 3: *View towards the northeast of the Eskom Nieuwehoop Substation currently under construction at the northern end of the electrical corridor.*

4.2. Site Description

The site is generally quite flat with occasional very low rocky outcrops. The vegetation is sparse and largely less than knee-high; trees are rare. The surface is coated mostly with fine gravel which is a product of the weathering bedrock. Very ephemeral stream beds cross the site, but these are generally only evident because of the elevated vegetation density and slightly larger bushes along their alignments. Figures 4 to 6 show examples of the landscape in the broader study area as seen on the remainder of Onder Rugzeer Farm 168.

Figure 4: *View of an ephemeral stream bed with its slightly elevated vegetation density.*

5. CULTURAL HERITAGE CONTEXT

This section of the HIA contains the desktop study and establishes what is already known about heritage resources in the vicinity of the study area. What was found during the field survey as presented below may then be compared with what is already known in order to gain an improved understanding of the significance of the newly reported resources.

Figure 5: *Example of overgrazed land with very sparse vegetation.*

Figure 6: *Example of gravel surface and one of the few trees in the study area.*

5.1. Archaeological Aspects

Bushmanland is well known for the vast expanses of gravel that occur in places and which frequently contain stone artefacts in varying densities (Beaumont *et. al* 1995). Such material is referred to as 'background scatter' and is invariably of very limited significance. At times, however, the scatter can become very dense and mitigation work is occasionally called for. The artefacts located in these contexts are largely Early Stone Age (ESA) and Middle Stone Age (MSA) and are not associated with any other archaeological materials – these would have long since decomposed and disappeared. Previous experience immediately east of the present site suggests that such dense accumulations of artefacts are unlikely to occur in this area.

Of potentially more significance, however, are Later Stone Age (LSA) sites which are commonly located along the margins of water features in Bushmanland. These features include both pans and ephemeral drainage lines. Such sites were identified to the east of the present study area in association with pans but artefact scatters associated with drainage lines were rare (Orton 2014a, 2014b, 2014c). The drainage lines on the present site, however, are more prominent and perhaps more likely to reveal LSA camp sites. These sites would typically contain mostly stone artefacts, but fragments of ostrich eggshell (used as water containers and also as a food source) and pottery are also found at times, while bone is rare and likely confined to sites that are very recent. Similar LSA sites can also be found in association with rocky outcrops but none appear to occur within the present study area. Because of their positions along water courses and adjacent to rocky areas, such sites are often avoided by development proposals because of the need to avoid the relevant natural features. Despite the increased likelihood of locating archaeology along streams, Morris (2009) noted that a search along the banks of the Hartebeest River close to Kenhardt, where he expected elevated frequencies of archaeological material, revealed virtually nothing.

Another kind of archaeological site fairly commonly encountered in Bushmanland is small rock outcrops that have been quarried as a source of stone material for making stone tools.

Several such occurrences were noted to the east where quartz outcrops where frequently flaked (Orton 2014a, 2014b, 2014c).

Rock engravings are known from the broader area (Louw Roux Bushmanland 2013). From the limited information available, these appear to be naturalistic images produced by the Bushmen. Geometric images, produced by the Khoekhoen, are not well known from the area (Orton 2013), although David Morris (pers. comm. 2015) has seen examples in the region. Painted art is also very rare but again, examples are known, particularly on large granite boulders.

5.2. Historical Aspects

The Anglo-Boer War was fought across the Northern Cape, but information on the role of Kenhardt appears difficult to locate. The town was occupied by the Boers in late February 1900 after they convinced the magistrate that they had a large gun and would fire on the town if it did not surrender. They later surrendered to the British who occupied the town on 31st March 1900. By mid-1900 there were perhaps 100 Cape Rebels detained in a camp outside of Kenhardt (Grobler 2004). The British raised a local force known as the Border Scouts in Upington in May 1900. Many were mixed-race individuals, some local farmers, others Kalahari hunters, but all disliked the Boers. The scouts were responsible for a large area of the north-western Cape Colony centred on Upington and Kenhardt. They eventually numbered 786 by January 1901 and were under the command of Major John Birbeck (AngloBoerWar.com 2015; Rodgers 2011). At the beginning of 1902 there were 150 Border Scouts stationed at Kenhardt. Two boers, H.L. Jacobs and A.C. Jooste, were accused of treason and executed in the town on 24 July 1901 (Grobler 2004). A memorial stands there to their honour (Green Kalahari n.d.).

No major action appears to have taken place around Kenhardt, although the Boers are known to have attacked a patrol on 17th May 1901, while the British attacked a Boer position on 25th June 1901 (AngloBoerWar.com 2015).

5.3. Built Environment

The built environment is sparsely represented in Bushmanland because the farms tend to be so large. The vast majority of structures appear to be quite recent in age (20th century) and are of very limited heritage significance. In any case, the development will not affect any buildings.

5.4. Graves

Graves are also very rare. Some older farms may have small graveyards located close to their farm buildings but, again, these are highly unlikely to be included within the areas proposed for development. Unmarked pre-colonial graves can, in theory, be located anywhere, although they are generally more common in sandy areas where excavation of graves was easier and in more productive areas where population densities would have been higher. It is highly unlikely that pre-colonial graves would be encountered in the study area.

5.5. Other Aspects

The cultural and natural landscape is also of concern. However, the cultural landscape is very poorly developed in this area with fences, water troughs and wind pumps being the primary features. The natural landscape lacks visually interesting and sensitive features. In addition, the proposed site is a long distance from any important roads (it is 11 km from the R27) and is highly unlikely to be visible to anyone other than local residents making use of the gravel road along the railway line. Solar PV facilities are not very tall and, if an earthy coloured paint is used for the buildings, they can be almost invisible from as little as 1 km away.

6. IDENTIFICATION OF KEY ISSUES

6.1. Key Issues Identified

Only one potentially significant heritage issue was identified prior to commencement of the BA Process. This was:

- The potential damage to or destruction of Stone Age archaeological sites occurring in proximity to water courses and pans.

The following comment was also received from the SAHRA on 22 September 2015 (via SAHRIS) based on the review of the Background Information Document. It is important to note that only the points relating to Archaeology and Heritage aspects have been extracted from the SAHRA comment and noted below:

> *In terms of the National Heritage Resources Act, no 25 of 1999, heritage resources, including archaeological or palaeontological sites over 100 years old, graves older than 60 years, structures older than 60 years are protected. They may not be disturbed without a permit from the relevant heritage resources authority. This means that prior to development it is incumbent on the developer to ensure that a Heritage Impact Assessment is done. This must include the archaeological component (Phase 1) and any other applicable heritage components. Appropriate (Phase 2) mitigation, which involves recording, sampling and dating sites that are to be destroyed, must be done as required.*
>
> *The quickest process to follow for the archaeological component is to contract an accredited specialist (see the web site of the Association of Southern African Professional Archaeologists www.asapa.org.za) to provide a Phase 1 Archaeological Impact Assessment Report. This must be done before any large development takes place.*
>
> *The Phase 1 Impact Assessment Report will identify the archaeological sites and assess their significance. It should also make recommendations (as indicated in section 38) about the process to be followed. For example, there may need to be a mitigation phase (Phase 2) where the specialist will collect or excavate material and date the site. At the end of the process the heritage authority may give permission for destruction of the sites.*

> *Any other heritage resources that may be impacted such as built structures over 60 years old, sites of cultural significance associated with oral histories, burial grounds and graves, graves of victims of conflict, and cultural landscapes or viewscapes must also be assessed.*

The present HIA meets the requirements of SAHRA in that it aims to satisfy Section 38(3) of the NHRA, the author is an appropriately accredited CRM Section member of ASAPA and recommendations for further studies as may be required are presented.

6.2. Sensitivity of the site in relation to proposed activity

The broader site is sensitive for the many archaeological artefacts and sites on its surface that could be damaged or destroyed through construction related activities. These include site preparation and all works related to installation of the project components.

6.3. Identification of Potential Impacts

The potential impacts identified during the BA are:

6.3.1. Construction Phase

- Damage to or destruction of archaeological resources and graves; and
- Impacts to the cultural and natural landscape.

6.3.2. Operational Phase

- Impacts to the cultural and natural landscape

6.3.3. Decommissioning Phase

- Impacts to the cultural and natural landscape

6.3.4. Cumulative Impacts

- Damage to or destruction of archaeological resources and graves; and
- Impacts to the cultural and natural landscape.

7. FINDINGS OF THE HERITAGE STUDY

Heritage resources were found to be very sparsely distributed across the broader landscape and only two areas (neither of which were actually covered by the survey) are likely to be sensitive. The first is the rocky koppie that occurs on the eastern margin of the corridor near its southern end (Figure 7). Fieldwork for another project nearby revealed the presence of Stone Age scatters, a possible grave and a few low stone-built structures on the eastern side of the koppie and which have low-medium heritage significance (Orton 2016). The second area is the small pan that occurs close to the Nieuwehoop Substation at the northern end of the transmission corridor, although just outside its mapped extent. It is generally the case that Stone Age artefacts scatters occur around the vast majority of water sources in the area. Isolated artefacts attributable to the background scatter will also be present but are of no concern. Figure 8 shows the location of the two sensitive landscape features.

The only other heritage resource is the cultural landscape which, in this area, is weakly developed. Because of the other infrastructure already present in the area (substation, railway line), it is already compromised and will not be significantly impacted.

Figure 7: *View of the rocky koppie as seen from the northeast.*

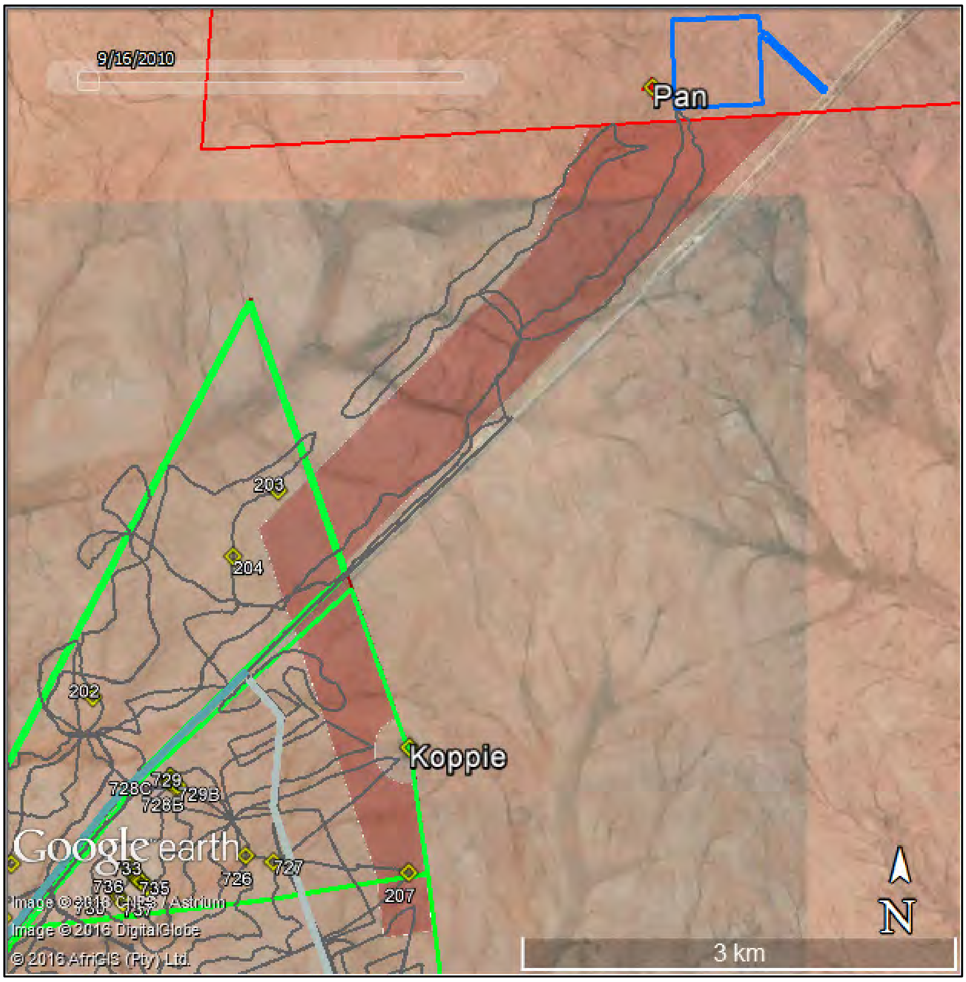


Figure 8: *Aerial view of the study area showing the locations of the proposed transmission corridor (shaded red), the finds in the broader area and GPS tracks (grey lines). The green lines show the proposed PV facilities and the blue square the Eskom Nieuwehoop Substation. The pan and koppie of concern are indicated.*

7.1. Statement of Significance

Section 38(3)(b) of the NHRA requires an assessment of the significance of all heritage resources. In terms of Section 2(vi), ''cultural significance'' means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance.

Although no archaeological resources were recorded in the areas of the corridor surveyed, it is anticipated that resources of low-medium significance for their scientific value will likely be present around the pan and on the rocky koppie. The landscape has low significance for its aesthetic value.

7.2. Summary of Heritage Indicators and Provisional Grading

No significant heritage resources were recorded along the proposed corridor route but it is anticipated that any that may occur in association with the pan or koppie will not be worth anything more than a provisional 3C grading (i.e. medium-low local significance).

8. ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

8.1. Damage to and Destruction of Archaeological Resources and Graves (Construction Phase)

Although no such resources were recorded during the survey, this assessment assumes that resources would be present at the pan and koppie. The potential impact of damage to and destruction of archaeological resources and graves is predicted to be a negative, direct impact. The impact is rated with a site specific spatial extent and a permanent duration. The consequence for graves would be extreme, while for archaeology it would be moderate. Because power lines have such a small surface footprint, the probability of any impact is rated as extremely unlikely (although note that the probability relates to the probability of impacting significant archaeological resources since it is guaranteed that at least some archaeological resources (isolated artefacts) will be directly impacted). The reversibility of the impact and irreplaceability of the resource are respectively rated as non-reversible and high.

Although no archaeological sites or graves were noted along the proposed transmission line corridor, it is possible that sites in surrounding areas could be disturbed during the construction phase if vehicles do not remain within the construction footprint. Archaeological mitigation is not suggested but all activities and vehicles should be confined to the approved footprint so as to minimise impacts to heritage resources in surrounding areas. The significance of the potential impact is expected to be very low (without the implementation of mitigation measures).

8.2. Impacts to the Natural and Cultural Landscape (Construction, Operational and Decommissioning Phases)

The impact of the proposed project on the natural and cultural landscape is expected to occur during the construction, operational and decommissioning phases. These potential impacts are predicted to be negative and direct, with a local spatial extent, and a long-term duration for the construction and operational phases and a short-term duration for the decommissioning phase. The consequence and probability of the impact are respectively rated as slight and very likely. The reversibility of the impact and irreplaceability of the resource are respectively rated as high and moderate for the construction, operational and decommissioning phases.

The addition of new transmission lines (and associated structures) to the landscape will alter its character from a rural landscape to one more strongly characterized by electrical infrastructure. Given that the precedent has already been set for electrical development, the significance of the potential impact is considered to be very low (without the implementation of mitigation measures). No mitigation is suggested.

8.3. Cumulative Impacts to Archaeological Resources and Graves

All the electrical development in the area will result in many archaeological artefacts and sites and possibly some graves being disturbed and /or destroyed over a wide area. Few of the sites recorded in the region have high cultural significance and it is likely that the vast majority of those that do would be protected from harm because of their proximity to water courses and pans. The locations of graves cannot be predicted and they are difficult to assess. As such, because graves can be very difficult to identify and many may well continue to exist beneath any developments, it is difficult to evaluate any cumulative impacts. The nature of graves as individual and generally isolated heritage resources is such that, although each is significant, the disturbance of multiple examples will not result in a significant cumulative impact. The potential negative cumulative impacts on archaeological resources and graves would occur at a site specific level and would be permanent in duration.

Because no sites of high archaeological significance or graves were found within the present study area, the cumulative impact consequence is rated as moderate with the probability of impacts being extremely unlikely (for the destruction of archaeological resources) and extreme and extremely unlikely (for the destruction of graves). These combine to provide a significance rating of very low for this project (without the implementation of mitigation measures – none have been recommended). The impacts are irreversible and the irreplaceability of archaeological resources and graves is high.

8.4. Cumulative Impacts to the Natural and Cultural Landscape

Given the large amount of other electrical infrastructure planned for the area, the addition of this relatively short transmission line is not expected to make any significant contribution to the cumulative impacts on the landscape. The potential impact is rated with a local spatial extent and a long-term duration. The consequence and probability of the impact are respectively rated as slight and very likely. The reversibility of the impact and irreplaceability of the resource are respectively rated as high and moderate. The impact significance is rated as being very low and no mitigation is suggested.

9. IMPACT ASSESSMENT SUMMARY

The assessment of potential impacts and recommendation of mitigation measures as discussed above are collated in Tables 1 to 4 below. Note that indirect impacts are not assessed because the nature of the identified heritage resources is such that significant indirect impacts are highly unlikely to occur.

Table 1 Impact assessment summary table for the Construction Phase

Construction Phase													
Direct Impacts													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Construction of the proposed power lines	Destruction of archaeological resources	Negative	Site	Permanent	Moderate	Extremely unlikely	Non-reversible	High	Vehicles to remain within construction corridor	Very low	Very low	5	High
Construction of the proposed power lines	Destruction of graves	Negative	Site	Permanent	Extreme	Extremely unlikely	Non-reversible	High	Vehicles to remain within construction corridor	Very low	Very low	5	High
Construction of the proposed power lines	Impacts to the natural and cultural landscape	Negative	Local	Long term	Slight	Very likely	High	Moderate	None	Very low	Very low	5	High

Table 2 Impact assessment summary table for the Operational Phase

Operational Phase													
Direct Impacts													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Construction of the proposed power lines	Impacts to the natural and cultural landscape	Negative	Local	Long term	Slight	Very likely	High	Moderate	None	Very low	Very low	5	High

Table 3 Impact assessment summary table for the Decommissioning Phase

Decommissioning Phase													
Direct Impacts													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
The presence of construction vehicles	Impacts to the natural and cultural landscape	Negative	Local	Short term	Slight	Very likely	High	Moderate	None	Very low	Very low	5	High

Table 4 Cumulative impact assessment summary table

Cumulative Impacts													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Construction of the proposed power lines	Destruction of archaeological resources	Negative	Site	Permanent	Moderate	Extremely unlikely	Non-reversible	High	None	Very low	Very low	5	High
Construction of the proposed power lines	Destruction of graves	Negative	Site	Permanent	Extreme	Extremely unlikely	Non-reversible	High	None	Very low	Very low	5	High
Construction of the proposed power lines	Impacts to the natural and cultural landscape	Negative	Local	Long term	Slight	Very likely	High	Moderate	None	Very low	Very low	5	High

10. PERMIT REQUIREMENTS

The NHRA does not require the developer to obtain permits prior to construction. However, any archaeological mitigation work (i.e. test excavations, sampling etc.) that may be required (in the event of archaeological resources of significance being found within the development footprint during construction) would need to be conducted under a permit issued to, and in the name of, the appointed archaeologist. The permit application process allows the heritage authorities to ensure that a suitably qualified and experienced archaeologist undertakes the work and that the proposed excavation/sampling methodology is acceptable.

11. INPUT TO THE ENVIRONMENTAL MANAGEMENT PROGRAMME

11.1. For inclusion in the EMPr

The pan and koppie should be excluded from physical impacts and cordoned off to protect any heritage resources that might be present as shown in Figure 9. Suggested buffers are 75 m radius from the centre of the pan and 120 m radius from the summit of the koppie.

The Environmental Control Officer (ECO) (or Environmental Officer) should meet with workers on site at the start of the construction phase to explain the possibility that graves might be present. During construction all personnel should be vigilant for any unusual stone features and these should be reported to the ECO who should then report the find(s) to an archaeologist.

It should be ensured that all vehicles and construction activities are restricted to within the approved footprint in order to minimise the chances of impacts to other heritage resources located outside of the transmission corridor.

11.2. For inclusion in the Environmental Authorisation

The following points should be included as conditions of authorisation:

- The pan and koppie should be avoided with buffers of 75 m from the centre of the pan and 120 m from the summit of the koppie;
- The construction crew should be informed of the possibility of encountering graves and should be encouraged to report any suspicious-looking stone features prior to disturbance; and
- If any archaeological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

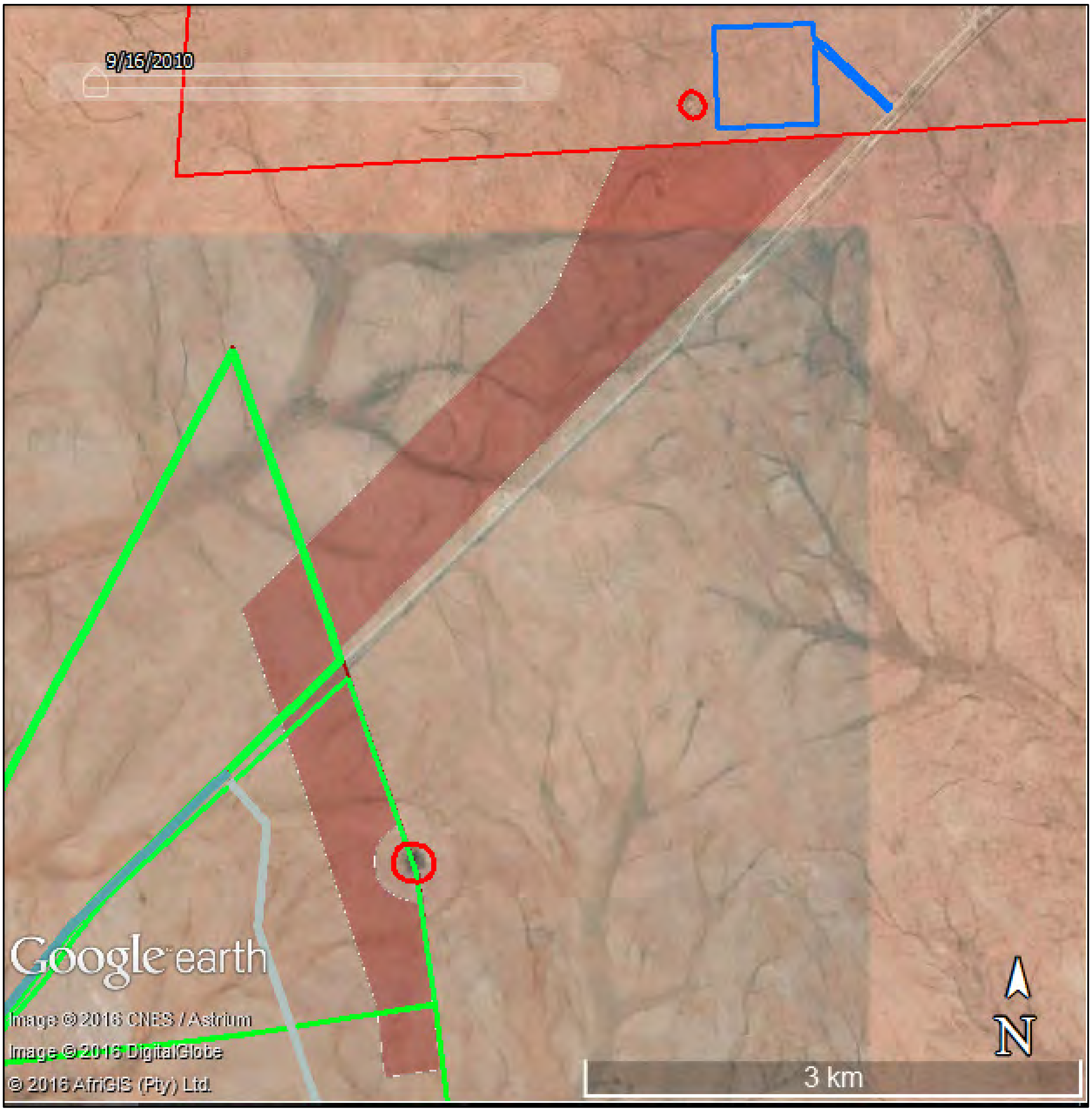


Figure 9: *Aerial view of the study area showing the two areas to be avoided (red circles) in relation to the proposed transmission line corridor (shaded red).*

12. CONCLUSIONS

So long as the buffers around the pan and the koppie are respected, no significant impacts to heritage resources are expected from the proposed electrical infrastructure in its presently proposed corridor and no archaeological mitigation is suggested. There is therefore no heritage-related reason to not authorise the project.

13. RECOMMENDATIONS

The proposed project should be allowed to proceed but subject to the following conditions:

- The pan and koppie should be avoided with buffers of 75 m from the centre of the pan and 120 m from the summit of the koppie;
- The construction crew should be informed of the possibility of encountering graves and should be encouraged to report any suspicious-looking stone features prior to disturbance; and
- If any archaeological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.

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15. APPENDIX 1 – Curriculum Vitae

Curriculum Vitae

Jayson David John Orton

ARCHAEOLOGIST AND HERITAGE CONSULTANT

Contact Details and personal information:

Address: 6A Scarborough Road, Muizenberg, 7945
Telephone: (021) 788 8425
Cell Phone: 083 272 3225
Email: jayson@asha-consulting.co.za

Birth date and place: 22 June 1976, Cape Town, South Africa
Citizenship: South African
ID no: 760622 522 4085
Driver's License: Code 08
Marital Status: Married to Carol Orton
Languages spoken: English and Afrikaans

Education:

SA College High School	Matric	1994
University of Cape Town	B.A. (Archaeology, Environmental & Geographical Science)	1997
University of Cape Town	B.A. (Honours) (Archaeology)*	1998
University of Cape Town	M.A. (Archaeology)	2004
University of Oxford	D.Phil. (Archaeology)	2013

*Frank Schweitzer memorial book prize for an outstanding student and the degree in the First Class.

Employment History:

Spatial Archaeology Research Unit, UCT	Research assistant	Jan 1996 – Dec 1998
Department of Archaeology, UCT	Field archaeologist	Jan 1998 – Dec 1998
UCT Archaeology Contracts Office	Field archaeologist	Jan 1999 – May 2004
UCT Archaeology Contracts Office	Heritage & archaeological consultant	Jun 2004 – May 2012
School of Archaeology, University of Oxford	Undergraduate Tutor	Oct 2008 – Dec 2008
ACO Associates cc	Associate, Heritage & archaeological consultant	Jan 2011 – Dec 2013
ASHA Consulting (Pty) Ltd	Director, Heritage & archaeological consultant	Jan 2014 –

Memberships and affiliations:

South African Archaeological Society Council member	2004 –
Assoc. Southern African Professional Archaeologists (ASAPA) member	2006 –
ASAPA Cultural Resources Management Section member	2007 –
UCT Department of Archaeology Research Associate	2013 –
Heritage Western Cape APM Committee member	2013 –
UNISA Department of Archaeology and Anthropology Research Fellow	2014 –
Fish Hoek Valley Historical Association	2014 –

Professional Accreditation:

ASAPA membership number: **233, CRM Section member**

Principal Investigator: Coastal shell middens (awarded 2007)
Stone Age archaeology (awarded 2007)
Grave relocation (awarded 2014)

Field Director: Rock art (awarded 2007)
Colonial period archaeology (awarded 2007)

Fieldwork and project experience:

Extensive fieldwork as both Field Director and Principle Investigator throughout the Western and Northern Cape, and also in the western parts of the Free State and Eastern Cape as follows:

Phase 1 surveys and impact assessments:

- Project types
  - Notification of Intent to Develop applications (for Heritage Western Cape)
  - Heritage Impact Assessments (largely in the Environmental Impact Assessment or Basic Assessment context under NEMA and Section 38(8) of the NHRA, but also self-standing assessments under Section 38(1) of the NHRA)
  - Archaeological specialist studies
  - Phase 1 test excavations in historical and prehistoric sites
  - Archaeological research projects
- Development types
  - Mining and borrow pits
  - Roads (new and upgrades)
  - Residential, commercial and industrial development
  - Dams and pipe lines
  - Power lines and substations
  - Renewable energy facilities (wind energy, solar energy and hydro-electric facilities)

Phase 2 mitigation and research excavations:

- ESA open sites
  - Duinefontein, Gouda
- MSA rock shelters
  - Fish Hoek, Yzerfontein, Cederberg, Namaqualand
- MSA open sites
  - Swartland, Bushmanland, Namaqualand
- LSA rock shelters
  - Cederberg, Namaqualand, Bushmanland
- LSA open sites (inland)
  - Swartland, Franschhoek, Namaqualand, Bushmanland
- LSA coastal shell middens
  - Melkbosstrand, Yzerfontein, Saldanha Bay, Paternoster, Dwarskersbos, Infanta, Knysna, Namaqualand
- LSA burials
  - Melkbosstrand, Saldanha Bay, Namaqualand, Knysna
- Historical sites
  - Franschhoek (farmstead and well), Waterfront (fort, dump and well), Noordhoek (cottage), variety of small excavations in central Cape Town and surrounding suburbs
- Historic burial grounds
  - Green Point (Prestwich Street), V&A Waterfront (Marina Residential), Paarl

APPENDIX 2 - Specialist Declaration

I, Jayson Orton, as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

- I act as the independent specialist in this application;
- I perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I have no vested interest in the proposed activity proceeding;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist: ______________________________

Name of Specialist: JAYSON ORTON

Date: 01 FEBRUARY 2016

BASIC ASSESSMENT REPORT

Appendix D.4:
Desktop Palaeontological Impact Assessment

PALAEONTOLOGICAL IMPACT ASSESSMENT:

Basic Assessment for the proposed transmission lines connecting the Kenhardt Solar Photovoltaic Facilities PV 1, PV 2 and PV 3 on Onder Rugzeer Farm 168 to the Nieuwehoop Substation on Gemsbok Bult 120, north-east of Kenhardt, Northern Cape Province

Report prepared for:

CSIR – Environmental Management Services

P O Box 17001

Congella, Durban, 4013

South Africa

Report prepared by:

Dr John Almond - Natura Viva cc

P.O. Box 12410

Mill Street, Cape Town, 8010

South Africa

March 2016

SPECIALIST EXPERTISE

Dr John Almond has an Honours Degree in Natural Sciences (Zoology) as well as a PhD in Palaeontology from the University of Cambridge, UK. He has been awarded post-doctoral research fellowships at Cambridge University and in Germany, and has carried out palaeontological research in Europe, North America, the Middle East as well as North and South Africa and Madagascar. For eight years he was a scientific officer (palaeontologist) for the Geological Survey / Council for Geoscience in the RSA. His current palaeontological research focuses on fossil record of the Precambrian - Cambrian boundary and the Cape Supergroup of South Africa. He has recently written palaeontological reviews for several 1: 250 000 geological maps published by the Council for Geoscience and has contributed educational material on fossils and evolution for new school textbooks in the RSA.

Since 2002 Dr Almond has also carried out numerous palaeontological impact assessments for developments and conservation areas in the Western, Eastern and Northern Cape, Free State, Northwest, Mpumalanga and Gauteng under the aegis of his Cape Town-based company *Natura Viva* cc. He was a long-standing member of the Archaeology, Palaeontology and Meteorites Committee for Heritage Western Cape (HWC) and an advisor on palaeontological conservation and management issues for the Palaeontological Society of South Africa (PSSA), HWC and SAHRA. He is currently compiling technical reports on the provincial palaeontological heritage of Western, Northern and Eastern Cape for SAHRA and HWC. Dr Almond is an accredited member of PSSA and APHAP (Association of Professional Heritage Assessment Practitioners – Western Cape).

SPECIALIST DECLARATION

I, Dr John Edward Almond, as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

- I act as the independent specialist in this application;
- I perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I have no vested interest in the proposed activity proceeding;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realize that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist: John E. Almond

Name of Specialist: Dr John Edward Almond

Date: 29 January 2016

EXECUTIVE SUMMARY

Scatec Solar SA 330, 350 and 370 (PTY) Ltd is proposing to develop three 75 MW Solar Photovoltaic (PV) Facilities (i.e. Kenhardt PV 1, PV 2 and PV 3) on the remaining extent of Onder Rugzeer Farm 168, situated *c*. 20 km north-east of Kenhardt, Northern Cape. The associated electrical infrastructure (i.e. transmission lines) that will support the Kenhardt PV Facilities are being assessed as part of a Basic Assessment Process. The following proposed transmission line and electrical infrastructure connectivity options have been considered in the Basic Assessment Process:

- Each PV facility will be connected by a separate short 132 kV transmission line to the Eskom Nieuwehoop Substation that is currently being constructed on Farm Gemsbok Bult (remaining extent of Portion 3 of Farm 120); or
- Connect the Kenhardt PV 2 and Kenhardt PV 3 projects via separate 22/33 kV transmission lines to the proposed Kenhardt PV 1 on-site substation which will link via a 132 kV line to the Eskom Nieuwehoop Substation; or
- Construct one 132 kV transmission line from the Kenhardt PV 1 project to the Eskom Nieuwehoop Substation and connect the Kenhardt PV 2 and Kenhardt PV 3 facilities together via medium voltage transmission lines to either the on-site substation of Kenhardt PV 2 or PV 3, followed by the construction of one 132 kV transmission line from the on-site substation to the Eskom Nieuwehoop Substation.

The above connectivity options occur within an electrical infrastructure corridor.

This present report provides a Palaeontological Impact Assessment of each of the proposed new transmission lines (to support each proposed Kenhardt PV facility), as part of the required Basic Assessment Process.

The corridor for the proposed 132 kV and 33 kV/22 kV transmission lines are underlain at depth by Precambrian basement rocks (*c*. 1-2 billion years old) assigned to the Namaqua-Natal Province. These ancient igneous and high-grade metamorphic rocks - mainly granites and gneisses of the Keimoes Suite and Jacomynspan Group - crop out at surface in small areas and are entirely unfossiliferous. A large proportion of the basement rocks are mantled by a range of superficial sediments of Late Caenozoic age that may contain sparse fossil remains. These predominantly thin, unconsolidated deposits include small patches of calcretes, gravelly to sandy river alluvium, pan sediments, surface gravels, colluvium (scree) as well as Pleistocene to Recent wind-blown sands of the Gordonia Formation (Kalahari Group). Most of these younger rock units are of widespread occurrence and low palaeontological sensitivity. Scientifically important vertebrate fossil remains (*e.g.* Pleistocene mammalian bones and teeth) have been recorded within older stratified pan and river sediments elsewhere in the Bushmanland region where they are often associated with stone artefacts, while a limited range of trace fossils (*e.g.* plant root casts, termitaria and other invertebrate burrows) may be found within calcrete horizons.

No previously recorded areas or sites of exceptional fossil heritage sensitivity or significance have been identified within the Kenhardt PV project area as a whole, including the transmission line corridor. Due to (1) the inferred scarcity of scientifically important fossil remains within the study areas, as well as (2) the small scale of excavations for electrical pylon footings concerned, the overall impact significance of the construction phase of each of the transmission lines is assessed as VERY LOW (before and after mitigation). This applies equally to all 132 kV and 33 kV/22 kV transmission lines under consideration. No significant impacts on fossil heritage are anticipated during the operational and decommissioning phases of the proposed transmission lines. The potentially fossiliferous sedimentary rock units represented within the study area (*e.g.* Gordonia aeolian sands, calcrete) are of widespread occurrence and this is also likely to apply to most of the fossils they contain. It is concluded that the cumulative impacts on fossil heritage resource posed by the transmission lines/corridor, in the context of several alternative energy and other infrastructural developments planned in the region (as explained in the BA Report), is of very low significance. There are no fatal flaws in the proposed developments, nor are there objections to their authorisation as far as fossil heritage conservation is concerned, since significant impacts on scientifically valuable fossils or fossil sites are not anticipated here. The no-go option (no transmission lines) will have a neutral impact on local palaeontological heritage resources. The only proposed condition to accompany environmental authorisation is that the recommendations for monitoring and mitigation included in the EMPr are fully complied with.

Given the low palaeontological sensitivity of the eastern Bushmanland region, as determined from desktop and field-based studies, as well as the inferred very low impact significance of the proposed 132 kV and 33 kV/22 kV transmission lines for fossil heritage conservation, no specialist palaeontological monitoring or mitigation is recommended here, pending the discovery of substantial new fossil remains during construction.During the construction phase all substantial bedrock excavations should be monitored for fossil material by the responsible Environmental Control Officer. Should significant fossil remains - such as vertebrate bones and teeth, plant-rich fossil lenses, petrified wood or dense fossil burrow assemblages - be exposed during construction, the responsible Environmental Control Officer should safeguard these, preferably *in situ*. The South African Heritage Resources Authority (SAHRA), should be alerted as soon as possible (Contact details: Mrs Colette Scheermeyer, P.O. Box 4637, Cape Town 8000, Tel: 021 462 4502, Email: cscheermeyer@sahra.org.za), so that appropriate action can be taken by a professional palaeontologist, at the developer's expense. Mitigation would normally involve the scientific recording and judicious sampling or collection of fossil material as well as associated geological data (*e.g.* stratigraphy, sedimentology, taphonomy) by a professional palaeontologist. The palaeontologist concerned with mitigation work will need a valid fossil collection permit from SAHRA and any material collected would have to be curated in an approved depository (*e.g.* museum or university collection). These recommendations should be included within the Environmental Management Programmes for the proposed transmission line developments.

For the purposes of this report the entire proposed transmission line corridor was assessed from a palaeontological impact point of view. The applicant is free to select any area within the surveyed area (i.e. the corridor) to construct the transmission lines, provided that the recommended mitigation measures are implemented as applicable.

COMPLIANCE WITH THE APPENDIX 6 OF THE 2014 EIA REGULATIONS

Requirements of Appendix 6 – GN R982	**Addressed in the Specialist Report**
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Preliminary Section of this Report
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Appendix I of the BA Report and Section 1.1.6 of this Report
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Not Applicable
e) a description of the methodology adopted in preparing the report or carrying out the specialised process;	Section 1.1
f) the specific identified sensitivity of the site related to the activity and its associated structures and infrastructure;	Section 1.3
g) an identification of any areas to be avoided, including buffers;	Not Applicable
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 1.3
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.1.4
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment;	Section 1.5, 1.6, 1.7 and 1.8
k) any mitigation measures for inclusion in the EMPr;	Section 1.7 and Section 1.8
l) any conditions for inclusion in the environmental authorisation;	Not applicable
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 1.8
n) a reasoned opinion- i. as to whether the proposed activity or portions thereof should be authorised; and ii. if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 1.9
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Not Applicable
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Section 1.5.1
q) any other information requested by the competent authority.	Not applicable

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LIST OF ABBREVIATIONS

DEA	Department of Environmental Affairs
EIA	Environmental Impact Assessment
PIA	Palaeontological Impact Assessment
SAHRA	South African Heritage Resources Agency
Ma / mya	Million years ago

GLOSSARY

Definitions	
Basement Rocks	Ancient igneous and metamorphic rocks (usually unfossiliferous) underlying the sedimentary cover rocks in a given region
Calcrete	Pedogenic limestone (*i.e.* limestone generated by soil processes within soils and surface rock debris), generally associated with seasonally arid climates.
Fossiliferous	Containing fossil remains
Igneous Rocks	Rocks that have crystallised from a molten state (magma / lava); *e.g*. granite.
Metamorphic	Rocks that have recrystallized under conditions of altered (usually highly elevated) temperature and pressure; *e.g.* gneiss.
Precambrian	Older than 541 million years old (mya).
Pleistocene Epoch	Time period between *c*. 2.6 mya and 10 000 years ago (associated with a series of major glaciations in the northern hemisphere).

PALAEONTOLOGICAL IMPACT ASSESSMENT

This report presents the findings of the Palaeontological Impact Assessment that was prepared by Dr. John Almond (of Natura Viva cc) as part of the Basic Assessment (BA) for the proposed Kenhardt PV 1 – Transmission Line, Kenhardt PV 2 – Transmission Line and Kenhardt PV 3 – Transmission Line projects within the Northern Cape Province.

1.1 INTRODUCTION AND METHODOLOGY

1.1.1 Scope and Objectives

The proposed 132 kV and 33 kV/22 kV transmission line connections for the proposed Kenhardt PV 1, Kenhardt PV 2 and Kenhardt PV 3 75 MW Solar Photovoltaic (PV) Facility projects overlie potentially fossiliferous sedimentary rocks. A desktop Palaeontological Impact Assessment - or at least a letter of exemption from a palaeontologist to indicate that this is unnecessary – has been requested by the South African Heritage Resources Agency (SAHRA) Archaeology, Palaeontology and Meteorites Unit for the three proposed PV developments and the associated electrical infrastructure (Case IDs: 8204, 8205 and 8206 letters of September 22, 2015; Case Numbers for the transmission line projects are 8207, 8208 and 8209).

Linked to the above, this present report provides desktop assessments of potential impacts on local palaeontological (*i.e.* fossil) heritage within the transmission line corridor between the proposed Kenhardt PV 1, Kenhardt PV 2 and Kenhardt PV 3 75 MW Solar PV Facilities on the remaining extent of Onder Rugzeer Farm 168 and the Eskom Nieuwehoop Substation that is currently being constructed on Farm Gemsbok Bult (remaining extent of Portion 3 of Farm 120), situated *c*. 20 km north-east of Kenhardt, Northern Cape Province. This report contributes to the BA's for the proposed transmission lines and includes recommendations for inclusion in the corresponding Environmental Management Programme (EMPr).

The overall objectives of the specialist study are to:

- Determine the current conditions in sufficient detail so that there is a baseline against which impacts can be identified and measured.
- Identify potential impacts that may occur during the construction, operational and decommissioning phases of the proposed development, as well as impacts associated with future environmental changes if the "no-go" option is implemented (both positive and negative).
- Assess the impacts in terms of direct, indirect and cumulative impacts.
- Provide recommendations with regards to potential monitoring programmes.
- Determine mitigation and/or management measures which could be implemented to as far as possible reduce the effect of negative impacts and enhance the effect of positive impacts.
- Incorporate and address all issues and concerns raised in relation to palaeontological impacts.

1.1.2 Terms of Reference

The Terms of Reference for the present study, as defined by the CSIR, are as follows:

1. Review detailed information relating to the project description and precisely define the environmental risks to palaeontological heritage, and consequences thereto.
2. Conduct a review of available information pertaining to the study area.
3. Draw on desktop information sources, the knowledge of local experts, information published in the scientific press and information derived from relevant EIAs and similar specialist studies previously conducted within the surrounding area.
4. Prepare and undertake a desktop study on the palaeontology and fossil heritage within the proposed project area, based on:
    - a review of all relevant palaeontological and geological literature, including geological maps and previous reports,
    - location and examination of fossil collections from the study area (*e.g.* museums), and
    - data on the proposed development (*e.g.* location of footprint, depth and volume of bedrock excavation envisaged).
5. Describe the type and location of known fossil heritage sites in the study area, and characterize all items that may be affected by the proposed project.
6. Describe the baseline environment and determine the *status quo* in relation to palaeontological impacts.
7. Note fossils and associated sedimentological features of palaeontological relevance (photos, maps, aerial or satellite images, and stratigraphic columns).
8. Analyse the stratigraphy, age and depositional setting of fossil-bearing units.
9. Evaluate the potential for occurrence of palaeontological heritage features within the study area.
10. Incorporate relevant information from other specialist reports/findings, if required.
11. Identify and rank the highlights and sensitivities to development of fossil heritage within study area.
12. Identify and rate potential direct, indirect and cumulative impacts of the proposed project on the palaeontology and fossil heritage during the construction, operational and decommissioning phases of the project. Study the cumulative impacts of the project by considering the impacts of existing industries / solar PV plants within the area (as well as those PV plants that are proposed), together with the impact of the proposed project.
13. Provide recommendations and suggestions regarding fossil heritage management on site, including conservation measures, as well as promotion of local fossil heritage (*e.g.* for public education, schools) to ensure that the impacts are limited.
14. Provide input to the EMPr, including mitigation and monitoring requirements to ensure that the impacts on the archaeological features and heritage features are limited.
15. Provide specific recommendations for further palaeontological mitigation (if any).
16. Compile an illustrated, fully-referenced review of palaeontological heritage within study area based on desktop study.

1.1.3 Approach and Methodology

The approach to a Phase 1 palaeontological heritage study is briefly as follows. In preparing a palaeontological desktop study the potentially fossiliferous rock units (groups, formations etc.) represented within the study area are determined from geological maps and satellite images. The known fossil heritage within each rock unit is inventoried from the published scientific literature, previous palaeontological impact studies in the same region, and the author's field experience and palaeontological database (consultation with professional colleagues as well as examination of institutional fossil collections may play a role here. This data is then used to assess the palaeontological sensitivity of each rock unit to development (provisional tabulations of palaeontological sensitivity of all formations in the Western, Eastern and Northern Cape have already been compiled by J. Almond and colleagues (*e.g.* Almond & Pether 2008). The likely impact of the proposed development on local fossil heritage is then determined on the basis of (1) the palaeontological sensitivity of the rock units concerned and (2) the nature and scale of the development itself, most significantly the extent of fresh bedrock excavation envisaged. When rock units of moderate to high palaeontological sensitivity are present within the development footprint, a Phase 1 field assessment study by a professional palaeontologist is usually warranted to identify any palaeontological hotspots and make specific recommendations for any mitigation required before or during the construction phase of the development. **However, due to the low palaeontological sensitivity of the present study area a Phase 1 field assessment is not required and a desktop assessment is being undertaken instead (i.e. this study).**

On the basis of the desktop and Phase 1 field assessment studies, the likely impact of the proposed development on local fossil heritage and any need for specialist mitigation are then determined. Adverse palaeontological impacts normally occur during the construction rather than the operational or decommissioning phase. Phase 2 mitigation by a professional palaeontologist – normally involving the recording and sampling of fossil material and associated geological information (*e.g.* sedimentological data) may be required (a) in the pre-construction phase where important fossils are already exposed at or near the land surface and / or (b) during the construction phase when fresh fossiliferous bedrock has been exposed by excavations. To carry out mitigation, the palaeontologist involved will need to apply for a palaeontological collection permit from the relevant heritage management authorities for the Northern Cape, *i.e.* SAHRA (Contact details: Mrs Colette Scheermeyer, P.O. Box 4637, Cape Town 8000, Tel: 021 462 4502, Email: cscheermeyer@sahra.org.za). It should be emphasized that, providing appropriate mitigation is carried out, the majority of developments involving bedrock excavation can make a positive contribution to our understanding of local palaeontological heritage.

1.1.4 Assumptions and Limitations

The accuracy and reliability of palaeontological specialist studies as components of Heritage Impact Assessments are **generally** limited by the following constraints:

1. Inadequate database for fossil heritage for much of South Africa, given the large size of the country and the small number of professional palaeontologists carrying out fieldwork here. Most development study areas have never been surveyed by a palaeontologist.

2. Variable accuracy of geological maps which underpin these desktop studies. For large areas of terrain these maps are largely based on aerial photographs alone, without ground-truthing. The maps generally depict only significant (“mappable”) bedrock units as well as major areas of superficial “drift” deposits (alluvium, colluvium) but for most regions give little or no idea of the level of bedrock outcrop, depth of superficial cover (soil etc.), degree of bedrock weathering or levels of small-scale tectonic deformation, such as cleavage. All of these factors may have a major influence on the impact significance of a given development on fossil heritage and can only be reliably assessed in the field.

3. Inadequate sheet explanations for geological maps, with little or no attention paid to palaeontological issues in many cases, including poor locality information.

4. The extensive relevant palaeontological "grey literature" - in the form of unpublished university theses, impact studies and other reports (e.g. of commercial mining companies) - that is not readily available for desktop studies.

5. Absence of a comprehensive computerized database of fossil collections in major South African institutions which can be consulted for impact studies. A Karoo fossil vertebrate database is now accessible for impact study work.

In the case of palaeontological desktop studies without supporting Phase 1 field assessments these limitations may variously lead to either:

(a) underestimation of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or

(b) overestimation of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by tectonism or weathering, or are buried beneath a thick mantle of unfossiliferous "drift" (soil, alluvium *etc.*).

Since most areas of South Africa have not been studied palaeontologically, a palaeontological desktop study usually entails inferring the presence of buried fossil heritage within the study area from relevant fossil data collected from similar or the same rock units elsewhere, sometimes at localities far away. Where substantial exposures of bedrocks or potentially fossiliferous superficial sediments are present in the study area, the reliability of a palaeontological impact assessment may be significantly enhanced through field assessment by a professional palaeontologist.

In the case of the Scatec Solar project area near Kenhardt in the Northern Cape, bedrock exposure is limited due to extensive cover by superficial deposits (*e.g.* alluvium, soils, surface gravels), especially in areas of low relief, as well as by pervasive *bossieveld* vegetation. For this reason, as well as the low palaeontological sensitivity of the sedimentary rocks mapped in the project area, a desktop-level rather than field-based assessment was considered appropriate for this study. Given the uniformity of the bedrock geology and superficial deposits (and hence palaeontological sensitivity) underlying the various transmission line routes under consideration, a single Palaeontological Impact Assessment Report is considered to be suitable and sufficient for the proposed 132 kV transmission lines (*i.e.* a separate study is not needed for each line/corridor).

Despite the lack of palaeontological field data from the project area itself, confidence levels in the conclusions reached in the desktop study are moderately high because of the author's field experience of the sedimentary rocks represented in the wider Bushmanland region (See reference list for previous palaeontological assessments in the area; *e.g.* Almond 2009, 2011, 2014a, 2014b, 2014c, 2014d). Recent palaeontological heritage assessments for several other alternative energy developments in the region have been taken into consideration (*e.g.* the Nieuwehoop Solar Park just to the east of the proposed project area).

In terms of the impact assessment, the methodology adopted is outlined in the BA Report, which also notes the developments within a 20 km radius that have been considered in order to assess cumulative impacts.

1.1.5 Sources of Information

The information used in this desktop study was based on the following sources:

1. A detailed project outline supplied by the CSIR - Environmental Management Services.

2. Previous desktop palaeontological assessment reports for study areas in the Kenhardt region by the author (Almond 2009, 2011, 2014a, 2014b, 2014c, 2014d). The last two reports assess fossil heritage resources within the Nieuwehoop Solar Park on farms Gemsbok Bult 120 and Boven Rugzeer 169.

3. A review of the relevant scientific literature, including published geological maps (e.g. 1: 250 000 scale geological map sheet 2920 Kenhardt published by the Council for Geoscience, Pretoria) and accompanying sheet explanations (e.g. Slabbert *et al*. 1999).

4. The author's previous field experience with the formations concerned and their palaeontological heritage (cf Almond and Pether 2008; SAHRIS website).

1.1.6 Declaration of Independence of Specialists

Refer to the preliminary section of this specialist report for the Curriculum Vitae of Dr. John Almond, which highlights his experience and expertise. The declaration of independence by the specialist is provided in Box 1.1 below and included in Appendix I of this BA Report.

BOX 1.1: DECLARATION OF INDEPENDENCE

I, John Almond, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed Kenhardt PV 1 – Transmission Line, Kenhardt PV 2 – Transmission Line and Kenhardt PV 3 – Transmission Line Projects, application or appeal in respect of which I was appointed, other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.

John E. Almond

JOHN ALMOND

1.2 DESCRIPTION OF PROJECT ASPECTS RELEVANT TO PALAEONTOLOGICAL HERITAGE IMPACTS

A detailed description of the proposed project is included in Section A of the BA Report. The proposed transmission line and electrical infrastructure BA project will include the following connectivity options:

- The construction of a single 132 kV transmission line from each Kenhardt PV facility to the Eskom Nieuwehoop Substation; or
- Connect the Kenhardt PV 2 and Kenhardt PV 3 projects via separate 22 kV/33 kV transmission lines to the proposed Kenhardt PV 1 on-site substation which will link via a 132 kV line to the Eskom Nieuwehoop Substation; or
- Construct one 132 kV transmission line from the Kenhardt PV 1 project to the Eskom Nieuwehoop Substation and connect the Kenhardt PV 2 and Kenhardt PV 3 facilities

together via medium voltage transmission lines to either the on-site substation of Kenhardt PV 2 or PV 3, followed by the construction of one 132 kV transmission line from the on-site substation to the Eskom Nieuwehoop Substation.

The above proposed transmission lines will be constructed within an electrical infrastructure corridor (as shown in Figure 1), which has been assessed in this report.

As noted above, the Scatec Solar project area near Kenhardt is located in a region of Bushmanland that is underlain by potentially fossiliferous sedimentary rocks of Late Tertiary or Quaternary age as well as by unfossiliferous basement rocks (as discussed in Section 1.3 of this report). The construction phase of the proposed transmission lines for each PV project will entail excavations into the superficial sediment cover and locally into the underlying bedrock as well. These include, for example, surface clearance operations and small excavations for the electrical pylon footings. All these developments may adversely affect potential, legally-protected fossil heritage resources within the study area by destroying, disturbing or permanently sealing-in fossils at or beneath the surface of the ground that are then no longer available for scientific research or other public good.

The planning, operational and decommissioning phases of the proposed transmission lines are very unlikely to involve additional adverse impacts on local palaeontological heritage, however.

1.3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

In this section of the report an outline of the geology of the corridor of the proposed transmissions line is first given, based on the relevant geological maps and scientific literature. This is followed by a brief review of fossil heritage that has previously been recorded from the sedimentary rock units that are represented within the project area.

1.3.1 Geological context

As mentioned above, the study area for the proposed 132 kV and 33 kV/22 kV transmission lines, located on the farms Onder Rugzeer 168, Boven Rugzeer 169 (only traversing above) and Gemsbok Bult 120, is located some 20 km northeast of Kenhardt, Northern Cape. The area is situated within the semi-arid Bushmanland region at elevations of between *c.* 930 to 970 m amsl, with a general slope towards the southwest. It is drained by a dendritic network of shallow, southwest-flowing tributary streams of the Hartbeesrivier. The geology of the study area is shown on the 1: 250 000 geology sheet 2920 Kenhardt (Council for Geoscience, Pretoria) (Figure 1). The entire area is underlain at depth by a variety of Precambrian basement rocks that are *c*. 2 billion years old and are assigned to the **Namaqua-Natal Province**. These ancient igneous and high-grade metamorphic rocks - mainly granites and gneisses - crop out at surface as small patches and are entirely unfossiliferous. The Precambrian crustal rocks are transected by a NW-SE trending fault zone and lie to the north of the major Wolfkop Fault. The basement rock units represented in the transmission line study areas include the **Jacomyns Pan Group** (gneisses of the Sandnoute Formation) and the **Keimoes Suite** (Elsie se Gorra Granite). These rock units are described in the Kenhardt 1: 250 000 sheet explanation by Slabbert *et al.* (1999) and placed in the context of the Namaqua-Natal Province by Cornell *et al.* (2006). However, they are entirely unfossiliferous and so will not be discussed further here.

A large proportion of the basement rocks in the transmission line project area are mantled by a range of superficial sediments of Late Caenozoic age, some of which are included within the **Kalahari Group**. These predominantly thin, unconsolidated deposits include small patches of calcretes (soil limestones), gravelly to sandy river alluvium, pan sediments along certain watercourses, surface gravels, colluvium (scree) as well as – especially – Quaternary to Recent aeolian (wind-blown) sands of the Gordonia Formation (Kalahari Group). According to the geological map, the basement rocks in the transmission line corridor are largely mantled by aeolian sands of the **Gordonia Formation** (“Kalahari sands”) as well as Late Caenozoic alluvial deposits associated with small drainage courses.

The geology of the Late Cretaceous to Recent Kalahari Group is reviewed by Thomas (1981), Dingle *et al.* (1983), Thomas & Shaw (1991), Haddon (2000) and Partridge *et al.* (2006). The thickness of the unconsolidated Kalahari sands in the Bushmanland area is variable and often uncertain. The Gordonia Formation dune sands are considered to range in age from the Late Pliocene/Early Pleistocene to Recent, dated in part from enclosed Middle to Late Stone Age stone tools (Dingle *et al*., 1983, p. 291). Note that the recent extension of the Pliocene - Pleistocene boundary from 1.8 Ma back to 2.588 Ma would place the older Gordonia Formation sands entirely within the Pleistocene Epoch. A number of older Kalahari formations underlie the young wind-blown surface sands in the main Kalahari depository to the north of the study area. However, at the latitude of the study area near Kenhardt (*c*. 29° S) Gordonia Formation sands less than 30 m thick are likely to be the main or perhaps only Kalahari sediments present (*cf* isopach map of the Kalahari Group, Figure 6 *in* Partridge *et al*., 2006). These unconsolidated sands will be locally underlain by thin subsurface gravels along the buried palaeosurface and perhaps by calcretes of Pleistocene or younger age (*cf* Mokalanen Formation).

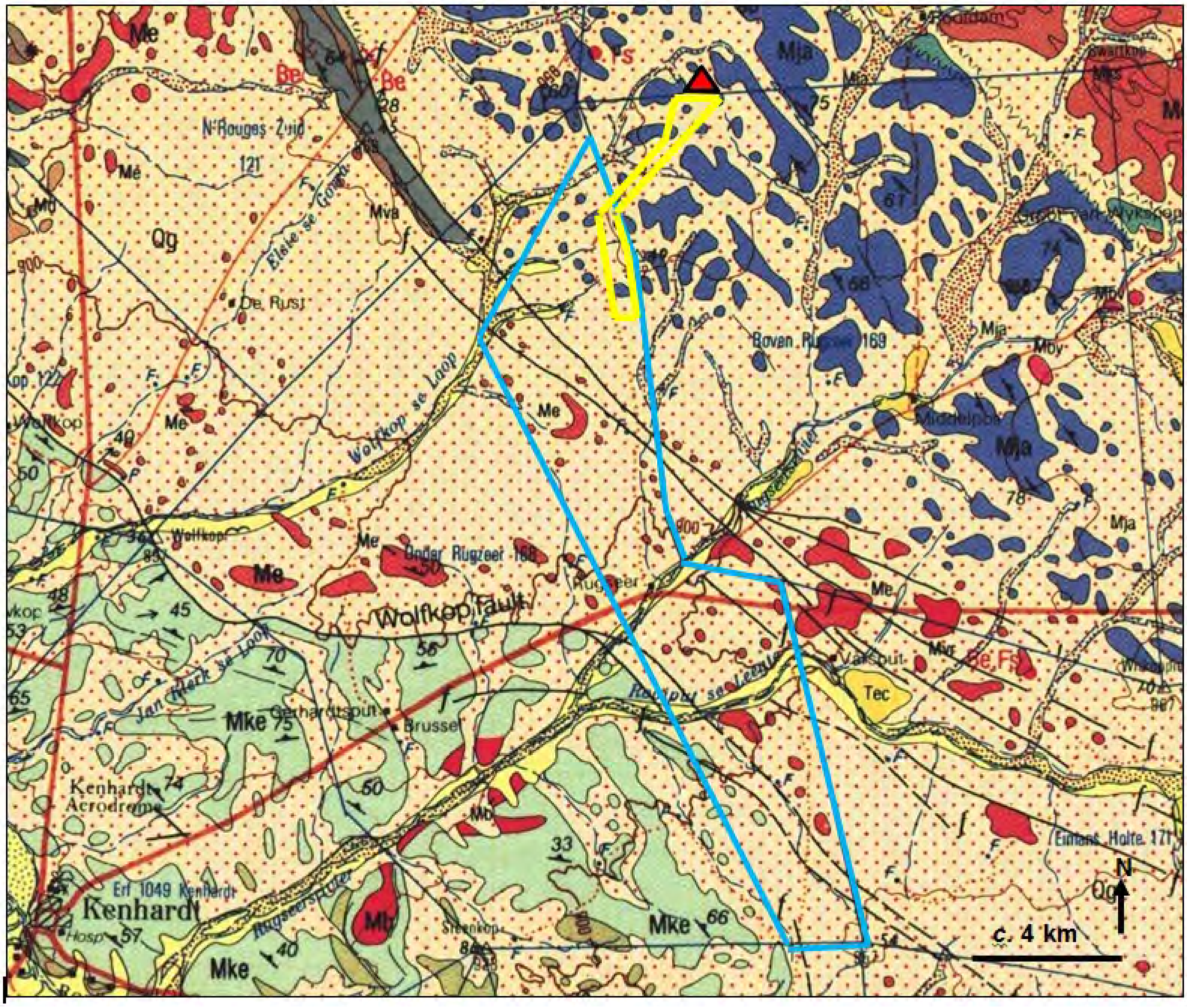

Figure 1. Extract from 1: 250 000 scale geological map sheet 2920 Kenhardt (Council for Geoscience, Pretoria) showing the geology of the Scatec Solar PV Facilities study area on Farm Onder Rugzeer 168 (blue polygon) situated c. 20 km to the NE of Kenhardt, Northern Cape. Eskom Nieuwehoop Substation on Gemsbok Bult 120 (shown by the red triangle) and the proposed electrical infrastructure corridor is shown in yellow.

Linked to Figure 1 above, the main geological units represented within the broader Scatec Solar project area, including the transmission line corridor, include:

PRECAMBRIAN BASEMENT ROCKS:

KEIMOES SUITE:

- **Red (Me) = Elsie se Gorra Granite**

KORANNALAND SUPERGROUP:

- **Brown (Mva) = Valsvlei Formation, Biesje Poort Group**
- **Grey (Msa) = Sandputs Formation, Biesje Poort Group**
- **Blue (Mja) = Sandnoute Formation, Jacomyns Pan Group**

VYFBEKER METAMORPHIC SUITE:

- **Pale blue-green (Mke) = Kenhardt Migmatite**

LATE CAENOZOIC SUPERFICIAL SEDIMENTS:

- **Pale yellow with sparse red stipple (Qg) = aeolian sands of the Gordonia Formation (Kalahari Group)**
- **Pale yellow with dense red stipple = alluvial and pan sediments**
- **Dark yellow (Tec) = calcrete**

1.3.2 Palaeontological Heritage

The Precambrian basement rocks represented within the study area are igneous granitoids or high grade metamorphic rocks that were last metamorphosed some 1 billion years ago and are entirely unfossiliferous. The sparse fossil record of Late Caenozoic superficial sediments in the Bushmanland region are briefly reviewed here (Refer also to Table 1). Note that, to the author's knowledge, there are no fossil records from the broader Scatec Solar project area itself, including the transmission line corridor, and no palaeontological fieldwork has been undertaken here (See also relevant desktop palaeontological assessments for farms Boven Rugzeer 169 and Gemsbok Bult 120 by Almond 2014c, 2014d).

The diverse superficial deposits within the South African interior, including Bushmanland, have been comparatively neglected in palaeontological terms. However, sediments associated with ancient drainage systems, springs and pans may occasionally contain important fossil biotas, notably the bones, teeth and horn cores of mammals as well as remains of reptiles like tortoises (*e.g.* Skead 1980, Klein 1984b, Brink1987, Bousman *et al.* 1988, Bender & Brink 1992, Brink *et al.* 1995, MacRae 1999, Meadows & Watkeys 1999, Churchill *et al.* 2000, Partridge & Scott 2000, Brink & Rossouw 2000, Rossouw 2006, Almond *in* Macey *et al.* 2011). Other late Caenozoic fossil biotas that may occur within these superficial deposits include non-marine molluscs (bivalves, gastropods), ostrich egg shells, trace fossils (e.g. calcretised termitaria, coprolites, invertebrate burrows, rhizocretions), and plant material such as peats or palynomorphs (pollens) in organic-rich alluvial horizons (Scott 2000) and diatoms in pan sediments. In Quaternary deposits, fossil remains may be associated with human artefacts such as stone tools and are also of archaeological interest (*e.g*. Smith 1999 and references. therein). Ancient solution hollows within extensive calcrete hardpans may have acted as animal traps in the past. As with coastal and interior limestones, they might occasionally contain mammalian bones and teeth (perhaps associated with hyaena dens) or invertebrate remains such as snail shells.

Diverse fossils associated with the ancient Tertiary drainage systems of the Karoo and Bushmanland region have been summarized by Almond *in* Macey *et al.* (2011. See also articles by Cooke 1949, Wells 1964, Butzer et al. 1973, Helgren 1977, Klein 1984, Macrae 1999). They include remains of fish, reptiles, mammals, freshwater molluscs, petrified wood and trace fossils (*e.g.* De Wit 1990, 1993, De Wit & Bamford 1993, Bamford 2000, Bamford & De Wit 1993, Senut *et al.* 1996).

In the Brandvlei area to the southwest of Kenhardt lies the north-south trending Geelvloer Palaeo-valley, a Mid Tertiary palaeodrainage system that links up with the Commissioners Pan

– Koa Valley system to the northwest. Here calcretised basal alluvial facies contain bones of hippopotamus-like artiodactyls called anthracotherids indicating a Miocene age (De Wit 1993, 1999, De Wit *et al.* 2000). Anthracotherids are an extinct group of amphibious mammalian herbivores only distantly related to true hippos that were widespread in the Miocene of Africa (Schneider & Marais 2004). Early to Mid-Miocene silicified woods from Brandvlei are referable to a number of extant tree families, including the Dipterocarpaceae that mainly inhabit tropical forests in Africa and Asia today. The fossil woods and associated sediments indicate that warm, tropical to subtropical climates prevailed in the Mid-Miocene and that perennial, low-sinuousity braided river systems supported lush riparian forests (De Wit & Bamford 1993, Bamford & De Wit 1993, Bamford 2000). Wet, weakly seasonal climates are suggested by the structure (indistinct growth rings) and dimensions (trunk diameters of over 50 cm) of the fossil woods (Bamford 2000).

Abraded Plio-Pleistocene fossil woods from relict alluvial terraces of the Sak River just north of Brandvlei include members of the Family Polygalaceae and also indicate humid growth conditions (Bamford & De Wit 1993). These terraces were formed by meandering rivers during intermittent pluvial (i.e. wetter), but still semi-arid, episodes following the onset of generally arid conditions in the western portion of southern Africa towards the end of the Miocene. So far fossils have not been recorded from the Sakrivier system closer to Kenhardt.

Pan sediments in Bushmanland have also recently yielded interesting Pleistocene mammalian faunas in association with age-diagnostic archaeological material. Important fossil mammalian remains assigned to the Florisian Mammal Age (*c.* 300 000 – 12 000 BP; MacRae 1999) have recently been documented from stratigraphic units designated Group 4 to Group 6 (i.e. calcrete hardpan and below) at Bundu Pan, some 22 km northwest of Copperton (Kiberd 2006 and references therein). These are among very few Middle Pleistocene faunal records from stratified deposits in the southern Africa region (Klein 1980, 1984a, 1984b, 2000) and are therefore of high palaeontological significance. Characteristic extinct Pleistocene species recorded at Bundu Pan are the giant Cape Horse or Zebra (*Equus capensis*) and the Giant Hartebeest (*Megalotragus priscus*). Other extant to extinct taxa include species of warthog, blesbok, black wildebeest, springbok and baboon. There is additionally trace fossil evidence for hyaenids (tooth marks) as well as ostrich egg shell. Preliminary dating and the inferred ecology of the fossil taxa present suggests the presence of standing water within a grassy savanna setting during the 200 - 300 000 BP interval when the Bunda Pan faunal assemblage accumulated. A sequence of Earlier, Middle and Later Stone Age (ESA, MSA and LSA, respectively) artefact assemblages is also recorded from this site. Stratigraphic Groups 4 to 6 (*i.e.* calcrete hardpan and below) contain a Final Acheulian or transitional ESA/MSA artefact assemblage, while Groups 2 - 3 above the calcrete horizon contain a MSA artefact assemblage. Orton (2012) recorded a single fossil equid tooth associated with a rich MSA artefact assemblage from gravels overlying a calcrete hardpan on the farm Hoekplaas near Copperton. This horizon is probably equivalent to Group 3 of Kiberd's stratigraphy at Bundu Pan, and therefore somewhat younger than the Florisian mammal fauna reported there.

The fossil record of the Kalahari Group as a whole is generally sparse and low in diversity; no fossils are recorded here in the Kenhardt geology sheet explanation by Slabbert *et al.* (1999). The Gordonia Formation dune sands were mainly active during cold, drier intervals of the Pleistocene Epoch that were inimical to most forms of life, apart from hardy, desert-adapted species. Porous dune sands are not generally conducive to fossil preservation. However, mummification of soft tissues may play a role here and migrating lime-rich groundwaters derived from underlying lime-rich bedrocks may lead to the rapid calcretisation of organic structures such as burrows and root casts. Occasional terrestrial fossil remains that might be expected within this unit include calcretized rhizoliths (root casts) and termitaria (*e.g.*

Hodotermes, the harvester termite), ostrich egg shells (*Struthio*), tortoise remains and shells of land snails (*e.g. Trigonephrus*) (Almond in Macey *et al.* 2011, Almond & Pether 2008). Other fossil groups such as freshwater bivalves and gastropods (*e.g. Corbula, Unio*), ostracods (seed shrimps), charophytes (stonewort algae), diatoms (microscopic algae within siliceous shells) and stromatolites (laminated microbial limestones) are associated with local watercourses and pans. Microfossils such as diatoms may be blown by wind into nearby dune sands (Du Toit 1954, Dingle *et al.,* 1983). These Kalahari fossils (or subfossils) can be expected to occur sporadically but widely, and the overall palaeontological sensitivity of the Gordonia Formation is therefore considered to be low. Underlying calcretes might also contain trace fossils such as rhizoliths, termite and other insect burrows, or even mammalian trackways. Mammalian bones, teeth and horn cores (also tortoise remains, and fish, amphibian or even crocodiles in wetter depositional settings) may be expected occasionally expected within Kalahari Group sediments and calcretes, notably those associated with ancient alluvial gravels (See Koa River Valley above). The younger (Pleistocene to Recent) fluvial and alluvial sands and gravels within the proposed development area are unlikely to contain many, if any, substantial fossil or subfossil remains.

Table 1: Fossil heritage recorded from the major rock units that are represented within the broader Scatec Solar study area near Kenhardt (including transmission line corridor to Nieuwehoop Substation)

GEOLOGICAL UNIT	ROCK TYPES AND AGE	FOSSIL HERITAGE	PALAEONT-OLOGICAL SENSITIVITY
LATE CAENOZOIC SUPERFICIAL SEDIMENTS, **especially** **ALLUVIAL AND PAN SEDIMENTS**	**fluvial, pan, lake and terrestrial sediments, including diatomite (diatom deposits), pedocretes (*e.g.* calcrete), colluvium (slope deposits such as scree), aeolian sands (Gordonia Formation, Kalahari Group)** **LATE TERTIARY, PLEISTOCENE TO RECENT**	**bones and teeth of wide range of mammals (*e.g.* mastodont proboscideans, rhinos, bovids, horses, micromammals), fish, reptiles (crocodiles, tortoises), ostrich egg shells, fish, freshwater and terrestrial molluscs (unionid bivalves, gastropods), crabs, trace fossils (*e.g.* calcretised termitaria, horizontal invertebrate burrows, stone artefacts), petrified wood, leaves, rhizoliths, stromatolites, diatom floras, peats and palynomorphs.**	**GENERALLY LOW BUT LOCALLY HIGH** **(*e.g.* Tertiary alluvium associated with old river courses)**
Basement granites and gneisses **NAMAQUA-NATAL PROVINCE**	**Highly-metamorphosed sediments, intrusive granites** **MID-PROTEROZOIC (*c*.1- 2 billion years old)**	**none**	**ZERO**

1.4 APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

All South African fossil heritage, including palaeontological sites and specimens, is protected by law (National Heritage Resources Act (Act 25 of 1999)) and fossils cannot be collected, damaged, destroyed or disturbed without a permit from SAHRA or the relevant Provincial Heritage Resources Agency.

As mentioned previously, where palaeontological mitigation of a development project is required, the palaeontologist concerned with mitigation work would need a valid fossil collection permit from SAHRA and any material collected would have to be curated in an approved depository (*e.g.* museum or university collection). All palaeontological specialist work should conform to international best practice for palaeontological fieldwork and the study (*e.g.* data recording fossil collection and curation, final report) should adhere as far as possible to the minimum standards for Phase 2 palaeontological studies recently developed by SAHRA (2013).

The present palaeontological heritage assessment falls under Sections 35 and 38 (Heritage Resources Management) of the National Heritage Resources Act (Act 25 of 1999), and it will also inform the EMPr for these projects.

The various categories of heritage resources recognised as part of the National Estate in Section 3 of the National Heritage Resources Act (Act 25 of 1999) include, among others:

- geological sites of scientific or cultural importance;
- palaeontological sites; and
- palaeontological objects and material, meteorites and rare geological specimens.

According to Section 35 of the National Heritage Resources Act, dealing with archaeology, palaeontology and meteorites:

1) The protection of archaeological and palaeontological sites and material and meteorites is the responsibility of a provincial heritage resources authority.
2) All archaeological objects, palaeontological material and meteorites are the property of the State.
3) Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority.
4) No person may, without a permit issued by the responsible heritage resources authority—
    i. destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;
    ii. destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;
    iii. trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or
    iv. bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.
5) When the responsible heritage resources authority has reasonable cause to believe that any activity or development which will destroy, damage or alter any archaeological or palaeontological site is under way, and where no application for a permit has been submitted and no heritage resources management procedure in terms of section 38 has been followed, it may-
    a) serve on the owner or occupier of the site or on the person undertaking such development an order for the development to cease immediately for such period as is specified in the order;
    b) carry out an investigation for the purpose of obtaining information on whether or not an archaeological or palaeontological site exists and whether mitigation is necessary;
    c) if mitigation is deemed by the heritage resources authority to be necessary, assist the person on whom the order has been served under paragraph (a) to apply for a permit as required in subsection (4); and
    d) recover the costs of such investigation from the owner or occupier of the land on which it is believed an archaeological or palaeontological site is located or from the person

proposing to undertake the development if no application for a permit is received within two weeks of the order being served.

1.5 IDENTIFICATION OF KEY ISSUES

1.5.1 Key Issues Identified During the Scoping Phase

The only key issue identified by the specialist during the Project Initiation Phase is the potential loss of palaeontological heritage resources (fossils, fossil sites including their geological context) through surface clearance and excavations into sedimentary rocks during the construction phase of the transmission line projects.

The Scoping Report was released for a 30-day comment period which extended from 25 September 2015 to 27 October 2015. The Addendum to the Scoping Report was also released for a 30-day comment period, extending from 6 October 2015 to 5 November 2015. To date, only one comment was raised by the SAHRA regarding impacts on palaeontological heritage posed by the proposed Scatec Solar development. No further comments have been received in relation to palaeontological impacts.

The following comment was received from the SAHRA on 22 September 2015 (via SAHRIS) based on the review of the Background Information Document (in relation to the Kenhardt PV 1, PV 2 and PV 3 projects, Case References 8204, 8205 and 8206. It is important to note that only the points relating to palaeontological aspects have been extracted from the SAHRA comments and noted below:

- *The PalaeoSensitivity Map on SAHRIS (http://www.sahra.org.za/sahris/map/palaeo) indicates moderate palaeontological sensitivity for the proposed area. Therefore, the SAHRA Archaeology, Palaeontology and Meteorites Unit requires a desktop Palaeontological Impact Assessment to be undertaken to assess whether or not the development will impact upon palaeontological resources - or at least a letter of exemption from a Palaeontologist is needed to indicate that this is unnecessary. If the area is deemed sensitive, a full Phase 1 Palaeontological Impact Assessment will be required and if necessary a Phase 2 rescue operation might be necessary.*

As noted above, based on the low palaeontological sensitivity of the area, this desktop Palaeontological Impact Assessment is being undertaken during the BA Phase (i.e. prior to the commencement of construction of the Kenhardt PV and Transmission Line projects (subject to the issuing of an Environmental Authorisation)). As mentioned above, this specialist assessment is conducted by Dr. John Almond in order to assess the significance of potential impacts of the proposed project on palaeontological resources (which is discussed in Section 1.6 of this report).

1.5.2 Identification of Potential Impacts

The potential impacts identified during the BA Phase are:

1.5.3 Construction Phase

- Potential loss of palaeontological heritage resources through disturbance, damage or destruction of fossils and fossil sites (including associated geological contextual data) through surface clearance and excavation activities during the construction phase.

1.5.4 Operational Phase

No significant impacts on palaeontological heritage are anticipated during the operational phase of the proposed transmission line developments.

1.5.5 Decommissioning Phase

No significant impacts on palaeontological heritage are anticipated during the decommissioning phase of the developments.

1.5.6 Cumulative Impacts

- Potential cumulative loss of palaeontological heritage resources through disturbance, damage or destruction of fossils and fossil sites (including associated geological contextual data) through surface clearance and excavation activities during the construction phase of proposed 132 kV and 33 kV/22 kV transmission lines in the context of several alternative energy projects planned within the broader Kenhardt region and other key electrical infrastructure developments within a 20 km radius of the proposed project site.

1.6 ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

In this section of the report potential impacts of the construction, operational and decommissioning phases of the proposed 132 kV and 33 kV/22 kV transmission lines on palaeontological heritage are outlined and recommendations for any necessary monitoring or mitigation are provided. Possible cumulative impacts in the light of other alternative energy development proposals in the Kenhardt region are also evaluated.

1.6.1 Potential Impacts (Construction Phase)

The construction phase of the proposed 132 kV and 33 kV/22 kV transmission lines will entail surface clearance for excavations into the superficial sediment cover (aeolian sands, surface gravels, stream alluvium *etc.*), which may contain fossil remains, and in some cases also into the underlying unfossiliferous bedrock. These include numerous shallow excavations for electrical pylon footings. As a result, fossils at the ground surface or buried beneath it may be disturbed, damaged, destroyed or sealed-in while their scientifically informative sedimentary context will also be disturbed or destroyed. Once constructed, the operational and decommissioning phases of the proposed transmission lines will not involve further adverse impacts on palaeontological heritage, however.

Desktop analysis of the fossil records of the various rock units underlying the broader proposed project area indicates that the majority of these units are of zero to low palaeontological sensitivity (as discussed in Section 1.3.2 and Table 1 of this report). The basement rocks are entirely unfossiliferous while the overlying Late Caenozoic superficial sediments (wind-blown sands, alluvium, gravels *etc.*) are of low to very low palaeontological sensitivity. Construction of the proposed transmission lines, especially given their short length (between 4 and 9 km) and the small pylon footings envisaged is therefore unlikely to entail significant impacts on local fossil heritage resources.

The inferred impacts of each of the proposed transmission lines on local fossil heritage are assessed in Tables 2, 4 and 6 below. These assessments apply only to the construction phase of the proposed developments since further impacts on fossil heritage during the operational and decommissioning phases of the transmission lines are not anticipated. **The results of the**

assessments are identical, due to the essential similarity in the underlying geology (Figure 1).

The destruction, damage or disturbance out of context of fossils and fossil sites preserved at the ground surface or below ground represents a *direct negative* impact that is confined to the development footprint (*site specific*). Such impacts are made only during the construction period, and can usually be partially mitigated but cannot be fully rectified; *i.e.* they are *non-reversible* and of *permanent* duration. Since several of the sedimentary units represented within the study area do contain fossils of some sort, some level impact on fossil heritage is probable (*likely*). However, because of the generally very sparse occurrence of well-preserved, scientifically-valuable fossils within the superficial sediments, and because most of the fossils encountered are likely to be of widespread occurrence (low irreplaceability) the consequence of these impacts is rated as *slight*.

No previously recorded areas or sites of exceptional fossil heritage sensitivity or significance have been identified within the proposed project area as a whole, including the transmission line corridor. Due to the inferred scarcity of exceptional fossil remains within the study area, as well as the shortness of all transmission lines and the small pylon footings envisaged, the overall impact significance of the construction phase of the proposed projects is assessed as *VERY LOW* (without mitigation) in all three cases. Because of the paucity of palaeontological field studies within this part of Bushmanland, confidence levels for this desktop palaeontological heritage assessment are only moderate (medium).

Specialist palaeontological monitoring and mitigation for this project are not recommended, pending the discovery of new fossil sites during development, given the uniformly low impact significance. The Environmental Control Officer responsible for the construction phase of the project should be aware of the necessity of conserving fossils and should monitor all substantial excavations into sedimentary rocks for fossil remains. Proposed mitigation of chance fossil finds during the construction phase involves safeguarding of the fossils (preferably *in situ*) by the responsible Environmental Control Officer, reporting of finds to the SAHRA and, where appropriate, judicious sampling and recording of fossil material and associated geological data by a qualified palaeontologist (as discussed in Section 1.8 of this report). Should these recommended mitigation measures be fully implemented, the impact significance of the transmission line developments would remain *VERY LOW* but small residual negative impacts (*e.g.* loss of undetected fossils) would remain. However, these negative impacts would be partially offset through the improved scientific understanding of local palaeontological heritage in a hitherto poorly-studied region of South Africa which would be considered as a significant *positive* outcome.

There are no fatal flaws in the proposed transmission line development proposals as far as fossil heritage is concerned.

1.6.2 Potential Impacts (Operational and Decommissioning Phases)

No significant impacts on fossil heritage resources are anticipated during the operational and decommissioning phases of the proposed transmission lines.

1.6.3 Cumulative Impacts

The palaeontological heritage impact significance of all the transmission lines proposed by Scatec Solar to service the three proposed PV solar energy developments near Kenhardt (within a 20 km radius of the proposed project) is rated equally as very low. The potentially fossiliferous sedimentary rock units represented within the broader project area are of widespread occurrence and this is also likely to apply to most of the fossils they contain. It is concluded that the cumulative impact on fossil heritage resources posed by the proposed transmission lines to the northeast of Kenhardt is of a low significance.

Given the generally low palaeontological sensitivity of the basement and overlying sedimentary rocks in the broader eastern Bushmanland region, significant cumulative impacts on fossil heritage are not anticipated here as a result of the proposed transmission lines in the context of various alternative energy and other infrastructure developments that have been proposed in the region (refer to the several recent palaeontological impact assessments undertaken by the author for projects near Kenhardt that are listed in the references, especially Almond 2014c, 2014d).

1.7 IMPACT ASSESSMENT SUMMARY

The assessment of impacts on palaeontological heritage resources for each proposed transmission line, as well as recommended mitigation and monitoring measures, as discussed above, are collated in Tables 2 to 7 below.

The no-go option (no solar developments and associated transmission lines) will have a neutral impact on local palaeontological heritage resources.

Table 2: Impact assessment summary table for the Construction Phase (Proposed Transmission Line for Kenhardt PV 1)

Construction Phase													
Direct Impacts													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Surface clearance and excavations into superficial sediments	Loss of fossil heritage at or beneath ground surface	Negative	Site	Permanent	Slight	Likely	Non-reversible	Low	• Undertake monitoring of all substantial excavations into sedimentary rocks for fossil remains and safeguard any finds in situ. • Appoint a professional palaeontologist to record and sample any chance fossil finds.	Very low	Very low	5	Medium

Table 3: Cumulative impact assessment summary table (Proposed Transmission Line for Kenhardt PV 1)

Cumulative Impacts													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Surface clearance and excavations into superficial sediments	Loss of fossil heritage at or beneath ground surface	Negative	Site	Permanent	Slight	Likely	Non-reversible	Low	• Undertake monitoring of all substantial excavations into sedimentary rocks for fossil remains and safeguard any finds in situ. • Appoint a professional palaeontologist to record and sample any chance fossil finds.	Very low	Very low	5	Medium

Table 4: Impact assessment summary table for the Construction Phase (Proposed Transmission Line for Kenhardt PV 2)

Construction Phase													
Direct Impacts													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Surface clearance and excavations into superficial sediments	Loss of fossil heritage at or beneath ground surface	Negative	Site	Permanent	Slight	Likely	Non-reversible	Low	• Undertake monitoring of all substantial excavations into sedimentary rocks for fossil remains and safeguard any finds in situ. • Appoint a professional palaeontologist to record and sample any chance fossil finds	Very low	Very low	5	Medium

Table 5: Cumulative impact assessment summary table (Proposed Transmission Line for Kenhardt PV 2)

Cumulative Impacts													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Surface clearance and excavations into superficial sediments	Loss of fossil heritage at or beneath ground surface	Negative	Site	Permanent	Slight	Likely	Non-reversible	Low	• Undertake monitoring of all substantial excavations into sedimentary rocks for fossil remains and safeguard any finds in situ. • Appoint a professional palaeontologist to record and sample any chance fossil finds	Very low	Very low	5	Medium

Table 6: Impact assessment summary table for the Construction Phase (Proposed Transmission Line for Kenhardt PV 3)

Construction Phase													
Direct Impacts													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Surface clearance and excavations into superficial sediments	Loss of fossil heritage at or beneath ground surface	Negative	Site	Permanent	Slight	Likely	Non-reversible	Low	• Undertake monitoring of all substantial excavations into sedimentary rocks for fossil remains and safeguard any finds in situ. • Appoint a professional palaeontologist to record and sample any chance fossil finds	Very low	Very low	5	Medium

Table 7: Cumulative impact assessment summary table (Proposed Transmission Line for Kenhardt PV3)

Cumulative Impacts													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Surface clearance and excavations into superficial sediments	Loss of fossil heritage at or beneath ground surface	Negative	Site	Permanent	Slight	Likely	Non-reversible	Low	• Undertake monitoring of all substantial excavations into sedimentary rocks for fossil remains and safeguard any finds in situ. • Appoint a professional palaeontologist to record and sample any chance fossil finds	Very low	Very low	5	Medium

1.8 INPUT TO THE ENVIRONMENTAL MANAGEMENT PROGRAM

Given the low palaeontological sensitivity of the proposed project area - including the transmission line corridors to the Eskom Nieuwehoop Substation - as determined from desktop analysis, as well as the inferred very low impact significance of the projects for fossil heritage conservation, no specialist palaeontological monitoring or mitigation is recommended here, pending the discovery of substantial new fossil remains during construction.

During the construction phase all substantial bedrock excavations should be monitored for fossil material by the responsible Environmental Control Officer (ECO). Should significant fossil remains - such as vertebrate bones and teeth, plant-rich fossil lenses, petrified wood or dense fossil burrow assemblages - be exposed during construction, the responsible ECO should safeguard these, preferably *in situ*. The SAHRA should be alerted as soon as possible (Contact details: Mrs Colette Scheermeyer, P.O. Box 4637, Cape Town 8000, Tel: 021 462 4502, Email: cscheermeyer@sahra.org.za), so that appropriate action can be taken by a professional palaeontologist, at the developer's expense. Mitigation would normally involve the scientific recording and judicious sampling or collection of fossil material as well as associated geological data (*e.g.* stratigraphy, sedimentology, taphonomy) by a professional palaeontologist.

The palaeontologist concerned with mitigation work will need a valid fossil collection permit from SAHRA and any material collected would have to be curated in an approved depository (*e.g.* museum or university collection). All palaeontological specialist work should conform to international best practice for palaeontological fieldwork and the study (*e.g.* data recording fossil collection and curation, final report) should adhere as far as possible to the minimum standards for Phase 2 palaeontological studies recently developed by SAHRA (2013).

No monitoring of mitigation is required during the operational and decommissioning phases of the transmission line developments.

These mitigation recommendations should be incorporated into the EMPr for each of the proposed transmission lines associated with the Kenhardt Solar PV energy facilities proposed by Scatec Solar.

1.9 CONCLUSION AND RECOMMENDATIONS

The corridor for the proposed transmission lines are underlain at depth by Precambrian basement rocks (*c*. 1-2 billion years old) assigned to the Namaqua-Natal Province. These ancient igneous and high-grade metamorphic rocks - mainly granites and gneisses of the Keimoes Suite and Jacomynspan Group - crop out at surface in small areas and are entirely unfossiliferous. A large proportion of the basement rocks are mantled by a range of superficial sediments of Late Caenozoic age that may contain sparse fossil remains. These predominantly thin, unconsolidated deposits include small patches of calcretes, gravelly to sandy river alluvium, pan sediments, surface gravels, colluvium (scree) as well as Pleistocene to Recent wind-blown sands of the Gordonia Formation (Kalahari Group). Most of these younger rock units are of widespread occurrence and low palaeontological sensitivity. Scientifically important vertebrate fossil remains (*e.g.* Pleistocene mammalian bones and teeth) have been recorded within older stratified pan and river sediments elsewhere in the Bushmanland region where they are often associated with stone artefacts, while a limited range of trace fossils (*e.g.* plant root casts, termitaria and other invertebrate burrows) may be found within calcrete horizons.

No previously recorded areas or sites of exceptional fossil heritage sensitivity or significance have been identified within the Scatec Solar project area as a whole, including the new transmission line corridor. Due to the inferred scarcity of scientifically important fossil remains within the study areas, as well as the small scale of excavations for electrical pylon footings concerned, the overall impact significance of the construction phase of the transmission lines is assessed as VERY LOW (before and after mitigation). This applies equally to all proposed transmission lines under consideration. No significant impacts on fossil heritage are anticipated during the operational and decommissioning phases of the proposed transmission lines. The potentially fossiliferous sedimentary rock units represented within the study area (*e.g.* Gordonia aeolian sands, calcrete) are of widespread occurrence and this is also likely to apply to most of the fossils they contain. It is concluded that the cumulative impacts on fossil heritage resources posed by the proposed transmission lines, in the context of several alternative energy and other infrastructural developments planned in the region (as explained in the BA Report), is of very low significance. There are no fatal flaws in the proposed developments, nor are there objections to its authorisation as far as fossil heritage conservation is concerned, since significant impacts on scientifically valuable fossils or fossil sites are not anticipated here. The no-go option (no transmission lines) will have a neutral impact on local palaeontological heritage resources. The only proposed condition to accompany environmental authorisation is that the recommendations for monitoring and mitigation included in the EMPr are fully complied with.

Given the low palaeontological sensitivity of the eastern Bushmanland region, as determined from desktop and field-based studies, as well as the inferred very low impact significance of the proposed transmission lines for fossil heritage conservation, no specialist palaeontological monitoring or mitigation is recommended here, pending the discovery of substantial new fossil remains during construction. Mitigation measures and monitoring recommendations for inclusion in the EMPr are discussed in Sections 1.6 and 1.8 of this report.

For the purposes of this report the entire proposed transmission line corridor was assessed from a palaeontological impact point of view. The applicant is free to select any area within the surveyed area (i.e. the corridor) to construct the transmission lines, provided that the recommended mitigation measures are implemented as applicable.

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BASIC ASSESSMENT REPORT

Appendix D.5:
Geohydrological Assessment

GEOHYDROLOGICAL ASSESSMENT

Basic Assessment for the Proposed Development of a 132 kV Transmission Line to service the proposed 75 MW Solar Photovoltaic Facility (KENHARDT PV 1 - Transmission Line) on the remaining extent of Onder Rugzeer Farm 168 and remaining extent of Portion 3 of Gemsbok Bult Farm 120, north-east of Kenhardt, Northern Cape Province

Report prepared for:

CSIR – Environmental Management Services

P O Box 17001

Congella, Durban, 4013

South Africa

Report prepared by:

Julian Conrad and Charles Peek

GEOSS - Geohydrological and Spatial Solutions International (Pty) Ltd

P.O. Box 12412

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South Africa

March 2016

SPECIALIST EXPERTISE

CURRICULUM VITAE - Julian Edward Conrad

GENERAL

Nationality:	South African
Profession:	Geohydrologist
Specialization:	Groundwater exploration, development, management and monitoring and the application of spatial technologies for geohydrological assessment and management purposes
Position in firm:	Director: GEOSS -Geohydrological and Spatial Solutions International (Pty) Ltd
Language skills:	English (mother tongue), Afrikaans (average).

Key skills

- Project leadership and management for the delivery of contract projects on brief, budget and time.
- Groundwater Resource Directed Measures (RDM) projects, including Reserve determinations; Classification; and Resource Quality Objectives. Groundwater Catchment Management Strategies as well as groundwater Validation and Verification. Legal compliance of groundwater use.
- Groundwater management and monitoring – database design, development and analysis of groundwater level and quality data.
- Groundwater development - borehole drilling and test pumping supervision and analysis.
- Groundwater exploration - (aerial photo interpretation, resistivity, magnetic and EM34 geophysical surveys for borehole siting purposes)
- Specialization in Geographical Information Systems (GIS) for geohydrological application.

Educational and professional status
Qualifications
1995: M.Sc. (Hydrogeology and GIS) University of Rhode Island, United States of America.
1985: B.Sc. (Hon) (Engineering geology) University of Natal, Durban, South Africa.
1984: B.Sc. (Geology) University of Natal, Durban, South Africa.

Courses

2010	Introduction to QGIS (GISSA) / Skills Presentation (Elsabé Daneel Productions cc)
2006	South African Groundwater Decision Tool (SAGDT)
2004	Fractured Rock Aquifer Assessment / 2001 Isotope Techniques in Catchment Management
2000	Groundwater Recharge
1999	Remote Sensing and Geohydrology / Applied 3D Groundwater Modelling (MODFLOW)
1997	Avenue Programming / 1995 ArcView (GIMS)
1991	Advanced training on Arc/Info (DWA&F) / 1990 Pump test analysis (IGS-UOFS).

Memberships

- International Association of Hydrogeologists (IAH)
- Geological Society of South Africa (GSSA) / Groundwater Division of the Geological Society of South Africa
- Water Institute of South Africa (WISA)
- Geo-Information Society of South Africa (GISSA)
- South African Council for Natural Scientific Professions (SACNASP)

EMPLOYMENT RECORD

▪ 1 March 2001 – present:	Founded GEOSS – a company specializing in geohydrology
▪ 1 May 1990 – 28 Feb. 2001	Hydrogeologist with Environmentek, Groundwater Group, CSIR
▪ Jan. 1986 – Dec. 1988	Geotechnical geologist with Rőssing Uranium Limited, Namibia

RELEVANT EXPERIENCE

- 25 years' experience in geohydrology, including the development of the GRDM and Water Resources Classification methodologies. This includes work in Validation and Verification projects and the development of the groundwater component of Catchment Management Strategies.
- Numerous groundwater exploration; development; monitoring and management projects have been completed.
- Numerous Environmental Impact Assessment (EIA) projects have been completed, that have triggered groundwater studies, both at the Scoping and EIA phases.
- Project management of numerous groundwater projects and large projects that have included many sub-consultants and specialists, especially RDM studies.

PUBLICATIONS (DETAILS ON REQUEST)

CURRICULUM VITAE - Charles Peek

GENERAL

Nationality:	South African
Profession:	Geohydrologist
Specialization:	Groundwater exploration, development, monitoring and management including GIS and Remote Sensing expertise.
Position in firm:	Geohydrologist at GEOSS - Geohydrological and Spatial Solutions International (Pty) Ltd
Date commenced:	4th February 2013
Language skills:	English (good – speaking, reading and writing) Afrikaans (fair - speaking, reading and writing).

Key skills

- Groundwater exploration, development, monitoring and management.
- Arc GIS software (ESRI products)
- Proficient in working with and analysis of SPOT and Landsat imagery, using ERDAS, PCI Geoinformatica, eCognition, and ENVI

RELEVANT EXPERIENCE

- Numerous groundwater exploration, development, monitoring and management projects.
- Extensive satellite image data processing (including geo-referencing) for the Validation and Verification projects within the Breede-Overberg Catchment Management Agency.

EDUCATIONAL AND PROFESSIONAL STATUS

Qualifications

2012	BSc Hon – Geoinformatics University of the Stellenbosch, South Africa
2011	BSc - Earth Science Degree: University of the Stellenbosch, South Africa

Memberships

- South African Council for National Scientific Professions (SACNASP) Mem. No. 500030/13

EMPLOYMENT RECORD

February 2013 to present:	GEOSS – Geohydrological and Spatial Solutions International (Pty) Ltd, Stellenbosch
April 2011 to November 2011:	Central Analytical Facilities, Geography and Geo-environmental Science, University of Stellenbosch.

SPECIALIST DECLARATION

I, **Julian Conrad**, as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

- I act as the independent specialist in this application;
- I perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I have no vested interest in the proposed activity proceeding;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist

Name of company: GEOSS - Geohydrological & Spatial Solutions International (Pty) Ltd.

Professional Registration (including number): SACNASP - 400159/05

Date: 21 February 2016.

EXECUTIVE SUMMARY

Scatec Solar is proposing to develop a 75 Megawatt (MW) Solar Photovoltaic (PV) power generation facility (referred to as Kenhardt PV 1) along with associated electrical infrastructure (including a 132 kV transmission line for the proposed 75 MW facility). The Eskom Nieuwehoop Substation and associated connection points to the substation are located on the remaining extent of Portion 3 of Gemsbok Bult Farm 120. The 75 MW Solar PV facility will cover an approximate area of 250 hectares (ha) and will be constructed in the vicinity of two other proposed 75 MW Solar PV facilities (with a collective footprint of approximately 750 ha and a combined power generation capacity of 225 MW), also proposed by Scatec Solar. Each 75 MW Solar PV Facility is being assessed separately as part of an Environmental Impact Assessment (EIA) process. Each transmission line and associated electrical infrastructure required to connect the proposed 75 MW Solar PV Facilities to the national grid are being assessed separately as part of a Basic Assessment (BA) Process. This Geohydrological Assessment is being conducted as part of the BA Process for the proposed 132 kV transmission line required for the proposed Kenhardt PV 1 project (referred to as Kenhardt PV 1 – Transmission Line). All the transmission lines are included within a corridor which will range from 300 m wide to 1 000 m wide extending from the Kenhardt PV 3 area all the way to the Eskom Nieuwehoop Substation. The corridor widens towards the Eskom Nieuwehoop Substation.

The study area receives approximately 71 mm of rainfall per year and it receives most of its rainfall during autumn and has a semi-arid to arid climate. It receives the lowest rainfall between July to September (i.e. winter) and the highest in March.

Geologically, the study area for the proposed Kenhardt PV 1 transmission line corridor is overlain by wind-blown sand (Qg) of the Gordonia Formation. Bedrock is expected to be Jacomyns Pan Formation (which consists of weathered metamorphic rock types). According to regional groundwater maps the entire study area does host an “intergranular and fractured” aquifer (i.e. the wind-blown sands and river alluvium as well as fractures within the bedrock constitute an aquifer) with an average borehole yield of 0.1 L/s to 0.5 L/s. Using Electrical Conductivity (EC) as a groundwater quality indicator, the regional groundwater maps indicate that the EC ranges from 300 – 1 000 mS/m within the study area and the area is classified as having a low vulnerability to surface based contaminants.

The potential impacts on the groundwater can be from the construction of storage yards and labour accommodation, as well as accidental oil spillages and fuel leakages during construction. All of these sources need to be managed and potential impacts minimised. However, none of these sources are considered a direct or indirect threat geohydrologically as the upper geological layers contain highly metamorphic rock types with limited fracture networks which host very little groundwater and the groundwater present in the area is saline. Protection measures are required to ensure the groundwater recharge and shallow groundwater is not negatively impacted and that the current groundwater can still be used as a source of water supply for livestock. Thus a precautionary approach needs to be taken and the existing groundwater levels and quality must not be negatively impacted.

If groundwater is to be considered for use at the site then abstraction of groundwater from the aquifer will need to undergo treatment prior to use. A separate study (outside of the BA Process) will be required to investigate the feasibility and financial viability of such a project.

COMPLIANCE WITH THE APPENDIX 6 OF THE 2014 EIA REGULATIONS

Requirements of Appendix 6 – GN R982	**Addressed in the Specialist Report**
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Preliminary sections of this report
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Appendix I of the BA Report and Section 1.1.7 of this Report
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1.2 and Section 1.1.3
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1.6.1
e) a description of the methodology adopted in preparing the report or carrying out the specialised process;	Section 1.1.2, Section 1.1.3 and Section 1.6.1
f) the specific identified sensitivity of the site related to the activity and its associated structures and infrastructure;	Section 1.2 and Section 1.3
g) an identification of any areas to be avoided, including buffers;	There are no areas to be avoided.
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Appendix A of this report
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.1.5
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment;	Section 1.6
k) any mitigation measures for inclusion in the EMPr;	Section 1.6, Section 1.7 and Section 1.8
l) any conditions for inclusion in the environmental authorisation;	Section 1.9
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 1.6, Section 1.7 and Section 1.8
n) a reasoned opinion- i. as to whether the proposed activity or portions thereof should be authorised; and ii. if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 1.9
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 1.6.1
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Section 1.6.1
q) any other information requested by the competent authority.	Not applicable at this stage

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FIGURES

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LIST OF ABBREVIATIONS

Bh	Borehole
EC	Electrical Conductivity
ET	Evapotranspiration
GEOSS	Trading name for Geohydrological & Spatial Solutions International (Pty) Ltd.
GIS	Geographical Information Systems
Ha	Hectare
L/s	Litres per second
m	Meters
mS/m	milliSiemens per meter
MAP	Mean Annual Precipitation
mbgl	metres below ground level
mg/L	milligrams per litre
NGA	National Groundwater Archive
^{o}C	degrees Celsius
ORP	Oxygen Reduction Potential
TDS	Total Dissolved Solids
Temp	Temperature
WL	Water Level

GLOSSARY

Definitions	
Aquifer	A geological formation that has structures or textures that hold water or permit appreciable water movement through them.
Borehole	includes a well, excavation, or any other artificially constructed or improved groundwater cavity which can be used for the purpose of intercepting, collecting or storing water from an aquifer; observing or collecting data and information on water in an aquifer; or recharging an aquifer [from National Water Act (Act No. 36 of 1998)].
DRASTIC	An acronym for a groundwater vulnerability assessment methodology: D = depth to groundwater / R = recharge/ A = aquifer media type / S = soil type / T = topography / I = impact of the unsaturated zone / C = hydraulic conductivity. The methodology uses a rating and weighting approach and was developed by the Environmental Protection Agency (USA)
Fractured Aquifer	Fissured and fractured bedrock resulting from decompression and/or tectonic action. Groundwater occurs predominantly within fissures and fractures.
Groundwater	Water found in the subsurface in the saturated zone below the water table or piezometric surface i.e. the water table marks the upper surface of groundwater systems.
Intergranular Aquifer	Generally unconsolidated but occasionally semi-consolidated aquifers. Groundwater occurs within intergranular interstices in porous medium. Typically occur as alluvial deposits along river terraces.
Intergranular and Fractured Aquifer	Largely medium to coarse grained granite, weathered to varying thicknesses, with groundwater contained in intergranular interstices in the saturated zone, and in jointed and occasionally fractured bedrock.

GEOHYDROLOGICAL ASSESSMENT

This report presents the findings of the Geohydrological Assessment that was prepared by Mr. Julian Conrad and Mr. Charles Peek (of Geohydrological and Spatial Solutions International (PTY) Ltd (GEOSS)) as part of the Basic Assessment (BA) for the proposed Kenhardt PV 1 – Transmission Line project within the Northern Cape Province.

1.1 INTRODUCTION AND METHODOLOGY

1.1.1 Introduction

The proposed project includes the development of a 75 MW Solar Photovoltaic (PV) Facility (referred to as Kenhardt PV 1) along with associated electrical infrastructure on the remaining extent of Onder Rugzeer Farm 168. The farm Onder Rugzeer 168 is situated alongside the farm Boven Rugzeer (Remaining Extent of Farm 169) and the proposed Eskom Nieuwehoop Substation, currently under construction. The proposed Kenhardt PV 1 project will be linked to the Eskom Nieuwehoop Substation by means of a 132 kV transmission line. The proposed transmission line corridor will extend from the proposed Kenhardt PV 1 project to Portion 3 of farm Gemsbok Bult 120. The proposed transmission line will also traverse (aboveground) the Remainder of Boven Rugzeer 169 and Portion 4 of Onder Rugzeer 168. The study area is located approximately 30 km north-east of Kenhardt and 80 km south of Upington within the Kheis Local Municipality, Northern Cape Province (**Map 1, Appendix A**).

Each 75 MW Solar PV Facility is being assessed separately as part of an Environmental Impact Assessment (EIA) process. Each transmission line required to connect the proposed 75 MW Solar PV Facilities to the national grid are being assessed separately as part of a BA Process. This Geohydrological Assessment is being conducted as part of the BA Process for the proposed 132 kV transmission line (referred to as Kenhardt PV 1 – Transmission Line), which will serve the Kenhardt PV 1 facility (assessed as part of the separate EIA Process). The maps provided in this report show the Kenhardt PV 1 facility for contextual purposes.

The proposed transmission line is expected to be overhead, with concrete and steel tower structures. All transmission lines for the Kenhardt PV 1, PV 2 and PV 3 transmission line projects will be constructed within an electrical infrastructure corridor (as shown in **Map 2, Appendix A**), which has been assessed in this report. All the transmission lines will be included within a corridor which will range from 300 m wide to 1 000 m wide extending from the Kenhardt PV 3 area to the Eskom Nieuwehoop Substation. The corridor widens towards the Eskom Nieuwehoop Substation.

1.1.2 Scope and Objectives

As explained in Section A of the BA Report, the Project Applicant intends to make use of existing boreholes to source groundwater (if available and if suitable) for the construction phase. One of the objectives of this Geohydrological Assessment is to confirm whether the groundwater is in fact sufficient and suitable for use (i.e. in terms of quality and quantity (i.e. borehole yields)). This study is therefore aimed at providing a clear indication of groundwater availability and suitability from existing boreholes.

The overall scope of this Geohydrological Assessment is to determine the impact of the proposed project on the surrounding geohydrology and any geohydrological features, as well as to recommend mitigation measures to reduce the significance of potential negative impacts.

For this specialist study, a desktop study was conducted based on existing maps and reports of the geology and geohydrology. Groundwater data, including groundwater level and groundwater quality data, was obtained from the National Groundwater Archive (NGA) for the area surrounding the proposed area. This was followed by a detailed fieldwork component to inform this Geohydrological Assessment.

1.1.3 Terms of Reference

The Scope of Work is based on the following broad Terms of Reference (TOR), which have been specified for this specialist study on groundwater (i.e. this Geohydrological Assessment):

- Identify significant features or disturbances within the proposed project area and define any environmental risks in terms of geohydrology and the proposed project infrastructure;
- Conduct a desktop study and describe the existing environment in terms of geohydrology (including hydrogeological characterisation of aquifers (types, sensitivity, vulnerability), and groundwater (quality, quantity, use, potential for industrial or domestic use) in the area surrounding the proposed development;
- Conduct a fieldwork assessment to determine the location of any boreholes and to collect groundwater samples (where possible) to ascertain the water quality;
- Develop a sensitivity map indicating the presence of sensitive areas, “no-go” areas, setbacks/buffers, as well as the identification of red flags or risks associated with geohydrological impacts;
- Highlight any gaps in baseline data and provide a description of confidence levels;
- Assess potential direct, indirect and cumulative impacts resulting from the construction, operational and decommissioning phases of the proposed project on the surrounding geohydrology;
- Identify any relevant legal and permit requirements that may be required in terms of groundwater/geohydrological impacts likely to be generated as a result of the proposed project;
- Provide mitigation, monitoring and management measures in order to minimize any negative geohydrological impacts and enhance the positive impacts;
- Assess the consequences and significance of potential groundwater contamination; and
- If necessary recommend groundwater management and monitoring for the proposed site.

1.1.4 Approach and Methodology

The specialist study was completed as follows:

Task 1: A desktop study and relevant literature review pertaining to the site was completed. Borehole data was searched for on the NGA and a project GIS was established.

Task 2: A site visit was completed on 28th and 29th September 2015. The field work included a hydrocensus, which extended to 1 km from the outline of the property boundaries. The objective of this task was three-fold:

1. To locate the NGA boreholes and complete a borehole assessment.
2. To locate boreholes not yet recorded on the NGA and complete assessments.
3. To collect anecdotal information from the land owners in the area as well as from discussions with the Department of Water and Sanitation (DWS)

geohydrologists. It was essential to collect as much information as possible relating to groundwater quality, groundwater levels and borehole yields.

Task 3: All the data obtained from the desktop review and fieldwork was assessed and the impacts relating to the site evaluated.

Task 4: The findings of the investigation, potential risks, any potential mitigation measures, monitoring requirements as well as relevant recommendations have been included in a report. The impacts were assessed based on the methodology indicated in Section D of the BA Report.

1.1.5 Assumptions and Limitations

The geohydrological appraisal is based on previous studies and available literature for the study area. The main assumptions are based on 1: 500 000 national scale Geographic Information System (GIS) datasets and that the previous geohydrological work completed was correct. The main limitation is that no drill records or yield test data exists for boreholes drilled or wells constructed within the study area. In addition it was determined that the proposed project will have no cumulative impacts on the geohydrology of the area (as this assessment recommends that groundwater is not suitable or sufficient for use) and this also takes into account other related projects in the area.

1.1.6 Source of Information

The geological information has been obtained from geological maps of the Council for Geoscience and Slabbert *et al*, 1999.

The groundwater related data and maps have been obtained from the 1: 500 000 Hydrogeological map series of the Republic of South Africa, (Department of Water Affairs and Forestry (DWAF) 2002). The report compiled by GEOSS (2014) as part of the EIA for the adjacent Nieuwehoop Development was also reviewed and relevant information has been used in this report, as applicable.

The field data obtained from the site visit completed on the 28th and 29th September 2015 was useful as it enabled the assessment of the more regional existing data sets and provides valuable insights into the geohydrology of the area.

1.1.7 Declaration of Independence of Specialists

Refer to preliminary section of this specialist report for the Curriculum Vitae of Mr. Julian Conrad and Mr. Charles Peek, which highlights their experience and expertise. The declaration of independence by the specialist is provided in Box 1.1 below and included in **Appendix I** of this BA Report.

BOX 1.1: DECLARATION OF INDEPENDENCE

I, Julian Conrad, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed Kenhardt PV 1 – Transmission Line Project, application or appeal in respect of which I was appointed, other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.

JULIAN CONRAD

1.2 DESCRIPTION OF PROJECT ASPECTS RELEVANT TO GEOHYDROLOGICAL IMPACTS

The Project Applicant is considering the use of existing boreholes to source groundwater (if available and suitable) for the construction activities.

Broadly speaking groundwater can theoretically be impacted two ways, namely:

- Over-abstraction (where groundwater abstraction exceeds recharge rates) and can result in the alteration of groundwater levels, flow directions and gradients; and
- Quality deterioration (i.e. anthropogenic activities negatively impacting groundwater quality).

There is currently abstraction taking place within the study area in the form of shallow boreholes installed with wind pumps. One borehole is equipped with a solar pump. The groundwater is being used for livestock watering only, as it is saline. The low rainfall and high evapotranspiration within the study area is a limiting factor for the recharge of the aquifer underling the study area (which is described in Section 1.3 of this report).

Therefore, the groundwater within the study area is not suitable for use (i.e. in terms of quality and quantity). As such, pipelines do not need to be constructed for the transfer of water from the boreholes to the site.

For the proposed project, it is recommended that the **groundwater not be used (i.e. abstracted) within the study area.** This recommendation is based on reasoning that the groundwater is saline and does not meet guidelines for construction use. The alternative source of water is that water tanks can be used to store the water from the municipality. In this regard, there will be generally about 5 to 10 (10,000 liter) tanks required per site. If the Municipality supplies water then during construction there is expected to be 1 trip every 2 days for 7 months.

The proposed construction of the transmission line can potentially impact the groundwater quality of the aquifer, although it is extremely unlikely. Possible contamination sources include: oil spillage and fuel leakages from construction vehicles and during the construction of the storage yards and temporary labour accommodation site camps.

It is important to note that a complete, detailed project description is provided in Section A of the BA Report.

If the Project Applicant still wants to explore the use of groundwater, the groundwater exploration and cost benefit study will have to be addressed as a separate study to this one.

1.3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

1.3.1 Rainfall and Temperature

Kenhardt normally receives approximately 70 mm of rain per year, with most rainfall occurring mainly during autumn. Figure 1a shows the average rainfall values for Kenhardt per month. It typically receives the lowest rainfall (0 mm) in June and the highest (23 mm) in March. The monthly distribution of average daily maximum temperatures (Figure 1b) shows that the average midday temperatures for Upington range from 19°C in June to 33°C in January. The region is the coldest during June and July.

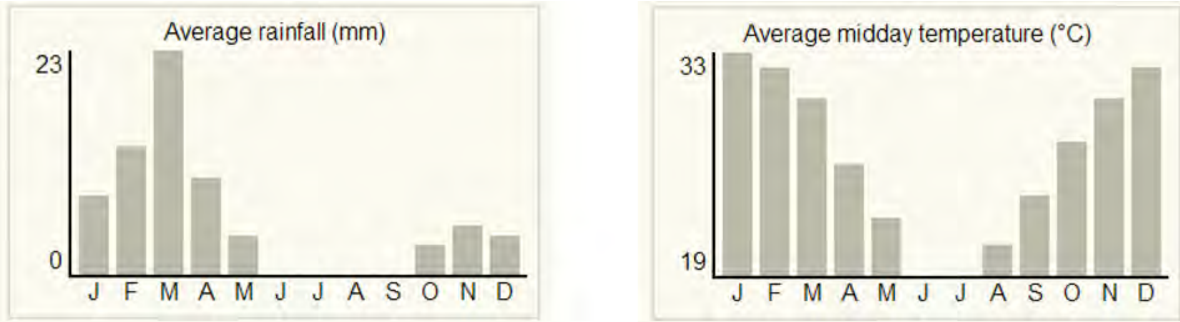

Figure 1a and 1b: Rainfall and Average Midday Temperature for Kenhardt (www.saexplorer.co.za)

The monthly distribution of rainfall and evaporation for the remaining extent of Onder Rugzeer Farm 168 is shown in Figure 2. The area receives approximately 71 mm of rainfall per year and because it receives most of its rainfall during autumn it has a semi-arid to arid climate. It receives the lowest rainfall between July to September (0 mm) and the highest in March. The relevance of this information is that the rainfall occurs whilst temperatures are quite high and therefore associated evaporation rates will be high. This implies that groundwater recharge will be very low. Figure 2 show the long term monthly rainfall and evaporation distribution respectively.

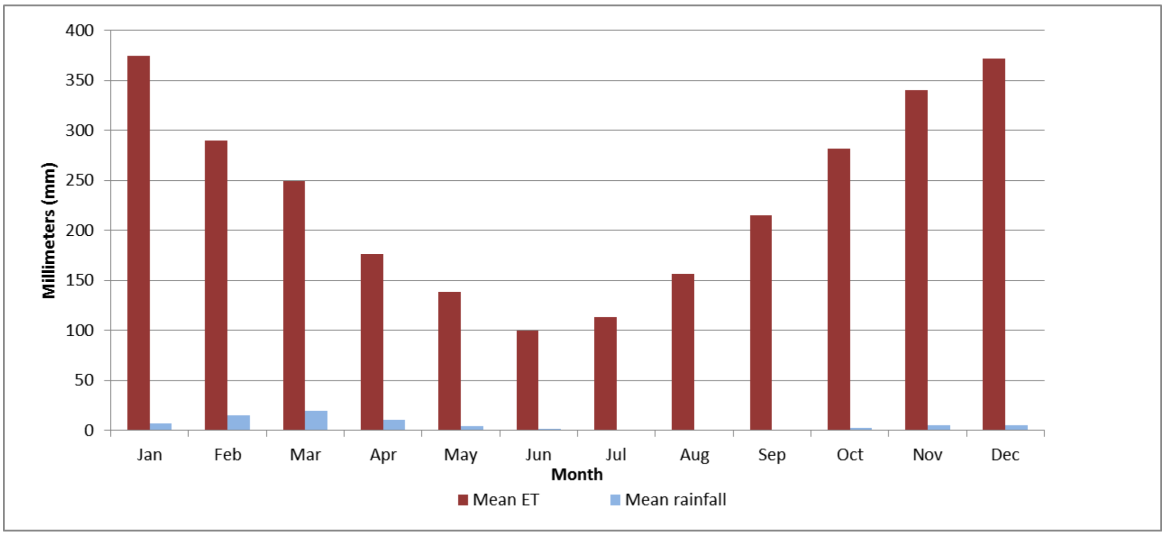

Figure 2: Long term average rainfall and evapotranspiration (ET) (Schulze et al., 2008)

1.3.2 Regional Geology

The Geological Survey of South Africa (now the Council for Geoscience) has mapped the area at 1:250 000 scale (2920 - Kenhardt). The geological setting is shown in **Map 3** (**Appendix A**). The main geology of the area is listed in **Table 1**. The formations occurring within the study area are indicated in bold (and shaded) in **Table 1**.

The oldest rocks in the area comprise of metamorphic gneisses (altered granite) which belong to the Jacomyns Pan Formation (Mja). The Jacomyns Pan Formation is also part of the Jacomyns Pan Group. These rocks mainly occur in the northern and central portion of the study area and are presumed to be bedrock. The study area is overlain by wind-blown sand (Qg) of the Gordonia Formation, the Gordonia Formation forms part of the Kalahari Group. The stream channels are filled with alluvial material.

Table 1: Geological Description of the Geological Formations found within the Study Area

Symbol	Name	Group	Description
Qg	**Gordonia Formation**	**Kalahari**	**Wind-blown dunes**
Mks	Klip koppies granite	Keimoes suite	Grey, fine to medium grained porphyritic granite
Mb	Brussel granite	Keimoes suite	Grey, fine to medium grained porphyritic granite
Me	Elsie se goria granite	Keimoes suite	Grey, medium grained granite, well-foliated.
Mva	Valsvei	Biesje poort	Yellow weathered, medium grained quarzitic gneiss with lenses of calc-silcate politic gneiss
Msa	Sandputs	Biesje poort	Grey to brown, fine grained weather calc-bearing quartzite
Mja	**Jacomyns pan**	**Jacomyns pan**	**Pelitic gneisses with quartzite, leuco-gneiss, amphibolite and calc-silcate rocks.**
Mke	Kenhardt migmatiet	Metamorphic suite	Migmatitic biotite gneiss, amphibolite, leucogneiss and porphyroblastic biotite.

1.3.3 Regional Hydrogeology

As mentioned previously, according to the 1:500 000 scale groundwater map of Prieska (2920) the entire study area does host an intergranular and fractured aquifer (i.e. the wind-blown sands and river alluvium as well as fractures within the bedrock constitutes an aquifer) with an average borehole yield of 0.1 L/s to 0.5 L/s (**Map 4**, **Appendix A**).

With such a low rainfall in the area, and thus associated low groundwater recharge conditions, it is anticipated that the groundwater quality will be poor. The regional 1:500 000 groundwater quality map (**Map 5**, **Appendix A**) indicates that the groundwater is of poor quality. Using Electrical Conductivity (EC) as a groundwater quality indicator, the EC ranges from 300 – 1 000 milliSiemens per meter (mS/m). In terms of domestic supply this is classified as “poor” and cannot be used for consumption or irrigation. As shown in Map 5 in Appendix A, the EC for the preferred site (Kenhardt PV 1) and the Kenhardt PV 1 transmission line corridor ranges from 300 mS/m to 1 000 mS/m. However, overall it is recommended that the groundwater not be used (i.e. abstracted) within the study area as a result of its saline nature and unsuitable quality. This is not considered a fatal flaw, as it simply means that alternate water supply needs to be sourced to fulfil the construction water requirements. As noted in Section A of the BA Report, if the groundwater is not sufficient or suitable for use, water will then be sourced from the municipal supply (i.e. delivery via water tankers).

The national scale groundwater vulnerability map, which was developed according to the DRASTIC methodology (Aller *et al*, 1987) classifies the area as having a “medium” groundwater vulnerability to surface based contaminants index whilst the corridor zone has a “low” vulnerability index (DWAF, 2005), (**Map 6**, **Appendix A**). The DRASTIC method takes into account the following factors:

D	=	depth to groundwater	(5)
R	=	recharge	(4)
A	=	aquifer media	(3)
S	=	soil type	(2)
T	=	topography	(1)
I	=	impact of the vadose zone	(5)
C	=	conductivity (hydraulic)	(3)

The vulnerability index is based on a rating and weighting approach. The number indicated in parenthesis at the end of each factor description is the weighting or relative importance of that factor. However this assessment is based on national scale mapping. Based on the local conditions at the study area there is a very low risk of groundwater contamination in this area as the groundwater level is relatively deep and the unsaturated as well as saturated zone has a very low hydraulic conductivity.

1.4 APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

If a more detailed study, which includes borehole drilling, pumping tests and water chemistry analysis (which is outside the current scope of this specialist study) concludes that groundwater abstraction should be pursued and successful boreholes are drilled, a Water Use Licence will be required from the DWS (in terms of Section 21 (a) of the National Water Act (Act 36 of 1998)) if the General Authorisation is exceeded. However if no groundwater abstraction is planned no approvals or legislation is required in terms of this specific water use.

1.5 KEY ISSUES

1.5.1 Key Issues Identified

The potential groundwater issues identified as part of this BA Process included:

- Limited groundwater availability and potential usage;
- Poor groundwater quality; and
- Low groundwater vulnerability to surface based contaminants as a result of construction activities.

To date, no comments and issues have been raised by I&APs in relation to groundwater resources or geohydrological impacts. The issues noted above were included for consideration in the BA Phase.

1.5.2 Identification of Potential Impacts

The following potential impacts (stated in no particular order) of the proposed project activities on groundwater and geohydrological resources are listed below and predicted and assessed in Section 1.6 of this report:

- Potential impact on groundwater quality as a result of accidental oil spillages or fuel leakages; and
- Potential impact on the groundwater as a result of the construction of the storage yards and temporary construction labour accommodation site camps.

1.5.3 Construction Phase

- Potential impact on groundwater quality as a result of accidental oil spillages or fuel leakages; and
- Potential impact on the groundwater as a result of the construction of the storage yards and temporary construction labour accommodation site camps.

1.5.4 Operational Phase

- There are no potential groundwater impacts during this phase.

1.5.5 Decommissioning Phase

- Potential impact on groundwater quality as a result of accidental oil spillages or fuel leakages.

1.5.6 Cumulative impacts

- There are no potential cumulative impacts on groundwater.

1.6 ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

1.6.1 Results of the Field Study

The initial desktop study, which included a search of the NGA for boreholes within the corridor and for a distance of 1 km from the corridor outline, resulted in no boreholes being located.

Also please note that GEOSS has previously worked in the area and groundwater data from that work (GEOSS, 2014) is also applicable to this project. Relevant information regarding borehole yields, borehole and groundwater depths and groundwater quality was also obtained from the landowner/farm manager during the previous site visit (GEOSS, 2014). GEOSS (2014) reported that borehole depths are typically between 60 – 120 m deep and fractures occur within the highly metamorphic rocks between two zones of 15 – 30 m and 100 – 120 m below ground level. Please note that the GEOSS (2014) boreholes located are referred to as “HBH” (i.e. hydrocensus borehole).

The desktop study informed the preparation for the field work in that groundwater is unlikely to be of socio-economic or ecological importance to any large degree in the area.

Nonetheless a site visit is always very informative and a hydrocensus was completed on 28th and 29th September 2015. The site visit was completed a dry time of the year and in the spring season. Please note that groundwater conditions do not vary significantly in this region and a once-off visit is sufficient to characterize the groundwater conditions of the area. Consultation with the land owners is always important for site specific data and anecdotal information. Mr Strauss (the occupier of the site) was very helpful in this regard. No further comments have been received regarding the geohydrological study. The locations of ten boreholes identified within this study area are listed in **Table 2**. The borehole positions are shown in **Map 2 (Appendix A**). Please note that the boreholes located during the September 2015 visit are referred to as “BH” (i.e. borehole) and not “HBH” to differentiate the data from the two visits. Nine of the ten boreholes where found to be wind pumps and the groundwater is piped into storage dams from the wind pumps. A Solar Pump was found to be installed at BH7 and the groundwater piped to a storage dam. Groundwater levels where measured, where possible, and water samples were collected and tested in the field to characterise the groundwater quality. The boreholes were found to be dry or to have very low yields (hence the use of wind pumps). For the boreholes that could be sampled the EC measurements exceed 300 mS/m and the groundwater quality is thus classified as “poor” according to the DWAF (1998) drinking water guidelines. Borehole BH7 was found to contain an EC of 1 030.8 mS/m, which classifies the groundwater as “completely unacceptable”.

A list of the boreholes locations and field chemistry from the 28th and 29th September 2015 visit is provided in **Table 2**.

Table 2: Hydrocensus boreholes (28 - 29 September 2015)

ID	Latitude	Longitude	WL (mbgl)	pH	Temp (C°)	EC (mS/m)	TDS (mg/L)	Salinity (mg/L)	ORP (mV)	Type	Comment
BH1	-29.20409	21.29679	Closed	7.49	19.3	300.2	2 203	1 780	145.6	WP	-
BH2	-29.20409	21.29679	Closed	7.78	17.8	300.1	2 281	1 850	147.9	WP	-
BH3	-29.223047	21.32389	Closed	7.8	17.9	350.2	2 632	2 160	118.1	WP	-
BH4	-29.233219	21.3153	Closed	7.99	18.5	296.3	2 197	1 780	73.9	WP	-
BH5	-29.270519	21.31655	Closed	-	-	-	-	-	-	WP	Pipe disappears underground – cannot find outlet
BH6	-29.27061	21.31848	Closed	-	-	-	-	-	-	WP	Pipe disappears underground – cannot find outlet
BH7	-29.27132	21.31855	12.102	7.13	25	1 030.8	6 669	5 700	90.2	BH	Solar Panel
BH8	-29.268721	21.32003	Closed	-	-	-	-	-	-	WP	Abandoned
BH9	-29.22345	21.26583	Closed	7.65	27	390.1	2 385	1 950	299	WP	Livestock
BH10	-29.187158	21.27478	Closed	-	-	-	-	-	-	WP	Inaccessible

1.6.2 Construction and Decommissioning Phases: Potential Impact on Groundwater Quality as a result of Accidental Oil Spillages or Fuel Leakages

If there is an accidental oil spill or fuel leakage during the construction, or decommissioning phases, then the low permeability of the vadose zone will provide significant attenuation capacity. The potential impact ratings have been listed in **Table 3** in Section 1.7.

The status of this impact, which is considered a direct impact, is rated as negative with a site specific spatial extent and short-term duration (i.e. the impact and risk will be experienced for less than 1 year). The consequence and probability of the impact are respectively rated as moderate and very unlikely. The reversibility of the impact is rated as high and the irreplaceability is rated as low. The significance of the impact without the implementation of mitigation measures is rated as low and with mitigation measures as very low.

Management Actions

A precautionary approach should be taken and reasonable measures should be undertaken to prevent oil spillages and fuel leakages from occurring. During the construction phase, vehicles must be regularly serviced and maintained to check and ensure there are no leakages. Any engines that stand in one place for a significant length of time must have drip trays. Fuel storage tanks should be above ground on an impermeable surface and within a bunded area. Construction vehicles and equipment should also be refuelled on an impermeable surface. If spillages occur, they should be contained and removed as rapidly as possible, with correct disposal practices of the spilled material. Proof of disposal (waste disposal slips or waybills) should be obtained and retained on file for auditing purposes.

During the operational phase the filling and servicing of vehicles should take place off-site.

With effective implementation of these mitigation actions, the impact of the project on groundwater as a consequence of the presence of accidental oil spillages and fuel leakages is predicted to be of very low significance.

1.6.3 Construction Phase: Potential Impact on the Groundwater as a result of the Construction of the Storage Yards and Temporary Construction Labour Accommodation Site Camps

The status of this impact is rated as negative and direct with a site specific spatial extent and short-term duration (i.e. the impact and risk will be experienced for less than 1 year). The consequence and probability of the impact is respectively rated as moderate and very unlikely. The reversibility of the impact is rated as high and the irreplaceability is rated as low. The significance of the impact without the implementation of mitigation measures is rated as low and if mitigation measures are implemented the rating is very low.

Even if different positions are selected for the storage yards and housing sites across the study area the ratings will remain the same. The reason for this is that the groundwater conditions across the site are essentially homogeneous across the area for the proposed transmission line corridor.

These potential impacts are only applicable during the construction phase and possibly the decommissioning phase; however they are not applicable to the operational phase. However, this potential impact for the decommissioning phase has not been rated as it is believed to be of a very low significance and extremely unlikely in terms of probability.

Management Actions

During the construction phase, all reasonable measures must be taken to prevent soil and groundwater contamination. The main source of contamination will be from construction vehicles leaking oil or fuel, fuel storage and spillages may occur whilst refuelling vehicles and machinery. During the construction phase, vehicles must be regularly serviced and maintained to check and ensure there are no leakages.

With effective implementation of these mitigation actions, the impact of the proposed project on groundwater as a consequence of the temporary storage yards and temporary site camp areas (required for the proposed transmission line) is predicted to be of very low significance.

1.6.4 Cumulative Impacts

There are no potential cumulative impacts with regard to the groundwater of the area from the construction, operation or decommissioning of the transmission lines (as groundwater is not recommended for use).

1.7 IMPACT ASSESSMENT SUMMARY

Impact assessment summary tables for direct and indirect impacts for the Construction and Decommissioning Phases have been included (see **Tables 3 and 4**). A Cumulative Impacts table has not been included as no cumulative impacts are applicable to the geohydrology for the proposed project.

Table 3: Impact assessment summary table for the Construction Phase

Construction Phase													
Direct and Indirect Impacts													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Construction of storage yards and labour accommodation sites	Groundwater contamination	Negative	Site	Short- term	Moderate	Very unlikely	High	Low	Vehicles to be correctly serviced	Low	Very low	5	High
Accidental oil spillage / fuel leakage	Groundwater contamination	Negative	Site	Short -term	Moderate	Very unlikely	High	Low	Storage tanks and filling areas to be on an impermeable surface. Storage tanks in a bunded area. Vehicles to be correctly serviced	Low	Very low	5	High

Table 4: Impact assessment summary table for the Decommissioning Phase

Decommissioning Phase													
Direct and Indirect Impacts													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Accidental oil spillage / fuel leakage	Groundwater contamination	Negative	Site	Short-term	Moderate	Very unlikely	High	Low	Storage tanks and filling areas to be on an impermeable surface. Storage tanks in a bunded area. Vehicles to be correctly serviced	Low	Very low	5	High

1.8 INPUT TO THE ENVIRONMENTAL MANAGEMENT PROGRAMME

Measures need to be put in place to ensure that the groundwater is not contaminated. The following aspects are considered important during the construction and possibly the decommissioning phase:

- All vehicles and other equipment (generators etc.) must be regularly serviced to ensure they do not spill oil. Vehicles should be refuelled and parked on paved (impervious) areas. If liquid product is being transported it must be ensured this does not spill during transit.
- Emergency measures and plans must be put in place and rehearsed in order to prepare for accidental spillage.
- Diesel fuel storage tanks must be above ground in a bunded area.
- Vehicle and washing areas must also be on paved surfaces and the by-products correctly managed.

1.9 CONCLUSION AND RECOMMENDATIONS

The groundwater in the area is saline and not fit for human consumption or recommended for the use in construction. There is limited abstraction occurring in the study area and groundwater is being used for livestock watering only. The study area is located in a highly metamorphosed geological setting. Metamorphic rocks rarely host sufficient groundwater and are considered an effective barrier to groundwater flow. The poor potential for groundwater development is related to the low occurrence of fractured networks within the formations and low rainfall.

The proposed activities have a very low significance of impact with respect to groundwater (with the implementation of mitigation measures).

From a geohydrological perspective there are no inclusions required for the environmental authorisation other than all reasonable measures must be taken to ensure fuel or oil spillage from site vehicles is limited during the construction phase. The proposed activity can proceed from a geohydrological perspective.

There are no areas that need to be avoided. However if a borehole is in the pathway of the power line, the replacement of the borehole needs to be discussed with the land owner.

If the Project Applicant considers the use of municipal water too expensive to use during the construction phase then a pilot groundwater exploration study and associated cost-benefit study needs to be completed (outside of this BA Process). Boreholes or additional boreholes being considered to be used for industrial use should be properly tested according to SANS guideline for borehole testing to assess their sustainable yield. A desalination plant is recommended for the removal of minerals from the saline groundwater. In addition a Water Use Licence will be required for the use of the groundwater if the use exceeds the General Authorisation. The possible use of groundwater will have to be addressed as an entirely separate project, however all indications at this stage are that groundwater will not be used in the construction, operational or decommissioning phases of the proposed transmission lines.

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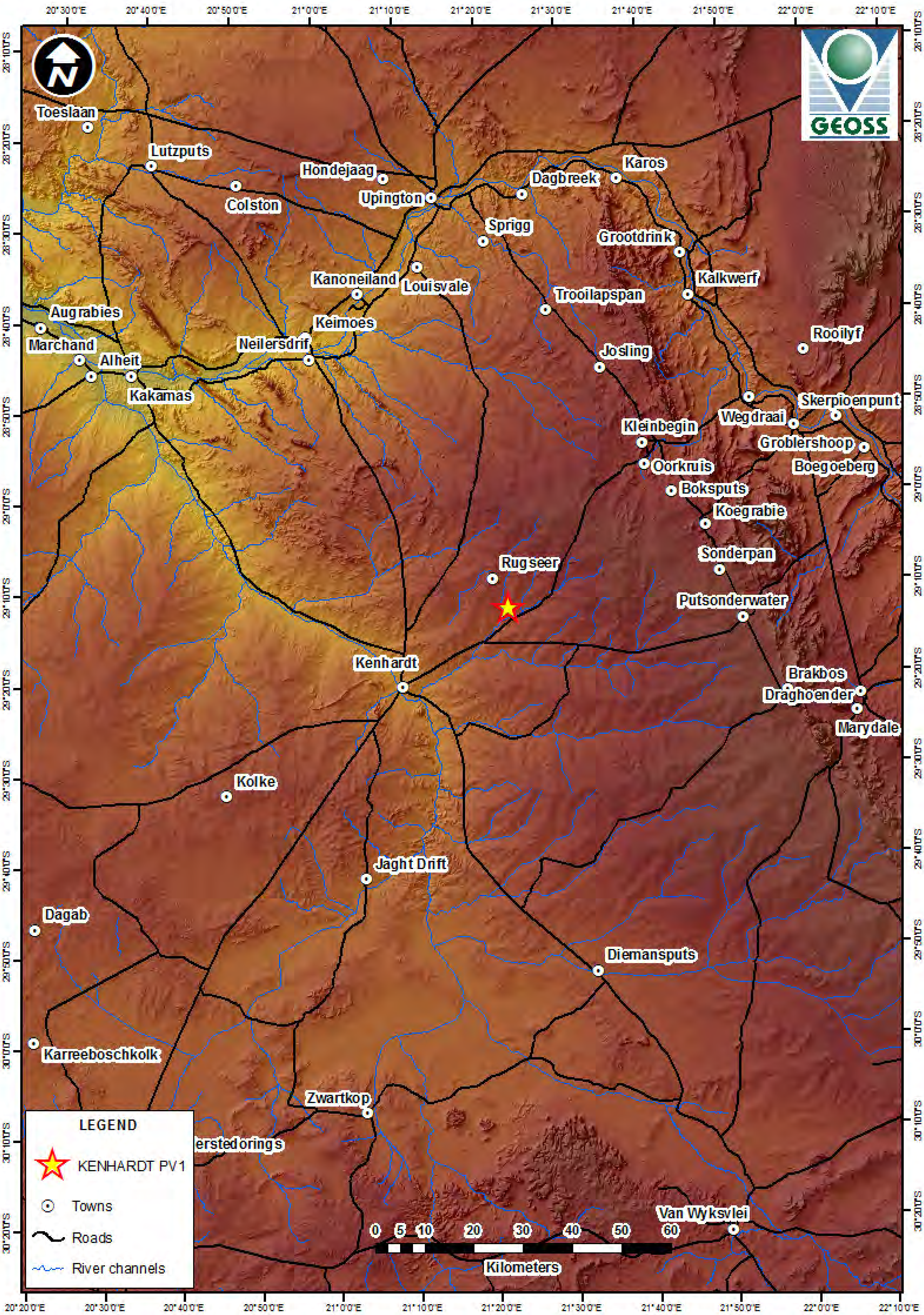
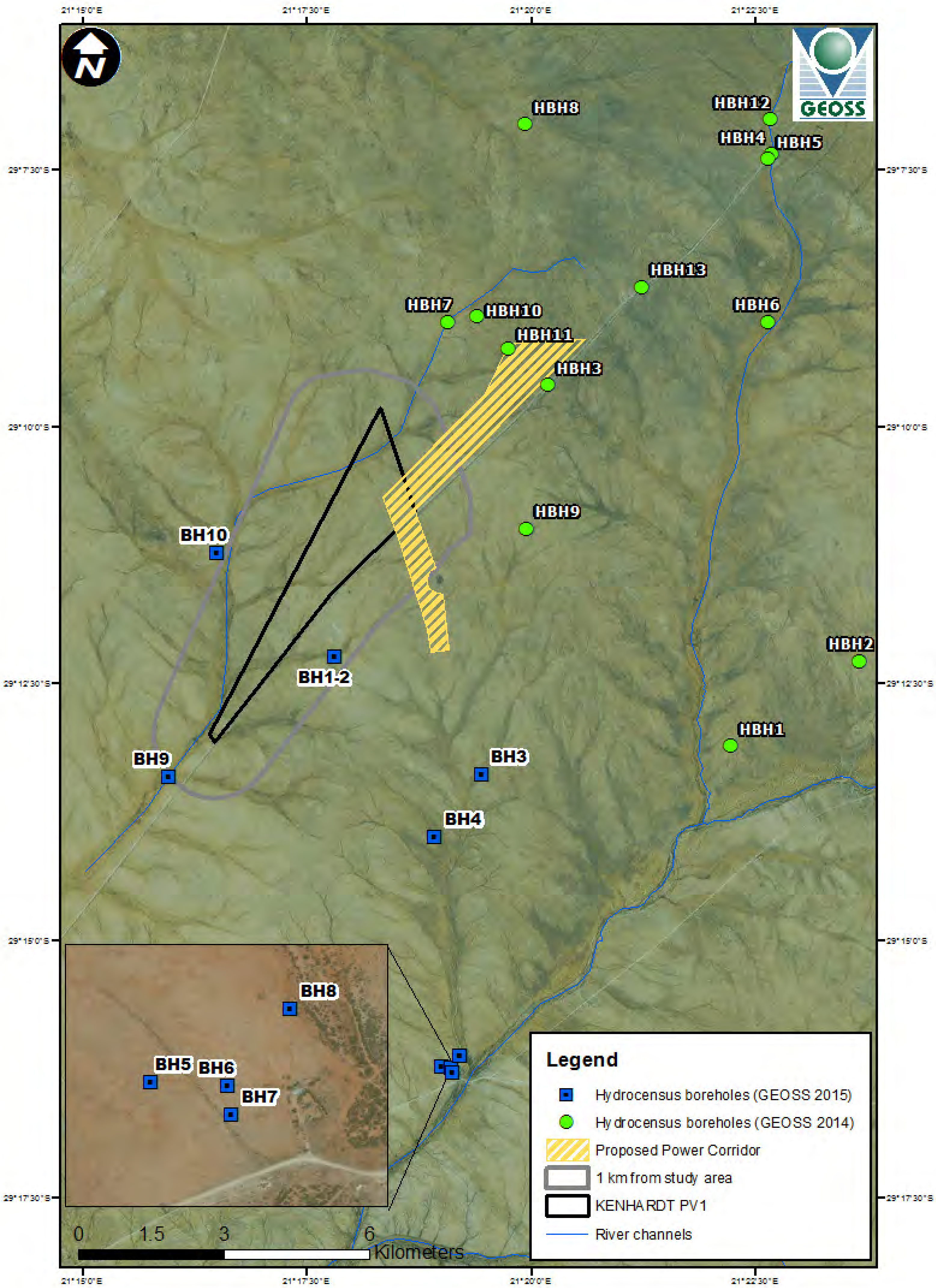
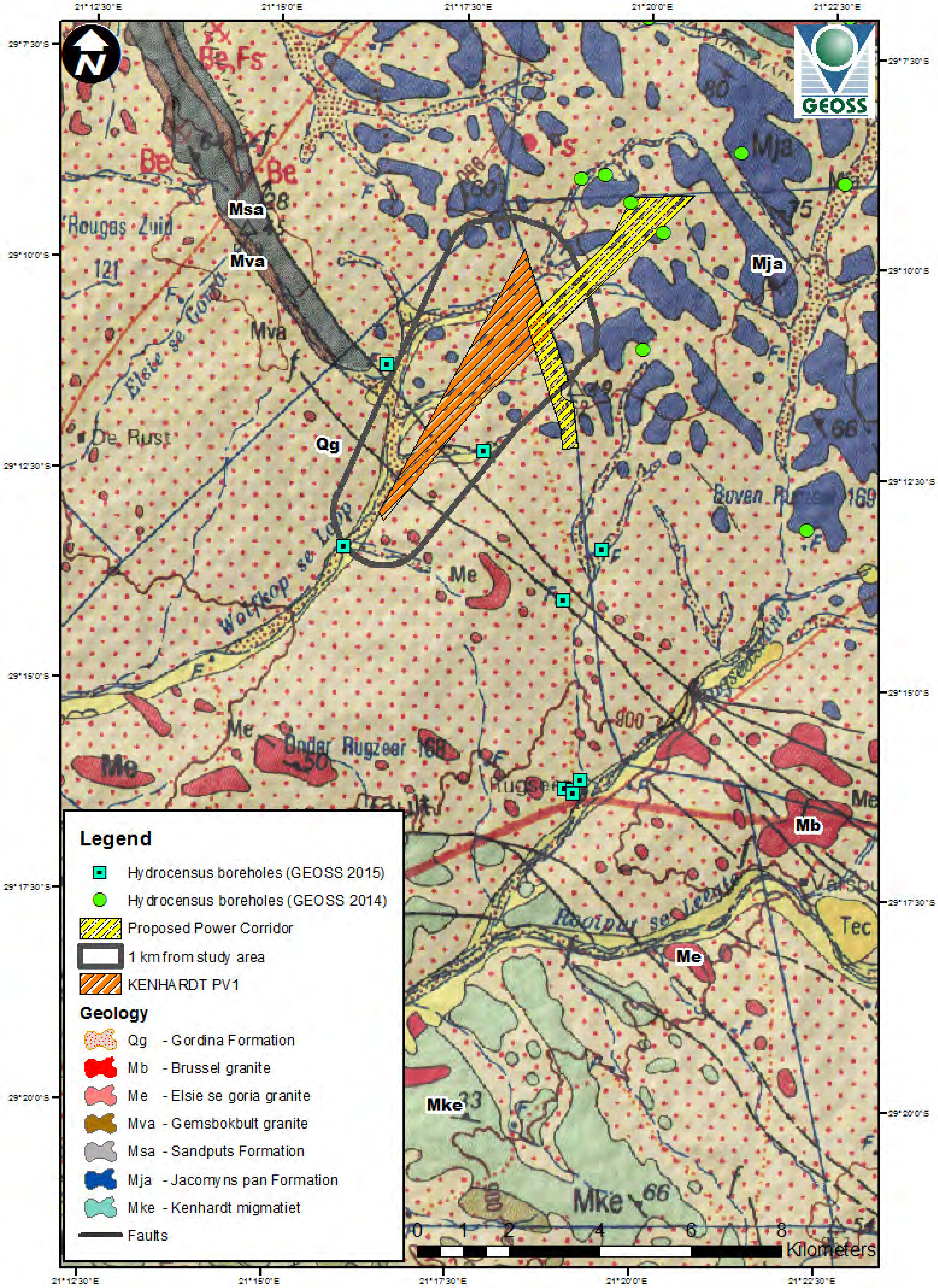
1.11 APPENDICES A: MAPS



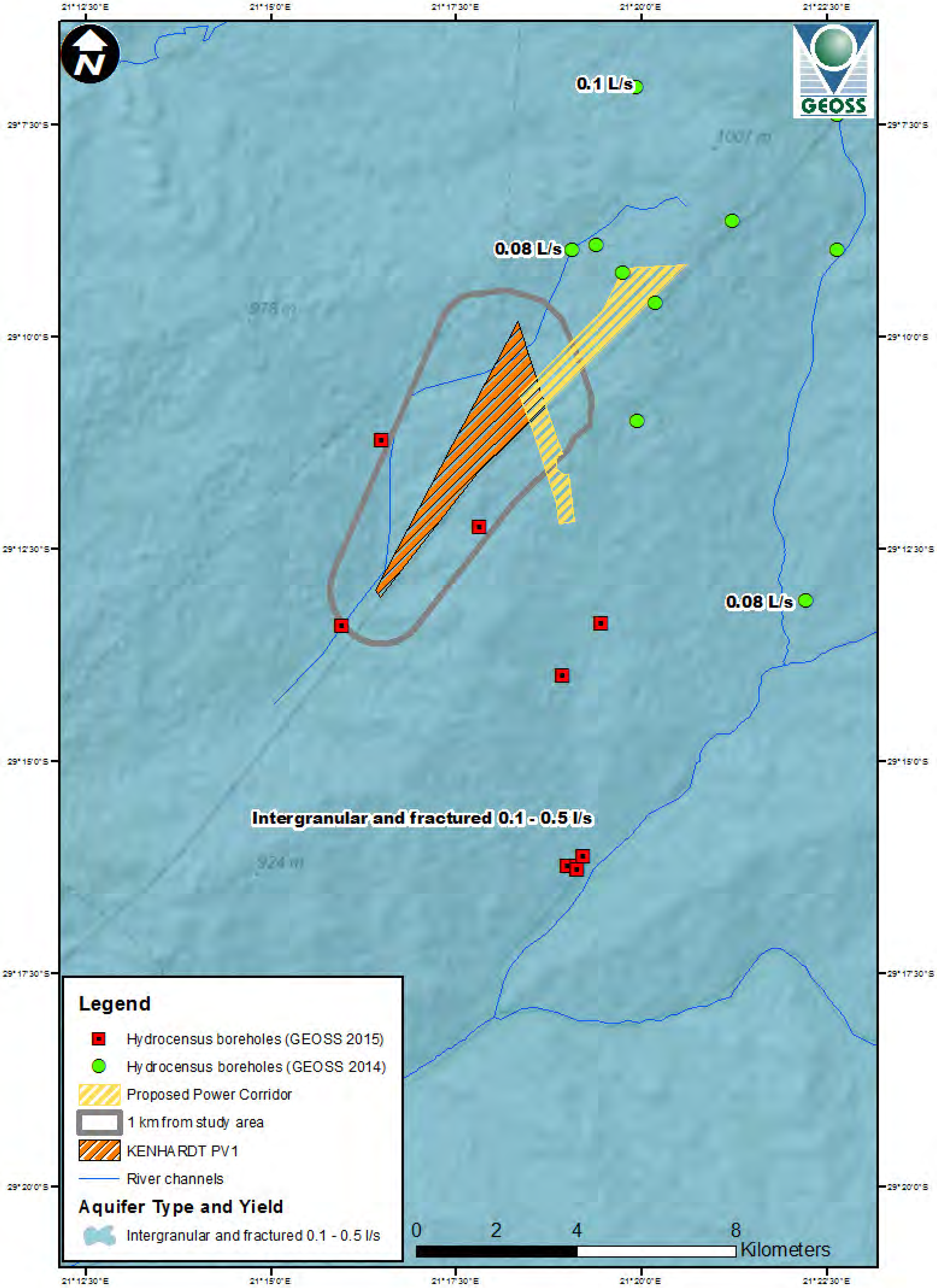
Map 1: Locality Map of the Study Area within a Regional Setting



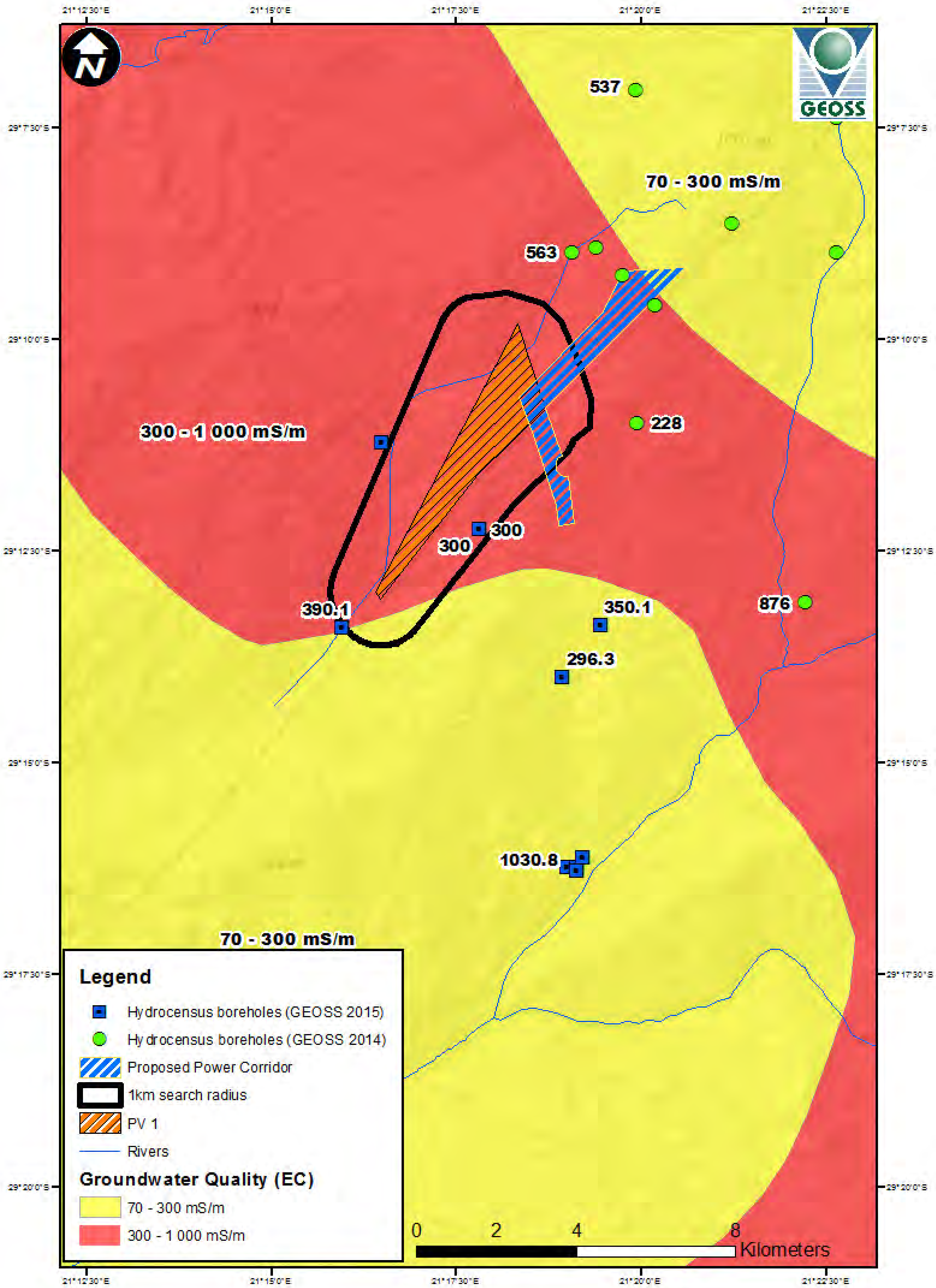
Map 2: Setting of the Study Area Superimposed on an Aerial Photograph (source ESRI), showing Hydrocensus Boreholes.



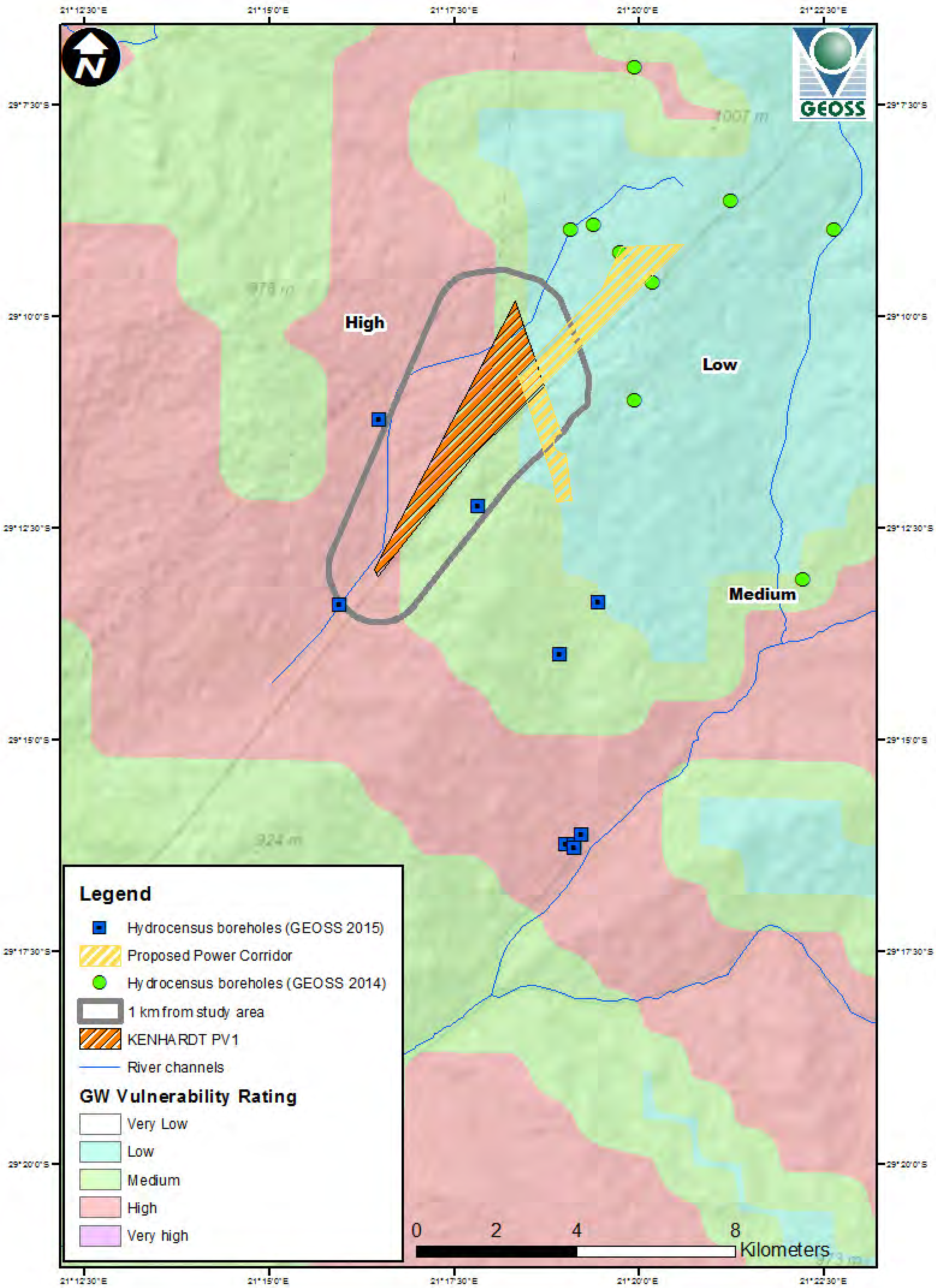
Map 3: The Geological Setting of the Study Area and NGA Boreholes (Council for Geoscience Map: 1:250 000 scale 2920 – Kenhardt)



Map 4: Aquifer Type and Yield (Department of Water Affairs Groundwater Map: 1:500 000 Scale 2920 - Prieska)



Map 5: Regional Groundwater Quality (Department of Water Affairs Groundwater Map: 1:500 000 scale 2920 - Prieska)



Map 6: Regional Groundwater Vulnerability (calculated according to the DRASTIC Methodology) and Boreholes (DWAF, 2005).

1.12 APPENDICES B: SITE PHOTOS

BH1 – wind pump

BH2 – wind pump

BH3 – wind pump

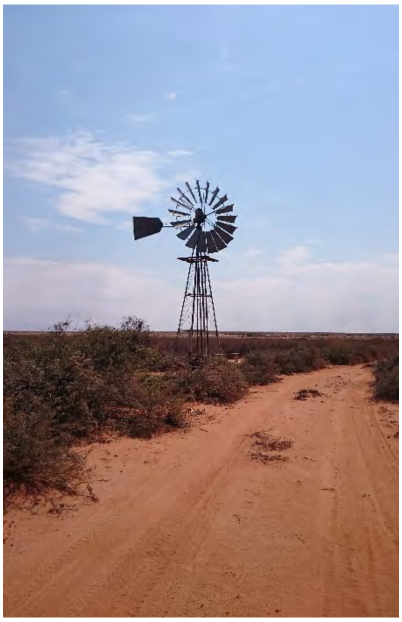
BH4 – wind pump

BH5 – wind pump

BH6 – wind pump

BH7 – solar pump borehole

BH8 – wind pump



BH9 – wind pump

**No photo available
(site not accessible)**

BH10 – wind pump

BASIC ASSESSMENT REPORT

Appendix D.6:
Soils and Agricultural Potential Assessment

SOILS AND AGRICULTURAL POTENTIAL ASSESSMENT:

Basic Assessment for the proposed development of a 132 kV Transmission Line to connect to the proposed 75 MW Solar PV Facility (Kenhardt PV 1) on the Remaining Extent of Onder Rugzeer Farm 168, and the Remaining Extent of Portion 3 of Gemsbok Bult Farm 120, north-east of Kenhardt, Northern Cape.

Report prepared for:

CSIR – Environmental Management Services

P O Box 17001

Congella, Durban, 4013

South Africa

Report prepared by:

Johann Lanz – Soil Scientist

P.O. Box 6209

Stellenbosch, 7599

South Africa

March 2016

SPECIALIST EXPERTISE

Curriculum Vitae – Johann Lanz

Education

• M.Sc. (Environmental Geochemistry)	University of Cape Town	1996 - June 1997
• B.Sc. Agriculture (Soil Science, Chemistry)	University of Stellenbosch	1992 - 1995
• BA (English, Environmental & Geographical Science)	University of Cape Town	1989 - 1991
• Matric Exemption	Wynberg Boy's High School	1983

Professional work experience

I am registered as a Professional Natural Scientist (Pri.Sci.Nat.) in the field of soil science, registration number 400268/12.

- **Soil Science Consultant** **Self employed** **2002 - present**

I run a soil science consulting business, servicing clients in both the environmental and agricultural industries. Typical consulting projects involve:

- Soil specialist study inputs to EIA's, SEA's and EMPR's. These have focused on impact assessments and rehabilitation on agricultural land, rehabilitation and re-vegetation of mining and industrially disturbed and contaminated soils, as well as more general aspects of soil resource management. Recent clients include: CSIR; SiVEST; Savannah Environmental; Aurecon; Subsolar; Red Cap Investments; MBB Consulting Engineers; Enviroworks; Sharples Environmental Services; Mainstream Renewable Power; Haw & Inglis; BioTherm Energy; WKN Windcurrent; Corobrik; Western Cape Provincial Department of Environmental Affairs and Development Planning; Alcan aluminium smelter (Coega); Namaqualand Restoration Initiative; AECI; Afrimat; Tiptrans.
- Soil resource evaluations and mapping for agricultural land use planning and management. Recent clients include: Zewenwacht Wine Estate, Lourensford Fruit Company; Thelema Mountain Vineyards; Delaire Wine estate; Newton-Johnson Wines; Spier Estate; Colors Fruit; Kaarsten Boerdery; Amanzi Country Estate (Port Elizabeth); Rudera Wines; Flagstone Wines; Cob Creek Estate (Jeffreys Bay); Solms Delta Wines; Dornier Wines.
- I have conducted several recent research projects focused on conservation farming, soil health and carbon sequestration.
- I have project managed the development of soil nutrition software for Farmsecure Agri Science.

- **Soil Science Consultant** **Agricultural Consultors International (Tinie du Preez)** **1998 - end 2001**

Responsible for providing all aspects of a soil science technical consulting service directly to clients in the wine, fruit and environmental industries all over South Africa, and in Chile, South America.

- **Contracting Soil Scientist** **De Beers Namaqualand Mines** **July 1997 - Jan 1998**

Completed a contract to make recommendations on soil rehabilitation and re-vegetation of mined areas.

Publications

- Lanz, J. 2012. Soil health: sustaining Stellenbosch's roots. In: M Swilling, B Sebitosi & R Loots (eds). *Sustainable Stellenbosch: opening dialogues*. Stellenbosch: SunMedia.
- Lanz, J. 2010. Soil health indicators: physical and chemical. South African Fruit Journal, April / May 2010 issue.
- Lanz, J. 2009. Soil health constraints. South African Fruit Journal, August / September 2009 issue.
- Lanz, J. 2009. Soil carbon research. *AgriProbe*, Department of Agriculture.
- Lanz, J. 2005. Special Report: Soils and wine quality. *Wineland Magazine.*

I am a reviewing scientist for the *South African Journal of Plant and Soil*.

SPECIALIST DECLARATION

I, Johann Lanz, as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

- I act as the independent specialist in this application;
- I perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I have no vested interest in the proposed activity proceeding;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

Name of specialist: Johann Lanz

Professional Registration (including number): SACNASP Registration Number: 400268/12

Date: 05 February 2016

EXECUTIVE SUMMARY

The proposed development is located on land zoned and used for agriculture. South Africa has very limited arable land and it is therefore critical to ensure that development does not lead to an inappropriate loss of land that may be valuable for cultivation. This assessment has found that the proposed site is on land which is of very low agricultural potential and is not suitable for cultivation.

The key findings of this study are:

- There are three factors that influence the significance of all potential agricultural impacts. The first is that the actual footprint of disturbance of the proposed power line is very small in relation to available, surrounding land. The second is that the impact of a power line on the kind of agricultural activity (grazing) along the proposed development is very minimal, as this can continue in the presence of a power line with negligible disturbance. The third is that the site has very low agricultural potential, limited by severe climatic moisture availability constraints and shallow, rocky soils.
- Because of these factors, there will be a very low significance overall impact of the proposed development on agricultural production and resources and also a very low significance cumulative impact.
- No agriculturally sensitive areas occur within the assessed corridor.
- Soils are shallow, red sandy soils on underlying rock and hard-pan carbonate, predominantly of the Coega and Mispah soil forms.
- The land capability is classified as Class 7 - non-arable, low potential grazing land.
- The site has a low grazing capacity of 31 - 40 hectares per large stock unit.
- Five potential negative impacts of the proposed development on agricultural resources and productivity were identified as:
    - Loss of agricultural land use caused by direct occupation of land by the proposed transmission line footprint.
    - Loss of topsoil in disturbed areas, causing a decline in soil fertility.
    - Soil erosion caused by alteration of the surface characteristics.
    - Degradation of veld vegetation beyond the footprint of the proposed transmission line.
    - Cumulative regional loss of agricultural land use as a result of several other developments in the area.
- All impacts were assessed as having very low significance (without the implementation of mitigation measures).
- The following mitigation measures were recommended:
    - Implement an effective system of stormwater run-off control;
    - Control dust during construction through appropriate dust suppression methods;
    - Strip and stockpile topsoil before disturbance and re-spread it on the surface as soon as possible after disturbance;
    - Manage any sub-surface spoils from excavations in such a manner that it will not impact on agricultural land; and
    - Minimise road footprint and control vehicle access on designated roads only.
- Because of the low agricultural potential of the site, the development should, from an agricultural impact perspective, be authorised. Authorisation is promoted by the fact that the site falls within a proposed renewable energy development zone, where such land use has been assessed as very suitable in terms of a number of factors,

including agricultural impact. It is preferable to incur a loss of agricultural land in such a region, without cultivation potential, than to lose agricultural land that has a higher potential, to renewable energy development elsewhere in the country.

- No agriculturally sensitive areas occur within the site and no part of it is therefore required to be set aside from the development. Because the site is uniformly low potential, from an agricultural point of view, there is no preferred location or layout within the assessed site. There are no conditions resulting from this assessment for inclusion in the environmental authorisation.

COMPLIANCE WITH THE APPENDIX 6 OF THE 2014 EIA REGULATIONS

Requirements of Appendix 6 – GN R982	**Addressed in the Specialist Report**
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Preliminary Section of this report
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Appendix I of the BA Report, Preliminary Section of this report and Section 1.6
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1 & 1.2
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1.3
e) a description of the methodology adopted in preparing the report or carrying out the specialised process;	Section 1.3
f) the specific identified sensitivity of the site related to the activity and its associated structures and infrastructure;	Section 3.8
g) an identification of any areas to be avoided, including buffers;	Section 3.8
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Figure 1
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.4
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment;	Section 6
k) any mitigation measures for inclusion in the EMPr;	Section 6
l) any conditions for inclusion in the environmental authorisation;	Not applicable
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 8
n) a reasoned opinion- i. as to whether the proposed activity or portions thereof should be authorised; and ii. if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 9
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 1.3
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Not applicable
q) any other information requested by the competent authority.	Not applicable

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TABLES

FIGURES

LIST OF ABBREVIATIONS

AGIS	Agricultural Geo-Referenced Information System
CSIR	Council for Scientific and Industrial Research
DAFF	Department of Agriculture, Forestry and Fisheries
EIA	Environmental Impact Assessment
PET	Potential evapotranspiration

SOILS AND AGRICULTURAL POTENTIAL ASSESSMENT

1 INTRODUCTION AND METHODOLOGY

This report presents the Soil and Agricultural Potential Assessment undertaken by Mr. Johann Lanz (an independent consultant), under appointment to the CSIR, as part of the Basic Assessment (BA) for the proposed transmission line for the proposed Kenhardt PV 1 Solar Photovoltaic (PV) Facility, near Kenhardt in the Northern Cape Province, which is referred to as the Kenhardt PV 1 – Transmission Line project).

1.1 OBJECTIVES OF THE SPECIALIST STUDY

The objectives of the study are to identify and assess all potential impacts of the proposed developments on agricultural resources including soils and agricultural production potential, and to provide recommended mitigation measures, monitoring requirements, and rehabilitation guidelines for all identified impacts.

The scope of work is captured and listed under the terms of reference below.

1.2 SCOPE OF WORK AND TERMS OF REFERENCE

The following terms of reference apply to this study:

The report will fulfil the terms of reference for an agricultural study as set out in the National Department of Agriculture's document, *Regulations for the evaluation and review of applications pertaining to renewable energy on agricultural land*, dated September 2011, with an appropriate level of detail for the agricultural suitability and soil variation on site (which may therefore be less than the standardised level of detail stipulated in the above regulations).

The above requirements together with requirements for a specialist report may be summarised as follows:

- Research and describe the existing environment in terms of its soils, geology and agricultural potential. Identify any significant soils and agricultural features or disturbances, as well as any sensitive features and receptors within the proposed project area.
- Undertake a desktop assessment to compile a baseline description, including an assessment of the existing soil and agricultural potential data for the site.
- Provide a sensitivity map indicating the presence of sensitive features and receptors (i.e. sensitive soil and agricultural features), "no-go" areas, setbacks/buffers, as well as any red flags or risks associated with soil and agricultural impacts.
- Define the environmental risks to the soils and agricultural land and potential, as well as the consequences thereto.
- Highlight any gaps in baseline data.

- Conduct a site visit and a field investigation of soils and agricultural conditions across the site and conduct a soil survey to distinguish areas that do not have and have potential for cultivation.
- Describe and map soil types (soil forms) and characteristics (soil depth, soil colour, limiting factors, and clay content of the top and sub soil layers).
- Describe the topography of the site and map soil survey points.
- Summarise available water sources for agriculture.
- Describe historical and current land use, agricultural infrastructure, as well as possible alternative land use options.
- Describe the erosion, vegetation and degradation status of the land.
- Determine and map, if there is variation, the agricultural potential across the site.
- Determine and map the agricultural sensitivity to development across the site.
- Identify relevant protocols, legal and permit requirements relating to soil and agricultural potential impacts likely to be generated as a result of the proposed project.
- Identify and assess all potential impacts (direct, indirect and cumulative) of the construction, operational and decommissioning phases of the proposed development on soils and agricultural potential, and note the economic consequences of the proposed development on soils and agricultural potential.
- Provide recommended mitigation measures, management actions, monitoring requirements, and rehabilitation guidelines for all identified impacts (for inclusion into the EMPr as well).

1.3 APPROACH AND METHODOLOGY

The pre-fieldwork assessment was based on the existing Agricultural Geo-Referenced Information System (AGIS) data as well as satellite imagery for the site. This was supplemented by a field investigation that aimed at ground-proofing the AGIS data and assessing specific field conditions and the variation of these across the site. It did not comprise a detailed soil mapping exercise, but was based on an overview assessment, which involved driving and walking across the site, assessing topography and surface conditions, investigating existing cuttings in numerous excavations along the railway, and in animal burrows. Because of the shallow soils and the existing burrows and excavations, it was not necessary to auger additional holes. The field investigation also included a visual assessment of erosion and erosion potential on site, taking into account the proposed development layout. The field assessment was completed on 18 November 2015 (summer). An assessment of soils (soil mapping) and long term agricultural potential is in no way affected by the season in which the assessment is made, and therefore the fact that the assessment was done in summer has no bearing on its results. The conducted soil investigation is considered adequate for the purposes of this study (i.e. for the purposes of determining the impact of the proposed development on agricultural resources and productivity). Detailed soil mapping has no relevance to an assessment of agricultural potential in this environment, as the limitations are overwhelmingly climatic. In other words, even where soils suitable for cultivation may occur, they cannot be utilised because of the aridity constraints. More detailed soil mapping would add no value to the assessment.

Soils have been classified according to the South African soil classification system.

Telephonic consultation was done with the current farmer of the land, Mr Sarel Strauss to get details of current farming practices on the farm.

The impacts have been assessed in line with the methodology indicated in Section D of the BA Report. The developments listed in Section D of the BA Report, which are located within a 20 km radius of the proposed Kenhardt PV 1 project, have been considered in the assessment of cumulative impacts.

1.4 ASSUMPTIONS AND LIMITATIONS

The following assumption was used in this specialist study:

- It was assumed that water is not available anywhere on the site for irrigation. Given the very severe moisture constraints of the environment and that no suitable water has ever been identified by farmers in the area, this is a fair assumption.
- The cumulative impact assessment assumes that a number of other renewable energy developments will take place in the surrounding area (See Section D of the BA Report).

The following limitations were identified in this study:

- Soils were not mapped in detail for the study. However detailed soil mapping has no relevance to an assessment of agricultural potential in this environment, as the limitations are overwhelmingly climatic. In other words, even where soils suitable for cultivation may occur, they cannot be utilised because of the aridity constraints. The study had more than sufficient information on the soils to make an assessment on the impacts of the development on agriculture, and so this is not seen as a limitation.
- The assessment rating of impacts is not an absolute measure. It is based on the subjective considerations and experience of the specialist, but is done with due regard and as accurately as possible within these constraints.

There are no other specific constraints and limitations for this study.

1.5 INFORMATION SOURCES

All data on land types, land capability, grazing capacity etc. was sourced from the online AGIS, produced by the Institute of Soil, Climate and Water (Agricultural Research Council, undated). Satellite imagery of the site available on Google Earth was also used for evaluation.

1.6 DECLARATION OF INDEPENDENCE OF SPECIALIST

Refer to the preliminary section of this specialist report for the Curriculum Vitae of Mr. Johann Lanz, which highlights his experience and expertise. The declaration of independence by the specialist is provided in Box 1.1 below (with a full declaration included in the preliminary sections of this report and Appendix I of the BA Report).

BOX 1.1: DECLARATION OF INDEPENDENCE

I, Johann Lanz, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed Kenhardt PV 1 – Transmission Line Project, application or appeal in respect of which I was appointed, other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.

JOHANN LANZ

2 DESCRIPTION OF PROJECT ASPECTS RELEVANT TO SOILS AND AGRICULTURAL IMPACTS

This project will entail construction of an approximately 4 km 132 kV transmission line extending from the proposed Kenhardt PV 1 facility to the Eskom Nieuwehoop Substation. The proposed transmission lines for the Kenhardt PV 1, Kenhardt PV 2 and Kenhardt PV 3 projects are being assessed separately as part of a BA Process. The proposed transmission lines are expected to be overhead, with concrete and steel tower structures. All transmission lines for the Kenhardt PV 1, PV 2 and PV 3 transmission line projects will be constructed within an electrical infrastructure corridor (as shown in Figure 1), which has been assessed in this report.

The components of the project that can impact on agricultural resources and productivity, during all phases of the project, are:

1. Occupation of land by the footprint of the proposed infrastructure as part of the development. This is confined largely to the pylon bases as agricultural activities can continue unhindered below the power lines.
2. Constructional activities that denude the surface cover of vegetation or disturb the soil below surface.
3. Vehicle traffic on site.

It is important to note that a detailed project description is included in Section A of the BA Report.

3 DESCRIPTION OF THE SOILS AND AGRICULTURAL CAPABILITY OF THE AFFECTED ENVIRONMENT

A satellite image of the site including the development layout is given in Figure 1. Photographs of site conditions are given in Figures 2 to 5.

3.1 CLIMATE AND WATER AVAILABILITY

Rainfall for the site is given as a very low 183 mm per annum, with a standard deviation of 71 mm according to the South African Rain Atlas (Water Research Commission, undated). The average monthly distribution of rainfall is shown in Table 1. One of the most important climate parameters for agriculture in a South African context is moisture availability, which is the ratio of rainfall to evapotranspiration. Moisture availability is classified into six categories across the country (as shown in Table 2). The proposed development site falls within Class 6, which is described as a very severe limitation to agriculture.

Table 1. Average monthly rainfall for the site (29° 10' S; and 21° 21' E) in mm (Water Research Commission, undated)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
25	33	38	24	11	5	3	4	5	8	11	16	183

Table 2. The classification of moisture availability climate classes for summer rainfall areas across South Africa (Agricultural Research Council, Undated)

Climate Class	Moisture Availability (Rainfall/0.25 PET)	Description of Agricultural Limitation
C1	>34	None to slight
C2	27-34	Slight
C3	19-26	Moderate
C4	12-18	Moderate to severe
C5	6-12	Severe
C6	<6	Very severe

Water for stock is obtained from wind pumps on the farm. There is insufficient water available for any form of irrigation.

3.2 TERRAIN, TOPOGRAPHY AND DRAINAGE

The proposed development is located on level plains with some relief in the Northern Cape interior at an altitude of between 900 and 1000 meters. Slopes across the site are almost entirely less than 2%.

The underlying geology is migmatite, gneiss and granite of the Namaqualand Metamorphic Complex with abundant calcrete.

There are no perennial drainage courses within the proposed project footprint. There are temporary drainage courses, typical of arid environments, where surface run-off would accumulate and flow, but this would only occur very occasionally, immediately after high rainfall events.

3.3 SOILS

The land type classification is a nationwide survey that groups areas of similar soil, terrain and climatic conditions into different land types. The proposed development is located on one land type, Ag6. This land type comprises predominantly shallow, red sands to loamy sands on underlying rock, hard-pan carbonate, or hard-pan dorbank. The soils fall into the arid Silicic, Calcic, and Lithic soil groups according to the classification of Fey (2010). A summary detailing soil data for the land type is provided in Table A1 in Appendix 1 of this report. The field investigation confirmed that the soils on site are shallow, red sandy soils on underlying rock and hard-pan carbonate. Actual soil forms vary within short distances depending on rock ridges that run across the area and the extent of calcrete formation. There are numerous outcrops of rocky ridges at the soil surface across the entire area. All investigated sample points across the area were one of four soil forms: Coega, Mispah, Plooysberg or Hutton. However there is very little practical difference between these different soil forms. All have a clay content of approximately 7%, are shallow and are underlain by a hard impenetrable layer (either rock or hard-pan carbonate).

The land has low to moderate water erosion hazard, mainly due to the low slope, but is susceptible to wind erosion because of the sandy texture of the soil.

Figure 1. Satellite image of site showing proposed transmission line corridor to the Eskom Nieuwehoop Substation (currently under construction).

Figure 2. Photograph showing typical site conditions.

Figure 3. Photograph showing typical site conditions in parts where more rocks occur.

Figure 4. Photograph showing typically occurring, shallow hard-pan carbonate horizon (Coega soil form).

Figure 5. Photograph showing typically occurring, red sandy soil overlying shallow rock (Hutton soil form).

3.4 AGRICULTURAL CAPABILITY

Land capability is the combination of soil suitability and climate factors. The area has a land capability classification, on the eight category scale, of Class 7 - non-arable, low potential grazing land. The limitations to agriculture are aridity and lack of access to water in addition to the shallow soil depth and rockiness. Because of these constraints, agricultural land use is restricted to low intensity grazing only. The natural grazing capacity is low, at mostly 31 - 40 hectares per animal unit. The current farmer uses an average stocking rate of 10 hectares per sheep.

3.5 LAND USE AND DEVELOPMENT ON AND SURROUNDING THE SITE

The farm is located within a sheep farming agricultural region and land use for the farm and surrounding area is sheep farming only. There is no cultivation or any history of cultivation on the farm. The Sishen–Saldanha railway line with its associated infrastructure runs through the farm to the south of the proposed transmission line corridor. Apart from fences and one stock watering point, there is no agricultural infrastructure on the site. There are no buildings on the site.

There are two proposed access roads. The one makes use of the existing road running along the Sishen-Saldanha railway line, which is in good condition. The other makes use of a farm track running northwards to the site through the farm. This will require upgrading. A maintenance gravel road (lesser than 6 m wide) will also be constructed below the proposed transmission line (within the electrical infrastructure corridor).

3.6 STATUS OF THE LAND

The biome classification for the site is Bushmanland Arid Grassland. The natural vegetation is grazed, veld conditions are very sparse but there is no evidence of significant erosion or other land degradation on the site.

3.7 POSSIBLE LAND USE OPTIONS FOR THE SITE

Because of both the climate and soil limitations, the site is not suitable for any agricultural land use other than low intensity grazing.

The site is within one of South Africa's eight proposed renewable energy development zones, and has therefore been identified as one of the most suitable areas in the country for renewable energy development, in terms of a number of environmental impact, economic and infrastructural factors. These factors include an assessment of the significance of the loss of agricultural land. Renewable energy development is therefore a very suitable land use option for the site.

3.8 AGRICULTURAL SENSITIVITY

Agricultural potential is uniformly low across the farm and the choice of placement of the development on the farm therefore has no influence on the significance of agricultural impacts. No agriculturally sensitive areas occur within the area of the proposed transmission line corridor, and so no parts of it need to be avoided by the development. No buffers are required.

4 APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

A servitude for the proposed transmission line will need to be registered on the affected farm portions. Rehabilitation after disturbance to agricultural land is managed by the Conservation of Agricultural Resources Act (Act 43 of 1983) (CARA). The Department of Agriculture, Forestry and Fisheries reviews and approves applications in terms of these Acts according to their *Guidelines for the evaluation and review of applications pertaining to renewable energy on agricultural land*, dated September 2011.

5 IDENTIFICATION OF KEY ISSUES AND POTENTIAL IMPACTS

The following have been identified by the specialist as potential impacts on agricultural resources and productivity.

5.1 CONSTRUCTION AND DECOMMISSIONING PHASES ONLY

1. Degradation of veld vegetation beyond the direct footprint of the proposed transmission line corridor due to construction and decommissioning phase disturbance and potential trampling by vehicles.
2. Loss of topsoil due to poor topsoil management (burial, erosion, etc.) during construction and decommissioning related soil profile disturbance (levelling, excavations etc.) and resultant decrease in that soil's capability for supporting vegetation.

5.2 ALL PHASES – CONSTRUCTION, OPERATION AND DECOMMISSIONING

1. Loss of agricultural land use due to direct occupation by the infrastructural footprint of the proposed development for the duration of the project (all phases). This will take affected portions of land out of agricultural production.
2. Soil erosion by wind or water due to the alteration of the land surface characteristics. Alteration of surface characteristics may be caused by construction related land surface disturbance, vegetation removal, and the establishment of excavations and surfaces for the proposed pylon bases. Erosion will cause loss and deterioration of soil resources and may occur during all phases of the project.

5.3 CUMULATIVE IMPACTS

1. Cumulative impacts due to the regional loss of agricultural land resources as a result of other developments on agricultural land in the region.

To date, no comments and issues have been raised by I&APs in relation to soil and agricultural potential. The National DEA has certain requirements for the Soils and Agricultural Potential Assessment, as shown in Table 3 below. Table 3 also shows how the requirements from the National DEA have been met.

Table 3: National DEA Requirements for the Soils and Agricultural Potential Assessment

DEA Requirement	Feedback from Specialist
• Detailed soil assessment of the site in question, incorporating a radius of 50 m surrounding the site, on a scale of 1:10 000 or finer. The soil assessment should include the following: - Identification of the soil forms present on site; - The size of the area where a particular soil form is found; - GPS readings of soil survey points; - The depth of the soil at each survey point; - Soil colour; - Limiting factors; - Clay content; - Slope of the site; - A detailed map indicating the locality of the soil forms within the specified area; and - Size of the site.	Detailed soil mapping has no relevance to an assessment of agricultural potential in this environment, where cultivation is not possible, soil conditions are generally poor and the agricultural limitations are overwhelmingly climatic. In such an environment, even where soils suitable for cultivation may occur, they cannot be cultivated because of the aridity constraints. The level of detail in the DEA (and DAFF) requirement is appropriate for arable land only. It is not appropriate for this site. Conducting a soil assessment at the required level of detail would be very time consuming and be a complete waste of that time. It would add absolutely no value to the assessment. The level of soil assessment that was conducted for this report is considered more than adequate for a thorough assessment of all agricultural impacts. The assessment did include identification of soil forms, soil depth, colour, limiting factors and clay content, and the slope and size of the site.
• Exact locality of the site	Refer to the site map shown in Figure 1.
• Current activities on the site, including developments or buildings.	Refer to Section 3.5 of this report
• Surrounding developments/land uses and activities in a radius of 500 m of the site.	Refer to Section 3.5 of this report.
• Access routes and the condition thereof.	Refer to Section 3.5 of this report.
• Current status of the land (including erosion, vegetation, and a degradation assessment).	Refer to Section 3.6 of this report.
• Possible land use options for the site.	Refer to Section 3.7 of this report.
• Water availability, source and quality (if available).	Refer to Section 3.1 of this report.
• Detailed descriptions of why agriculture should or should not be the land use of choice.	Refer to Sections 3.7 and 9 of this report.
• Impact of the change of land use on the surrounding area.	Refer to Section 6 of this report.
• A shape file containing the soil forms and relevant attribute data as depicted on the map.	A shapefile containing soil forms is not relevant - see first pint above

6 ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

The five potential impacts identified in Section 5 above are assessed in table format in Tables 4 and 5 below.

The proposed development is located on land zoned and used for agriculture. South Africa has very limited arable land and it is therefore critical to ensure that development does not lead to an inappropriate loss of land that may be valuable and important for agricultural production. The proposed site is however on land which has very low agricultural potential and is only suitable for low intensity grazing.

There are three factors that influence the significance of all potential agricultural impacts. The first is that the actual footprint of disturbance of the proposed power line is very small in relation to available, surrounding land. The second is that the impact of a power line on the kind of agricultural activity (grazing) along the proposed development is very minimal, as this can continue in the presence of a power line with negligible disturbance. The third is that the site has very low agricultural potential, limited by severe climatic moisture availability constraints and shallow, rocky soils.

Furthermore, the low slope gradients reduce the significance of potential erosion impacts. Irreplaceability of impacts is considered low because of the very low significance impact and because the resource that is being impacted on is non-arable, low potential grazing land which is not a scarce resource in the country. The confidence level of the assessment is considered high because there is certainty about the low agricultural potential of the land and the impacts are fairly easy to understand and predict.

Although there are a large number of other potential projects in the area that will also lead to some loss of agricultural land, the impact of this development is so small that its contribution to the cumulative impact is also very low.

Because agricultural potential and conditions are uniform across the proposed transmission line corridor, impact assessment is identical for all transmission line sites.

Mitigation measures are also included in Tables 4 and 5. Recommendations for the monitoring and review of all identified mitigation measures are described in Section 8 of this report, as well as the EMPr (Appendix G of the BA Report).

6.1 DEGRADATION OF VELD VEGETATION BEYOND THE DIRECT FOOTPRINT OF THE PROPOSED TRANSMISSION LINE DUE TO CONSTRUCTION AND DECOMMISSIONING DISTURBANCE AND POTENTIAL TRAMPLING BY VEHICLES

The potential impact of degradation of veld vegetation beyond the direct footprint of the proposed Transmission Line is rated as a negative, direct impact that is predicted to occur as a result of disturbance during activities undertaken during the construction and decommissioning phases. The impact is rated with a site specific spatial extent and medium-term duration (i.e. the impact and risk will be experienced between 1 and 10 years). The consequence and probability of the impact are respectively rated as slight and likely. The reversibility and irreplaceability of the impact are respectively rated as moderate and low. The significance of the impact without the implementation of mitigation measures is rated as very low.

The following mitigation measures have been recommended during the construction and decommissioning phases in order to reduce the significance of veld degradation:

- Minimize the footprint of disturbance during construction and decommissioning activities.
- Confine vehicle access to roads only. Control dust generation during construction and decommissioning activities by implementing standard construction site dust control measures (dampening with water) where required. Because of water scarcity, this should only be done where and when dust generation is a significant problem.

With effective implementation of these mitigation actions, the impact of the project on veld degradation is predicted to be of very low significance.

6.2 LOSS OF TOPSOIL DUE TO POOR TOPSOIL MANAGEMENT

The potential impact of loss of topsoil due to poor topsoil management (burial, erosion, etc.) during construction and decommissioning related soil profile disturbance (such as levelling, excavations, etc.) and the resultant decrease in the capability of the soil to support vegetation is rated as a negative, direct impact. The impact is rated with a site specific spatial extent and medium-term duration (i.e. the impact and risk will be experienced between 1 and 10 years). The consequence and probability of the impact are respectively rated as slight and likely. The reversibility and irreplaceability of the impact are respectively rated as moderate and low. The significance of the impact without the implementation of mitigation measures is rated as very low.

The following mitigation measures have been recommended during the construction and decommissioning phases in order to reduce the loss of topsoil:

- Strip and stockpile topsoil from all areas where soil will be disturbed. There are no particular requirements for stockpile management and it can therefore be done in the way that is most practical for the operation.
- After cessation of disturbance, re-spread topsoil over the surface.
- Dispose of any sub-surface spoil material, generated from excavations, where they will not impact on land that supports vegetation, or where they can be effectively covered with topsoil.

With effective implementation of these mitigation actions, the impact of the project on topsoil is predicted to be of very low significance.

6.3 LOSS OF AGRICULTURAL LAND USE

The potential impact of loss of agricultural land use due to the direct footprint of the proposed project for the construction, operational and decommissioning phases is predicted to be a negative, direct impact. The impact is rated with a site specific spatial extent and long-term duration (i.e. the impact and risk will be experienced for the duration of the proposed project). The consequence and probability of the impact are respectively rated as slight and very likely. The reversibility and irreplaceability of the impact are respectively rated as high and low. The significance of the impact without the implementation of mitigation measures is rated as very low. No mitigation measures are recommended.

6.4 SOIL EROSION DUE TO ALTERATION OF THE LAND SURFACE CHARACTERISTICS

The potential impact of soil erosion by wind or water due to alteration of the land surface characteristics is predicted to be a negative, direct impact. As noted above, alteration of surface characteristics may be caused by construction related land surface disturbance, vegetation removal, and the establishment of excavations and surfaces for the proposed pylon bases. The impact is rated with a site specific spatial extent and long-term duration (i.e. the impact and risk will be experienced for the duration of the proposed project). The consequence and probability of the impact are respectively rated as slight and likely. The reversibility and irreplaceability of the impact are both rated as low. The significance of the impact without the implementation of mitigation measures is rated as very low.

The following mitigation measures have been recommended during the construction, operational and decommissioning phases in order to reduce soil erosion:

- Implement an effective system of run-off control, where it is required, that collects and safely disseminates run-off water from all hardened surfaces and prevents potential down slope erosion.

With effective implementation of these mitigation actions, the impact of increased soil erosion is predicted to be of very low significance.

6.5 CUMULATIVE IMPACT: REGIONAL LOSS OF AGRICULTURAL LAND RESOURCES

As mentioned above, the implementation of various other developments (refer to Section D of the BA Report) in conjunction with the proposed Scatec Solar PV facilities and transmission lines are expected to result in a cumulative impact in terms of the loss of agricultural land resources on a regional scale. The impact is rated with a regional spatial extent and long-term duration (i.e. the impact and risk will be experienced for the duration of the proposed project). The consequence and probability of the impact are respectively rated as slight and very likely. The reversibility and irreplaceability of the impact are respectively rated as moderate and low. The significance of the impact without the implementation of mitigation measures is rated as very low. No mitigation measures are recommended.

7 IMPACT ASSESSMENT SUMMARY

The potential impacts of the proposed project on soils and agricultural potential is summarised in Tables 4 and 5.

Table 4. Impact assessment summary table.

Aspect/Impact pathway	Nature of impact	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility	Irreplaceability	Mitigation/ Management Actions	Significance		Ranking of residual impact	Confidence level
										Without Mitigation	*With Mitigation*		
Construction and Decommissioning Phases (Direct Impacts).													
Vehicle traffic and dust generation	Veld degradation	Negative	Site	Medium term	Slight	Likely	Moderate (i.e. Partially)	Low	1. Minimize footprint of disturbance. 2. Confine vehicle access on roads only. 3. Control dust generation during construction and decommissioning activities by adopting standard construct site dust control methods (such as dampening surfaces with water), where required. Because of water scarcity, this should only be done where and when dust generation is a significant problem.	Very Low	Very Low	5	High
Constructional and decommissioning activities that disturb the soil profile.	Loss of topsoil	Negative	Site	Medium term	Slight	Likely	Moderate (i.e. Partially)	Low	1. Strip and stockpile topsoil from all areas where soil will be disturbed. 2. After cessation of disturbance, re-spread topsoil over the surface.	Very Low	Very Low	5	High

Aspect/Impact pathway	Nature of impact	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility	Irreplaceability	Mitigation/ Management Actions	Significance		Ranking of residual impact	Confidence level
										Without Mitigation	*With Mitigation*		
									3. Dispose of any sub-surface spoils from excavations where they will not impact on land that supports vegetation, or where they can be effectively covered with topsoil.				
Construction, Operational and Decommissioning Phases (Direct Impacts).													
Occupation of the land by the project infrastructure	Loss of agricultural land use	Negative	Site	Long term	Slight	Very Likely	High	Low	None	Very Low	Not Applicable	5	High
Change in surface characteristics and surface cover.	Erosion	Negative	Site	Long term	Slight	Likely	Low	Low	Implement an effective system of run-off control, where it is required, that collects and safely disseminates run-off water from all hardened surfaces and prevents potential down slope erosion.	Very Low	Very Low	5	High

Table 5. Cumulative impact assessment summary table.

Aspect/Impact pathway	Nature of impact	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility	Irreplaceability	Mitigation/ Management Actions	Significance		Ranking of residual impact	Confidence level
										Without Mitigation	*With Mitigation*		
Occupation of the land by the infrastructure of multiple projects	Regional loss of agricultural land	Negative	Regional	Long term	Slight	Very Likely	Moderate	Low	None	Very Low	Not Applicable	5	High

8 INPUT TO THE ENVIRONMENTAL MANAGEMENT PROGRAMME

The following main mitigation measures and monitoring requirements are proposed for inclusion in the EMPr:

- Minimize the footprint of disturbance during construction and decommissioning activities.
- Confine vehicle access to roads only.
- Control dust generation during construction and decommissioning activities by adopting standard construct site dust control methods (such as dampening surfaces with water), where required. Because of water scarcity, this should only be done where and when dust generation is a significant problem..
- Strip and stockpile topsoil from all areas where soil will be disturbed.
- After cessation of disturbance, re-spread topsoil over the surface.
- Dispose of any sub-surface spoil material, generated from excavations, where they will not impact on land that supports vegetation, or where they can be effectively covered with topsoil.
- Implement an effective system of run-off control, where it is required, that collects and safely disseminates run-off water from all hardened surfaces and prevents potential down slope erosion.

The following main monitoring requirements are proposed for inclusion in the EMPr:

- Undertake a periodic site inspection to verify the occurrence of off-road vehicle tracks surrounding the site.
- Establish an effective record keeping system for each area where soil is disturbed for constructional and decommissioning purposes. Recommendations for the recording system are included in the EMPr (Appendix G of the BA Report).
- Undertake a periodic site inspection to verify and inspect the effectiveness and integrity of the run-off control system and to specifically record the occurrence of any erosion on site or downstream. Corrective action must be implemented to the run-off control system in the event of any erosion occurring.

9 CONCLUSION AND RECOMMENDATIONS

The proposed development is on land zoned and used for agriculture. South Africa has very limited arable land and it is therefore critical to ensure that development does not lead to an inappropriate loss of land that may be valuable for cultivation. This assessment has found that the proposed site is on land which is of very low agricultural potential and is not suitable for cultivation.

Because of the low agricultural potential of the site, the development should, from an agricultural impact perspective, be authorised.

Authorisation is promoted by the fact that the site falls within a proposed renewable energy development zone, where such land use has been assessed as very suitable in terms of a number of factors, including agricultural impact. It is preferable to incur a loss of agricultural land in such a region, without cultivation potential, than to lose agricultural land that has a higher potential, to renewable energy development elsewhere in the country.

No agriculturally sensitive areas occur within the site and no part of it is therefore required to be set aside from the development. Because the site is uniformly low potential, from an agricultural point of view, there is no preferred location or layout within the assessed site. There are no conditions resulting from this assessment for inclusion in the environmental authorisation. The following management and mitigation measures should be included in the EMPr:

- Minimize the footprint of disturbance during construction and decommissioning activities.
- Confine vehicle access to roads only.
- Control dust generation during construction and decommissioning activities by implementing suitable, standard construction site dust control measures (i.e. dampening with water) where required. Because of water scarcity, this should only be done where and when dust generation is a significant problem.
- Strip and stockpile topsoil from all areas where soil will be disturbed.
- After cessation of disturbance, re-spread topsoil over the surface.
- Dispose of any sub-surface spoil material, generated from excavations, where they will not impact on land that supports vegetation, or where they can be effectively covered with topsoil.
- Implement an effective system of run-off control, where it is required, that collects and safely disseminates run-off water from all hardened surfaces and prevents potential down slope erosion.

10 REFERENCES

Agricultural Research Council. Undated. AGIS Agricultural Geo-Referenced Information System available at http://www.agis.agric.za/.

Fey, M. 2010. Soils of South Africa. Cambridge University Press, Cape Town.

Water Research Commission. Undated. South African Rain Atlas available at http://134.76.173.220/rainfall/index.html.

APPENDIX 1: SOIL DATA

Table A1. Land type soil data for site.

Land type	Land capability class	Soil series (forms)	Depth (cm)	Clay % A horizon	Clay % B horizon	Depth limiting laye	% of land type
Ag6	7	Hutton	10-35	6-12	7-15	ca, so, db	43
		Mispah	5-15	5-12		R	14
		Hutton	45->120	6-12	7-15	ca, so, R	10
		Hutton	10-35	10-20	15-25	ca, so, db	9
		Rock outcrop	0			R	8

Land capability classes: 7 = non-arable, low potential grazing land.
Depth limiting layers: R = hard rock; so = partially weathered bedrock; ca = hardpan carbonate; db = dorbank hardpan.

BASIC ASSESSMENT REPORT

Appendix D.7:
Social Impact Assessment

SOCIAL IMPACT ASSESSMENT:

Basic Assessment for the proposed transmission lines connecting the Kenhardt Solar Photovoltaic Facilities PV 1, PV 2 and PV 3 on Onder Rugzeer Farm 168 to the Nieuwehoop Substation on Gemsbok Bult 120, north-east of Kenhardt, Northern Cape Province

Report prepared for:

CSIR – Environmental Management Services

P O Box 17001

Congella, Durban, 4013

South Africa

Report prepared by:

Rudolph du Toit

P.O. Box 320

11 Jan Cilliers Road, Stellenbosch, 7600

South Africa

March 2016

SPECIALIST EXPERTISE

Curriculum Vitae – Rudolph du Toit

Personal information

Name:	Rudolph du Toit
Firm:	Council for Scientific and Industrial Research (CSIR)
Position in Firm:	Senior Environmental Planner
Profession:	Environmental Planning, Assessment & Management
Date of Birth:	23 May 1978
Languages:	English and Afrikaans
Marital status:	Married
Email:	rdutoit@csir.co.za
Telephone number:	021 888 2538 / 076 902 6479

Tertiary Education

Undergraduate
Bachelor of Arts (BA) Environmental and Development Studies
Department of Geography and Environmental Studies
University of Stellenbosch (US), 2003-2005

Bachelor of Law (LLB) (in progress)
College of Law
University of South Africa (UNISA), 2015

Honours
Bachelor of Philosophy (B.Phil.) Sustainable Development Planning and Management
School for Public Leadership
University of Stellenbosch (US), 2006

Masters
Master of Philosophy (M.Phil.) Development Planning
School of Public Leadership
University of Stellenbosch (US), 2007-2009

Employment Experience

1. Organisation: Independent contractor for the CapeNature Working for Water Project
   Position: Team leader: Natural resource management (Alien clearing)
   Period: 1998 to 2001

2. Organisation: Magnetic South
   Position: Outdoor pursuit management
   Period: 2003 to 2007 (part-time during studies)

3. Organisation: Strategic Environmental Focus (SEF) (Pty) Ltd.
   Position: Sustainability coordinator: Environmental planning & reporting
   Period: 2008 to 2010

4. Organisation: Council for Scientific and Industrial Research (CSIR)
   Position: Environmental Planner
   Period: 2010 to present

5. Organisation: University of Stellenbosch
   Position: Guest lecturer: Development Planning and Environmental Analysis module (part-time)
   Period: 2013 to present

6. Organisation: University of Stellenbosch
   Position: External moderator: Development Planning (School for Public Leadership) (part-time)
   Period: 2015

Professional Affiliations

Registered member of the South African Institute for Impact Assessment (Registration Number 2779)

Research Publications

- Du Toit, R. (2009). ***Developing a Scorecard for Sustainable Transport: A Cape Town Application.*** Stellenbosch University Press

- Michelle Audouin, Mike Burns, Alex Weaver, David le Maitre, Patrick O'Farrell, Rudolph du Toit, Jeanne Nel. (2015). ***An Introduction to Sustainability Science and its Links to Sustainability Assessment.*** *In Morrison-Saunders, A. and Pope, J., Eds. Handbook of Sustainability Assessment.* Edward Elgar Publishing, 321 -349. ISBN 978-1-78347-136-2

Conference Presentations & Papers

- Du Toit, R. (2012). **Wind *Energy and Public Participation: A one-sided debate?*** Proceedings of the 17th Annual Conference of the International Association for Impact Assessment South Africa: "Urban Evolution", 27 - 29 August, 2012.
- Du Toit, R. & Van der Westhuizen, C. (2013). ***Strategic Environmental Assessment (SEA) as a means of building the Green Economy in South Africa: The development of a national wind and solar energy roll-out plan.*** Proceedings of the OECD DAC SEA Task Team Workshop on SEA & Green Economy, Lusaka (Zambia), 17- 18 January 2013.
- Contributing author to: Dalal-Clayton, B. (2013) ***The Role of Strategic Environmental Assessment in Promoting a Green Economy: Background document for the OECD DAC SEA task Team workshop on SEA & Green Economy, Lusaka, 17- 18 January 2013***. IIED, London
- Burns, M., Du Toit, R. & Schreiner, G. (2013). ***Graphical Causal Loop modelling of socio-ecological systems to identify & evaluate key impact "strings".*** Proceedings of the 18th Annual Conference of the International Association for Impact Assessment South Africa: 16 - 18 September, 2013.

Key courses

- Advanced Facilitation & Experiential Learning: Team Building Institute (Pty) Ltd (2001)
- Clean Development Mechanism (CDM) Project Development Training: Danish Energy Management (Pty) Ltd (2008)
- Project Management Principles & Practice: University of Pretoria (2011)
- Integrating Sustainability with Environmental Assessment in South Africa (Presented by A. Morrison –Saunders & J. Pope): North-West University (2012)
- Sharpening the Tool: New techniques and methods in Environmental Impact Assessment: Sustainable Environmental Solutions (Pty) Ltd (2015)
- Effective Skills for Challenging Meetings & Engagements: Conflict Dynamics (2015)

Projects and Environmental Assessment Reports

The following table presents an abridged list of projects that I have been involved in, indicating my role in each project:

Environmental Impact Assessment (EIA) Experience		
Project	**Role**	**Date**
1. Basic Assessment: Bottelary Road Upgrade: Van der Merwe Venter Twenty Group and Silmore Trust	Environmental Control Officer	July 2009
2. MTN Remote Hub: Umbutho Civil & Electrical	Environmental Control Officer	July 2009
3. Basic Assessment: Hermanus (Overberg Municipality) substation upgrade & underground cable	Junior Environmental Manager and co-author	August 2009
4. Basic Assessment for the InnoWind Swellendam wind energy project: Single test turbine construction	Project Manager and Lead Author	January 2010
5. Basic Assessment for the InnoWind Heidelberg wind energy project: Single test turbine construction	Project Manager and Lead Author	January 2010
6. Basic Assessment for the InnoWind Albertinia wind energy project: Single test turbine construction	Project Manager and Lead Author	January 2010
7. Basic Assessment for the InnoWind Mossel Bay wind energy project: Single test turbine construction	Project Manager and Lead Author	January 2010
8. EIA for InnoWind Swellendam wind energy project, Western Cape	Project Manager and Lead Author	July 2010

Environmental Impact Assessment (EIA) Experience		
Project	**Role**	**Date**
9. EIA for InnoWind Heidelberg wind energy project, Western Cape	Project Manager and Lead Author	July 2010
10. EIA for InnoWind Albertinia wind energy project, Western Cape	Project Manager and Lead Author	July 2010
11. EIA for InnoWind Mossel Bay wind energy project, Western Cape	Project Manager and Lead Author	July 2010
12. EIA for the Electrawinds (NL) Coega IDZ Wind Energy Project: Proposed construction of 75 MW installed capacity	Project Manager	January 2010
13. EIA for Glencore Exploration (UK): On-shore and off-shore exploration drilling operation; Matanda Block, Cameroon	Project Manager	November 2010
14. EIA for Noble Energy (Cameroon): Off-shore exploration drilling, Yoyo Concession and Tilapia Exploration Block, Cameroon	Management, integration and drafting of water quality section of the EIA report.	April 2011
15. EIA for the Vleesbaai Independent Power Producer (VIPP) Wind Energy Facility near Vleesbaai	Project Manager and Lead Author	August 2012 (on-going)
16. Windlab Developments South Africa (Pty) Ltd Ishwati Emoyeni 140 MW Wind Energy EIA near Murrysburg in the Western Cape	Project Manager	September 2014 (on-going)
17. EIA for the City of Cape Town 1500 MW Gas-to-power facility, Atlantis, Western Cape	Project Leader	July 2015 (on-going)

Strategic Environmental Assessment (SEA) Experience		
Project	**Role**	**Date**
18. Strategic Environmental Assessment (SEA) for the Port of Saldanha: Transnet National Ports Authority (TNPA)	Project Manager and Lead Author	July 2012
19. City of Cape Town Far South Strategic Environmental Assessment (SEA)	Project Manager and Lead Author	June 2014

Specialist Study Experience		
Project	**Role**	**Date**
20. Mulilo Renewable Project Developments (Pty) Ltd Gemsbok Solar	Conducting the Social Impact Assessment (SIA) as part of the	September 2014

Specialist Study Experience		
Project	**Role**	**Date**
PV1 75MW Solar Photovoltaic EIA in the Northern Cape	suite of EIA specialist studies	
21. Mulilo Renewable Project Developments (Pty) Ltd Gemsbok Solar PV2 75MW Solar Photovoltaic EIA in the Northern Cape	Conducting the Social Impact Assessment (SIA) as part of the suite of EIA specialist studies	September 2014
22. Mulilo Renewable Project Developments (Pty) Ltd Boven Solar PV1 75MW Solar Photovoltaic EIA in the Northern Cape	Conducting the Social Impact Assessment (SIA) as part of the suite of EIA specialist studies	September 2014
23. Scatec Solar 330 (Pty) Ltd Kenhardt PV 1 75MW Solar Photovoltaic EIA in the Northern Cape	Conducting the Social Impact Assessment (SIA) as part of the suite of EIA specialist studies	August 2015
24. Scatec Solar 350 (Pty) Ltd Kenhardt PV 2 75MW Solar Photovoltaic EIA in the Northern Cape	Conducting the Social Impact Assessment (SIA) as part of the suite of EIA specialist studies	August 2015
25. Scatec Solar 370 (Pty) Ltd Kenhardt PV 3 75MW Solar Photovoltaic EIA in the Northern Cape	Conducting the Social Impact Assessment (SIA) as part of the suite of EIA specialist studies	August 2015
26. Scatec Solar 163 (Pty) Ltd Kenhardt PV 1 – Transmission Line Basic Assessment to service the proposed Kenhardt PV 1 75MW Solar Facility in the Northern Cape	Conducting the Social Impact Assessment (SIA) as part of the suite of BA specialist studies	August 2015
27. Scatec Solar 163 (Pty) Ltd Kenhardt PV 1 – Transmission Line Basic Assessment to service the proposed Kenhardt PV 1 75MW Solar Facility in the Northern Cape	Conducting the Social Impact Assessment (SIA) as part of the suite of BA specialist studies	August 2015
28. Scatec Solar 163 (Pty) Ltd Kenhardt PV 1 – Transmission Line Basic Assessment to service the proposed Kenhardt PV 1 75MW Solar Facility in the Northern Cape	Conducting the Social Impact Assessment (SIA) as part of the suite of BA specialist studies	August 2015

Environmental Management & Sustainability Planning Experience		
Project	**Role**	**Date**
29. Working for Water (CapeNature) alien clearing project: Uniondale Poort	Team Leader: natural resource management	January 1998
30. Working for Water (CapeNature) alien clearing project: Avontuur area	Team Leader: natural resource management	March 1999
31. Working for Water (CapeNature) alien clearing project: Prince Alfred Pass area	Team Leader: natural resource management	January 2000
32. Working for Water (CapeNature) alien clearing project: Langkloof farms	Team Leader: natural resource	February 2001

Environmental Management & Sustainability Planning Experience		
Project	**Role**	**Date**
	management	
33. Qualitative Environmental Impact Analysis related to Major Incedent: PetroSA Mossel Bay GTL refinery	Project Manager and Lead Author	October 2010
34. Maseve Platinum Sustainability Assessment, Rustenburg	Project Manager	August 2011
35. Notice of Impacts Associated with Exploration Drilling in BHP Billiton Gabon's Licensed Areas of Okondja, Akieni & Lastoursville (Gabon)	Project Manager	June 2011
36. PetroSA LNG Importation Pipeline Screening Study (Saldanha Bay to Mosselbay)	Responsible investigating and assessing planning impacts	March 2014
37. Department of Environmental Affairs (DEA) National Sustainable Development Strategy and Action Plan (NSSD) 1: Monitoring & Evaluation Report	Project manager and lead author	November 2013 (on-going)
38. Apollo Brick (Pty) Ltd energy efficiency and fuel switching CDM project	Investigation of possible conversation of the energy efficiency project to an accredited CDM project	January 2008
39. Mxit Lifestyle (Pty) Ltd carbon footprint audit	Carbon audit of Mxit Lifestyle (Pty) Ltd	January 2009
40. EIA for Addax Petroleum: Off-shore exploration/appraisal drilling; Ngosso Permit, Cameroon	Research team: collection of benthic macrofauna samples and bio-indicators for water quality analysis	August 2010
41. EIA for Glencore Exploration (UK): Off-shore exploration drilling, Bolongo Block, Cameroon	Research team: collection of benthic macrofauna samples and bio-indicators for water quality analysis	February 2011
42. Integrated State of the Environment Report For Namibia (Phase 1)	Project Leader	June 2015 (on-going)
43. Guest lecturer: Stellenbosch University's Sustainability Institute (School of Public Leadership)	Guest lecturer: Theory & Practice of Sustainability Assessment	July 2013 (on-going)

SPECIALIST DECLARATION

I, **Rudolph du Toit**, as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

- I act as the independent specialist in this application;
- I perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I have no vested interest in the proposed activity proceeding;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

Name of Specialist: **Rudolph du Toit**

Date: **28 January 2016**

EXECUTIVE SUMMARY

Project Context

Scatec Solar SA 163 (PTY) Ltd (hereinafter referred to as Scatec Solar) is proposing to develop three 75 Megawatt (MW) Solar Photovoltaic (PV) power generation facilities and associated electrical infrastructure (including transmission lines for each 75 MW facility) on the remaining extent of Onder Rugzeer Farm 168 and the connection points to the Eskom Nieuwehoop Substation on the remaining extent of Portion 3 of Gemsbok Bult Farm 120, approximately 80 km south of Upington and 30 km north-east of Kenhardt within the !Kheis Local Municipality, Northern Cape Province.

The three proposed 75 MW Solar PV facility projects, which require a full Scoping and Environmental Impact Assessment (EIA), are referred to as (together with the corresponding assigned DEA EIA Reference Numbers):

- Kenhardt PV 1 – DEA EIA Reference: 14/12/16/3/3/2/837;
- Kenhardt PV 2 – DEA EIA Reference: 14/12/16/3/3/2/838; and
- Kenhardt PV 3 – DEA EIA Reference: 14/12/16/3/3/2/836.

The proposed transmission lines which will connect each 75 MW Solar PV facility to the Eskom Nieuwehoop Substation require a separate Basic Assessment (BA) Process. These projects are referred to as:

- Kenhardt PV 1 – Transmission Line: DEA EIA Reference: to be obtained;
- Kenhardt PV 2 – Transmission Line: DEA EIA Reference: to be obtained; and
- Kenhardt PV 3 – Transmission Line: DEA EIA Reference: to be obtained.

This Social Impact Assessment (SIA), compiled by Rudolph du Toit of the Council for Scientific and Industrial Research (CSIR) and externally reviewed by Ms. Liza van der Merwe (a private consultant), contributes to the abovementioned separate, requisite EIA and BA Processes. A single SIA has been compiled based on the following reasons:

Employment opportunities created during the construction phase of each project (i.e. each 75 MW PV project) are estimated to number approximately 1 260 - 2 100 man months (for skilled opportunities) and approximately 5 600 - 6 400 man months (for unskilled opportunities). Employment opportunities created during the construction phase of each transmission line project are estimated to range between 1 560 and 1 820 man months. Employment opportunities to be created during the operational phase of each project (i.e. each 75 MW PV project) are estimated to number approximately 4 800 man months (for skilled opportunities) and approximately 9 600 man months (for unskilled opportunities) over the 20 year plant lifespan. Scatec Solar further proposes an Economic Development Plan which will be developed to achieve the following:

- Create a local community trust which has an equity share in the project life to benefit historically disadvantaged communities;

- Initiate a training strategy to facilitate employment from the local community; and
- Where possible, give preference to local suppliers of components for the construction of the proposed Solar PV facilities and transmission lines.

The study area is located within the ZF Mgcawu District Municipality (formerly known as the Siyanda District Municipality). The actual project footprint (Remaining Extent of Onder Rugzeer Farm 168 and the remaining extent of Portion 3 of Gemsbok Bult Farm 120 (for the connection points to the Eskom Nieuwehoop Substation)) is located in the !Kheis Local Municipality. However, the closest urban centre, Kenhardt, is located in the Kai !Garib Local Municipality. Given the proximity of the proposed projects to the town of Kenhardt (i.e. approximately 20 to 30 km north-east of Kenhardt); the focus of this SIA will be on the Kai !Garib Local Municipality.

Affected Socio-Economic Environment

The total population of the Kai !Garib municipal area is 65 869; of which 6 679 reside in the Kenhardt area. A total of 16 703 households are located in the Kai !Garib Local Municipality, with 35% of households being female headed. The total female population dominates the total male population by 8.5% (Kai !Garib Draft Integrated Development Plan (IDP), 2014). The working age demographic (15 to 65 years) makes-up 70.5% of the population, whereas those below 15 years of age comprise 24.4% of the population. The +65 years age group makes-up 5.1% of the population. Accordingly, the dependency ratio (the economically active population versus the non-economically active population) is 41.9% (Stats SA, 2011).

The official unemployment rate of 10% has decreased by 6.1% since the 2011 Census measurement of 16.1%. The economic sector is dominated by agriculture which provides 51.8% of jobs, followed by the Community and Government Services sector with 15.9%.

Informants[1] in Kenhardt indicated that levels of unemployment in the town are particularly high (i.e. higher than reflected in the relevant census data). All informants indicated that the vast majority of the economically active population is dependent on some form of government subsidy[2] (reported to be approximately R 1300 per person per month). Subsequently, the local labour market appears to offer very limited absorption of the economically active population component (i.e. approximately 4675 employment opportunities, based on a 70.5% working age demographic for the Kai !Garib municipal area) of the 6679 inhabitants of the Kenhardt area.

Public infrastructure (public telephones, the public swimming pool and benches) was vandalised to an extent that will probably render future utilisation impossible without municipal upgrades. Acts of social disorder, such as loitering and vandalism, are regularly associated with poverty and elevated levels of distress within communities (Richardson &

[1] Sociological research ethics dictates that the identity of informants (i.e. those being interviewed) should be protected if *any* possibility of physical, mental, emotional or legal harm exists. Accordingly, the identities of informants are not disclosed in this study.
[2] 'Subsidy' is used here to represent a variety of government subsidies.

Shackleton, 2014). According to Fisher and Baron's (1982) Equity-Control Theory (ECT), acts of vandalism are often triggered by a perceived violation of norms related to fairness in terms of social and environmental arrangements. According to the ECT, acts of vandalism can be understood as an attempt to reduce inequality.

Informants further indicated that teenage pregnancies and drug abuse were major social issues in Kenhardt, and that the prevalence of these issues is increasing. This claim is validated by secondary data contained in the Kai !Garib Draft IDP (2014), which lists teenage pregnancy and drug abuse as major social challenges within the larger municipal area. Both these issues elevate the local dependency ratio, thereby placing already stressed livelihood strategies under even more strain.

It is suggested that teenage pregnancy is positively related to elevated levels of poverty, associated idleness and inappropriate forms of recreation (Were, 2007). Poverty and limited recreation opportunities appear to be clear contributing factors to the high teenage pregnancy rate. However, poor sex education, limited understanding of and access to modern contraception and lack of parental guidance are likely exacerbating factors.

Informants complained that informal shop owners and traders are generally foreign nationals and are not seen as members of the community. This outsider versus insider experience, coupled with a dependency of the local community on the services offered by outsiders, appears to generate feelings of distrust and vulnerability. This existing outsider versus insider phenomenon suggests that the local community could be sensitive to the influx of job seekers and other forms of in-migration into Kenhardt.

Informants further reported frustration regarding job creation expectations created by other developments in the area. Consequently, the Kenhardt community is likely to be particularly sensitive to similar expectation which could be created by the proposed developments.

Methods

Applied Anthropological Methods

Collection of primary data during the site visit was guided by a Participant Observation Methodology (Anderson & Taylor, 2002). Participant observation is an applied anthropological approach, whereby the researcher 'becomes' a resident in the community for a given period of time to observe the normal daily lives of community members and to conduct informal interviews with informants. The intention of interviews is to uncover the major livelihood strategies present in the study area, to understand the key socio-economic challenges, and gain insights into the 'constructed reality' of the Kenhardt community. Observation of community members' lives, routines and living environments help to gain insight into practices, patterns and processes which community members may not be consciously aware of.

Systems Theory

Conventional SIA reports generally describe the affected environment in terms of social and economic conditions, with only very cursory references to the biophysical environment. Due to the inherent complexity of human-nature interaction, and the profound impacts resulting from this interaction, a more holistic approach was adopted towards understanding and representing the affected environment. Accordingly, the receiving environment and subsequent impacts thereon were viewed and interpreted as a coupled socio-ecological system (SES). This approach is a radical departure from viewing the receiving environment as a loose collection of independent economic, social and environmental variables.

Vulnerability Context

Finally, an Asset Pentagon has been used to interpret the collected information. An Asset Pentagon is an assessment method developed within the discipline of Livelihoods Assessment, and aims to establish the vulnerability context of a given social grouping. People's access to productive assets (Human-, Social-, Natural-, Physical- and Financial capital) lies at the heart of their vulnerability context. Generally, the greater access people have to assets, the more livelihood strategies are available and the easier it is for them to switch from one strategy to the next. Conversely, limited access to assets results in reduced livelihood strategies and impaired ability to assume alternative strategies should the need arise.

Assessment of Impacts and Identification of Management Actions

Potential Impact 1: Influx of Jobseekers

Construction of the proposed projects (i.e. three Solar PV facilities and three transmission lines) is likely to attract job seekers to the town of Kenhardt. Such an influx generally causes a disturbance in the existing social order as prevailing leadership, kinship and social control mechanisms are challenged by new and alternative values, beliefs and practices. The impact is expected to be ***long to medium term*** in duration and ***local in extent***. Influx of job seekers into the study area is therefore rated as having a ***moderate significance (negative)*** rating before mitigation. Should the mitigation measures discussed below be implemented, this significance rating should reduce to ***low***.

Mitigation

The proponent must develop a Workforce Recruitment Policy. The proponent should also clearly define who is considered to be local (Kenhardt) residents; known as the Project Affected People (PAP). It is also suggested that the proponent assembles a database of local residents and their relevant skills and experience well in advance of the construction phase of the proposed projects. Finally, the proponent should develop a Stakeholder Engagement Plan which sets-out the communication strategy to be followed with regards to the proposed solar development and transmission lines.

Potential Impact 2: Increases in Social Deviance

In-migration into the study area, particularly Kenhardt, is likely to increase the incidence of teenage pregnancies, drug abuse, prostitution and other socially deviant behaviour. This impact is expected to be ***medium term*** in duration and ***local*** in extent. Increases in social deviance within the study area are therefore rated as having a ***moderate significance (negative)*** rating before mitigation which will drop to ***low significance*** with mitigation. Increases in social deviance are extremely difficult to control and often lie outside the exclusive control of the proponent as it is driven by complex socio-ecological conditions related to poverty and feelings of hopelessness.

Mitigation

The mitigation measures proposed for Potential Impact 1 must also be used to mitigate impacts resulting from increases in social deviance, as Potential Impact 1 is a precursor to Potential Impact 2. Furthermore, the proponent must be contractually bound to deliver on its Economic Development Plan for the area once the proposed project is successfully selected as a preferred bidder.

Potential Impact 3: Expectations regarding jobs

Informants in the Kenhardt area indicated a significant level of frustration with other proposed developments in the area due to expectations of possible employment. Unrealised expectations in a poor community could lead to feelings of desperation, disempowerment, anger and a general distrust in developers. In isolated cases, such frustration of expectations might lead to malicious damage of project property and intimidation of employees. The impact is expected to be ***short term*** in duration and ***local in extent***. Expectations regarding jobs are therefore rated as having a ***low significance (negative)*** rating before mitigation. Should the mitigation measures discussed below be implemented, this significance rating will be reduced to ***very low***.

Mitigation

Proper implementation of the Stakeholder Engagement Plan proposed for Potential Impact 1 should lead to realistic expectations of employment for most of the local community.

Potential Impact 4: Local Spending

Procurement of goods and services in the Kenhardt area during the construction and operational phase of the proposed project is likely to hold socio-economic benefits as a result of the multiplier effect (i.e. the increase in final income resulting from a new injection of spending). A secondary positive impact might result from entrepreneurial development in the project area especially in the service industry. The impact is expected to be ***medium to long term*** in duration and ***local in extent***. Local spending in the study area is therefore rated as having a ***low significance (positive)*** rating.

Enhancement

The proponent must procure goods and services, as far as practically possible, from within the project area (with a focus on Kenhardt). It is also suggested that regularly required goods and services (e.g. food and accommodation) be obtained from as large a selection of local service providers as possible to ensure distribution of project benefits.

Potential Impact 5: Local employment

The creation of short term employment for low skilled community members in the study area, though not ideal, does provide much needed temporary financial relief, while also contributing to a sense of empowerment and dignity. The limited number of long term employment offered by the proponent provides long term (small scale) socio-economic benefit to the affected community and may also contribute to the multiplier effect, as more income generally results in greater spending. The impact is expected to be ***long term*** in duration and ***local in extent***. Local employment is therefore rated as having a ***moderate significance (positive)*** rating.

Enhancement

As recommended for Potential Impact 1, the proponent must develop a Workforce Recruitment Policy. This policy must reserve employment, where practically possible, for local residents (particularly for vulnerable groups such as women and previously disadvantaged individuals). This requirement should be contractually binding on the proponent.

Potential Impact 6: Human Development via the proposed Economic Development Plan

Scatec Solar indicated that an Economic Development Plan is suggested for the study area, should the proposed project be successful. The positive impacts of this plan are self-evident and will relate to the creation of employment, local spending and human capacity development. The impact is expected to be ***long term*** in duration and ***local in extent***. Human development is therefore rated as having a ***moderate significance (positive)*** rating.

Enhancement

It is proposed that the proponent must engage with local Non-governmental Organisations (NGOs), Community Based Organisations (CBOs) and local government structures to identify and agree upon relevant skills and competencies required in the Kenhardt community. The proponent should also consider aligning economic development and skills development initiatives with the Kai !Garib Local Municipality's IDP objectives.

Potential Impact 7: Job losses

It is expected that the proposed projects could possibly be decommissioned after an operational lifespan of approximately 20 years. Decommissioning of the proposed developments will result in job losses. Secondary impacts might result from incorrect decommissioning of project infrastructure which might be used for inappropriate purposes. This in turn could result in health and safety impacts on the local community. This impact is expected to be ***long term*** in duration and ***local in extent***. Job losses resulting from decommissioning within the study area are therefore rated as having a ***moderate significance (negative)*** rating before mitigation and a ***low significance (negative)*** with mitigation. This impact is however considered to be acceptable in light of the local need for employment and development.

Mitigation
The proponent must comply with relevant South African labour legislation when retrenching employees. Scatec Solar should also consider appropriate succession training of locally employed staff earmarked for retrenchment during decommissioning. Such training could gradually equip workers to enter gainful employment in other locally viable sectors. Finally, all project infrastructures should be decommissioned appropriately and thoroughly to avoid misuse and disposed of or re-used according to relevant standards.

Overall significance rating

The overall significance rating of the *negative* socio-economic impacts associated with the proposed projects is ***low*** to ***moderate***; whereas the overall significance rating of the *positive* socio-economic impacts associated with the proposed development is ***moderate***. It is therefore concluded that the prospective socio-economic benefits of the proposed projects outweigh the socio-economic losses/impacts.

COMPLIANCE WITH THE APPENDIX 6 OF THE 2014 EIA REGULATIONS

Requirements of Appendix 6 – GN R982	**Addressed in the Specialist Report**
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Specialist Expertise Section at the beginning of this report and Appendix A of the EIA Report
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Specialist Declaration Section (Appendix B of the EIA Report, Appendix I of the BA Report and at the beginning of this report).
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	30 July 2014. The season of the site visit is immaterial as social impacts likely to result from the proposed project are not seasonal in nature.
e) a description of the methodology adopted in preparing the report or carrying out the specialised process;	Section 1.3
f) the specific identified sensitivity of the site related to the activity and its associated structures and infrastructure;	Section 3
g) an identification of any areas to be avoided, including buffers;	Not applicable as the project is not proposed in an urban area where social impacts are expected to manifest.
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Not applicable as the project is not proposed in an urban area where social impacts are expected to manifest.
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.5
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment;	Sections 4.3, 4.4, 4.5 and 4.6
k) any mitigation measures for inclusion in the EMPr;	Sections 5
l) any conditions for inclusion in the environmental authorisation;	No conditions identified or required.
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	No monitoring conditions identified

Requirements of Appendix 6 – GN R982	Addressed in the Specialist Report
	or required.
n) a reasoned opinion- i. as to whether the proposed activity or portions thereof should be authorised; and ii. if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 5
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 3.1.2
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Section 4.1
q) any other information requested by the competent authority.	External Peer Review required by the DEA. This external review report is included as an appendix to this specialist report.

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ABBREVIATIONS AND ACRONYMS:

CLD	Causal Loop Diagram
DEA	Department of Environmental Affairs
ECT	Equity Control Theory
EIA	Environmental Impact Assessment
IDP	Integrated Development Plan
MW	Megawatt
PV	Photovoltaic
SIA	Social Impact Assessment
SES	Socio-ecological System

SOCIAL IMPACT ASSESSMENT

1 INTRODUCTION AND METHODOLOGY

This Social Impact Assessment (SIA) was commissioned in response to the Environmental Impact Assessment (EIA) and Basic Assessment (BA) application processes initiated by Scatec Solar SA 163 (PTY) Ltd (Scatec) for the three proposed 75 Megawatt (MW) Solar Photovoltaic (PV) Facilities and three transmission lines to connect each facility to the National Grid, near Kenhardt in the Northern Cape. The proposed EIA and BA projects are referred to as follows:

- EIA Projects - Kenhardt PV 1, Kenhardt PV 2, and Kenhardt PV 3; and
- BA Projects – Kenhardt PV 1 – Transmission Line, Kenhardt PV 2 – Transmission Line, and Kenhardt PV 3 – Transmission Line.

This SIA has been compiled by Rudolph du Toit of the Council for Scientific and Industrial Research (CSIR) and externally reviewed by Ms. Liza van der Merwe (a private consultant). As part of the acceptance of the Scoping Reports, the Department of Environmental Affairs requested for an external review of the SIA to be conducted. The review report is included as Appendix A of this report.

A single SIA has been compiled based on the following reasons:

- The proposed project sites (as included in the official survey area) are located in very close proximity to each other and therefore present very similar baseline social conditions;
- The nature of the proposed development (i.e. solar PV electricity generation and transmission line development) is exactly the same for all the proposed projects sites. As such, the anticipated impacts resulting from the proposed developments will be similar regardless of its location; and
- Anticipated significant social impacts are expected to manifest in the urban node or sizeable human settlement in closest proximity to the proposed development (i.e. the town of Kenhardt) and not on the actual project sites. This is due to the extremely low population density of the relevant farms, its remote location and the relative absence of infrastructure and economic opportunity capable of attracting and sustaining agents of social change. Accordingly, it makes no difference on which land parcel or ERF the relative impacts originate, as the consequences resulting from such impacts are expected to manifest in Kenhardt, and can therefore be addressed in a single report.

A SIA can be defined as the process of determining "*[t]he consequences to human populations of any public or private actions (these include policies, programmes, plans and/or projects) that alter the ways in which people live, work, play, relate to one another, organise to meet their needs and generally live and cope as members of society. These* *impacts are felt at various levels, including individual level, family or household level, community, organisation or society level. Some social impacts are felt by the body as a physical reality, while other social impacts are perceptual or emotional*" (Barbour, 2007).

Evidently, the realm of human experience is characterised by subjectivity; both in terms of affected community's experiences and the SIA practitioner's interpretation of such experiences. Such subjectivity is known as the "social construct of reality" (Anderson & Taylor, 2002). However, social well-being can largely be agreed upon regardless of ones worldview. Accordingly, the SIA process must be committed to the following objectives (Barbour, 2007):

- The principles of sustainable development and social sustainability;
- Vulnerable groups;
- Meeting basic needs and services;
- Livelihood strategies;
- Fairness and equity;
- Social justice;
- Openness and participation; and,
- Accountability.

In pursuit of these objectives, it is imperative that an SIA looks beyond the direct positive and negative impacts likely to result from proposed projects and looks at promoting the well-being of communities potentially affected by a project by addressing entrenched structural issues of empowerment, minority groups, gender issues and poverty reduction.

1.1 SCOPE AND OBJECTIVES

This SIA Report investigates the potential social disruptors and associated social impacts likely to result from the development of the proposed Kenhardt PV 1, Kenhardt PV 2, and Kenhardt PV 3 solar energy projects, as well as the proposed Kenhardt PV 1 – Transmission Line, Kenhardt PV 2 – Transmission Line, and Kenhardt PV 3 – Transmission Line projects near Kenhardt in the Northern Cape. In this regard, the study focuses on the town of Kenhardt and not the individual land parcels on which the proposed projects will developed, as most, if not all, of the anticipated social impacts will be experienced in the urban area nearest to the proposed developments (i.e. Kenhardt). Social disruptors and impacts under investigation are those which are most likely to significantly influence social and cultural concerns, values, consequences and benefits to communities.

The objective of this SIA is to assist with informed decision-making by the competent authority (DEA) as, as well as the development of appropriate management directives, as it relates to the consideration of social impact likely to result from the proposed development.

1.2 TERMS OF REFERENCE

The SIA will include:

- A review of existing information, and collecting and reviewing baseline social information etc.
- Conducting interviews with key affected parties, including local communities, local landowners, key government officials (local and regional) etc.
- An identification and assessment of key social issues and potential impacts (negative and positive) associated with the construction, operational and decommissioning phases of the proposed projects.
- An identification of potential mitigation and enhancement measures.
- A specialist report which includes an assessment of the potential social impacts associated with the proposed projects.
- An outline of mitigatory measures and additional management or monitoring guidelines.
- Provide input to the Environmental Management Programme (EMPr), including mitigation and monitoring requirements to ensure that negative social impacts are limited.

1.3 STUDY APPROACH AND METHODOLOGY

This SIA consulted secondary data sources (published documentation) to obtain basic socio-economic baseline demographics. This secondary data was then augmented with primary data generated by a site visit to the proposed project site as well as the town of Kenhardt and the surrounding areas.

1.3.1 Applied Anthropological Methods

Collection of primary data during the site visit was guided by a Participant Observation Methodology (Anderson & Taylor, 2002). Participant observation is an applied anthropological approach, whereby the researcher ‘becomes’ a resident in the community for a given period of time to observe the normal daily lives of community members and to conduct informal interviews with informants. The intention of interviews is to uncover the major livelihood strategies present in the study area, to understand the key socio-economic challenges, and gain insights into the ‘constructed reality’ of the Kenhardt community. Observation of community members’ lives, routines and living environments help to gain insight into practices, patterns and processes which community members may not be consciously aware of.

1.3.2 Systems Theory

Conventional SIA reports generally describe the affected environment in terms of social and economic conditions, with only very cursory references to the biophysical environment. Due to the inherent complexity of human-nature interaction, and the profound impacts resulting from this interaction, a more holistic approach was adopted towards understanding and representing the affected environment. Accordingly, the receiving environment and subsequent impacts thereon were viewed and interpreted as a coupled socio-ecological system (SES). This approach is a radical departure from viewing the receiving environment as a loose collection of independent economic, social and environmental variables.

Systems theory provides insight into complex system relationships by interpreting a given system through the following set of principles:

- Complex systems **are open systems** (i.e. free interaction with other systems across systemic boundaries);
- Complex systems operate under conditions **not at equilibrium** (i.e. supply and demand of systemic services are not in balance, also known as redundancy in cases of over supply);
- Complex systems have an **asymmetrical structure** (i.e. structure is maintained, though component parts my change);
- Complex systems consist of **many** components;
- In a complex system, components on average **interact with many others** via numerous possible routes;
- Some sequences of interaction within complex systems will result in **feedback routes;**
- Parts of a complex system interact in non-linear ways to create properties and behaviours which is not inherent to the system's component parts; known as **emergence.**

Subsequently, typical socio-economic baseline data is then represented in a Causal Loop Diagram (CLD) to illustrate the systemic causal linkages between variables present in the SES in which the study area is located.

1.3.3 Vulnerability Context

Finally, an Asset Pentagon has been used to interpret the collected information. An Asset Pentagon is an assessment method developed within the discipline of Livelihoods Assessment, and aims to establish the vulnerability context of a given social grouping. People's access to productive assets (Human-, Social-, Natural-, Physical- and Financial capital) lies at the heart of their vulnerability context. Generally, the greater access people have to assets, the more livelihood strategies are available and the easier it is for them to switch from one strategy to the next. Conversely, limited access to assets results in reduced livelihood strategies and impaired ability to assume alternative strategies should the need arise.

As a result, the SIA research approach is descriptive in nature and uses indicative reasoning to reach its impact assessment findings. In terms of the impact assessment, the methodology adopted is outlined in Section D of the BA Report and Chapter 4 of the EIA Report.

1.4 INFORMATION SOURCES

The primary and secondary data sources used in the SIA include:

- Primary data generated through participant observation techniques;
- The South African Guideline for Involving Social Assessment Specialists in EIA (Barbour, 2007);
- The Kai !Garib Local Municipality Draft IDP of 2014;
- Orlight SA (Pty) Ltd's "Kenhardt Solar PV Power Plant"; BioTherm (Pty) Ltd's "Aries Solar PV Facility"; AES Solar Energy Limited's "Olvyn Kolk PV Power Plant" and the Eskom SOC's "Aries-Helios 765 kV transmission line upgrade");
- The 2011 Census report (Statistics South Africa (StatsSA), 2011); and
- Academic journal articles on the topics of vandalism, teenage pregnancy and poverty such as Ceccato and Haining (2005).

1.5 ASSUMPTIONS AND LIMITATIONS

Secondary data on the study area is very limited. The site visit was therefore intended to gather sufficient primary data to guide the SIA. However, information gathered during the site visit generally carries a medium level of confidence as the SIA is an applied research method, as opposed to a scientific research method. This means that much less time and resources are available for primary research and the subsequent verification of findings. As a result, the majority of significance ratings ascribed to both the potential positive and negative impacts of the proposed Kenhardt PV and Transmission Line projects were given a ***medium*** confidence rating.

The SIA[3] assumes that the majority of socio-economic impacts will be experienced in the town of Kenhardt; due to its proximity to the project site. It is however possible for socio-economic impacts to be experienced in other urban nodes close to the project site. The project boundary, in terms of socio-economics, is therefore arbitrarily constructed.

Various energy-related developments are present in the general study (i.e. within a 50 km radius) area and were considered in this study (e.g. Mulilo Renewable Project Developments (Pty) Ltd's "Phase 1 and Phase 2- Nieuwehoop Solar PV Power Plants"; Orlight SA (Pty) Ltd's "Kenhardt Solar PV Power Plant"; BioTherm (Pty) Ltd's "Aries Solar PV Facility"; AES Solar Energy Limited's "Olvyn Kolk PV Power Plant" and the Eskom SOC's "Aries-Helios 765 kV transmission line upgrade"). However, when considering cumulative impacts, the combined impacts of *all* developments in a given area should be considered; not only the impacts resulting from *similar* activities/projects. Clearly, considering the possible socio-economic impacts likely to result from all development in an arbitrarily defined study area is not practically possible in the limited timeframe of the EIA process. However, this SIA

[3] This study is a SIA as per the definition contained in the *Guideline for Involving Social Assessment Specialists in the EIA Process* (Barbour, 2007): "*Social impacts can be defined as 'The consequences to human populations of any public or private actions (these include policies, programmes, plans and/or projects) that alter the ways in which people live, work, play, relate to one another, organise to meet their needs and generally live and cope as members of society*'".

attempts to identify and understand the cumulative socio-economic impacts likely to result from the interaction of similar (i.e. solar energy and electrical infrastructure developments) development activities within the general study area. Section D of the BA Report and Chapter 4 of the EIA Report notes the developments within a 20 km radius that have been considered in order to assess cumulative impacts.

In terms of the employment estimates, the man months noted in this study, which are also known as “person months", is the total number of employees in each of the Contract Months, within the Construction Measurement Period and the Operating Measurement Period, as applicable. It should be noted that the said “person months” are, at present, best estimates only and could well change once the project is initiated.

1.6 DECLARATION OF INDEPENDENCE OF SPECIALIST

Refer to the beginning of Appendix D.7 and Appendix A of the EIA Report for the Curriculum Vitae of Rudolph du Toit, which highlights his experience and expertise. The declaration of independence by the specialist is provided in Box 1 below and included in Appendix I of the BA Report and Appendix B of the EIA Report.

BOX 1: DECLARATION OF INDEPENDENCE

I, Rudolph du Toit, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed Kenhardt PV Facilities and Transmission Lines Project, application or appeal in respect of which I was appointed, other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.

RUDOLPH DU TOIT

2 PROJECT CONTEXT (SOCIO-ECONOMICS)

2.1 PROJECT INFORMATION

As noted above, Scatec is proposing to develop three 75 MW Solar PV power generation facilities and associated electrical infrastructure (including transmission lines for each 75 MW facility) on the remaining extent of Onder Rugzeer Farm 168 and the connection points to the Eskom Nieuwehoop Substation on the remaining extent of Portion 3 of Gemsbok Bult Farm 120, approximately 80 km south of Upington and 30 km north-east of Kenhardt within the !Kheis Local Municipality, Northern Cape Province (Figure 2.1).

The three proposed 75 MW Solar PV facilities require a separate EIA Process and the three transmission line/electrical infrastructure projects (that will support the Kenhardt PV facilities) require a BA Process.

The following proposed transmission line and electrical infrastructure connectivity options have been considered in the BA Process:

- Each PV facility will be connected by a separate short 132 kV transmission line to the Eskom Nieuwehoop Substation that is currently being constructed on Farm Gemsbok Bult (remaining extent of Portion 3 of Farm 120); or
- Connect the Kenhardt PV 2 and Kenhardt PV 3 projects via separate 22/33 kV transmission lines to the proposed Kenhardt PV 1 on-site substation which will link via a 132 kV line to the Eskom Nieuwehoop Substation; or
- Construct one 132 kV transmission line from the Kenhardt PV 1 project to the Eskom Nieuwehoop Substation and connect the Kenhardt PV 2 and Kenhardt PV 3 facilities together via medium voltage transmission lines to either the on-site substation of Kenhardt PV 2 or PV 3, followed by the construction of one 132 kV transmission line from the on-site substation to the Eskom Nieuwehoop Substation.

The above connectivity options occur within an electrical infrastructure corridor (Figure 2.1).

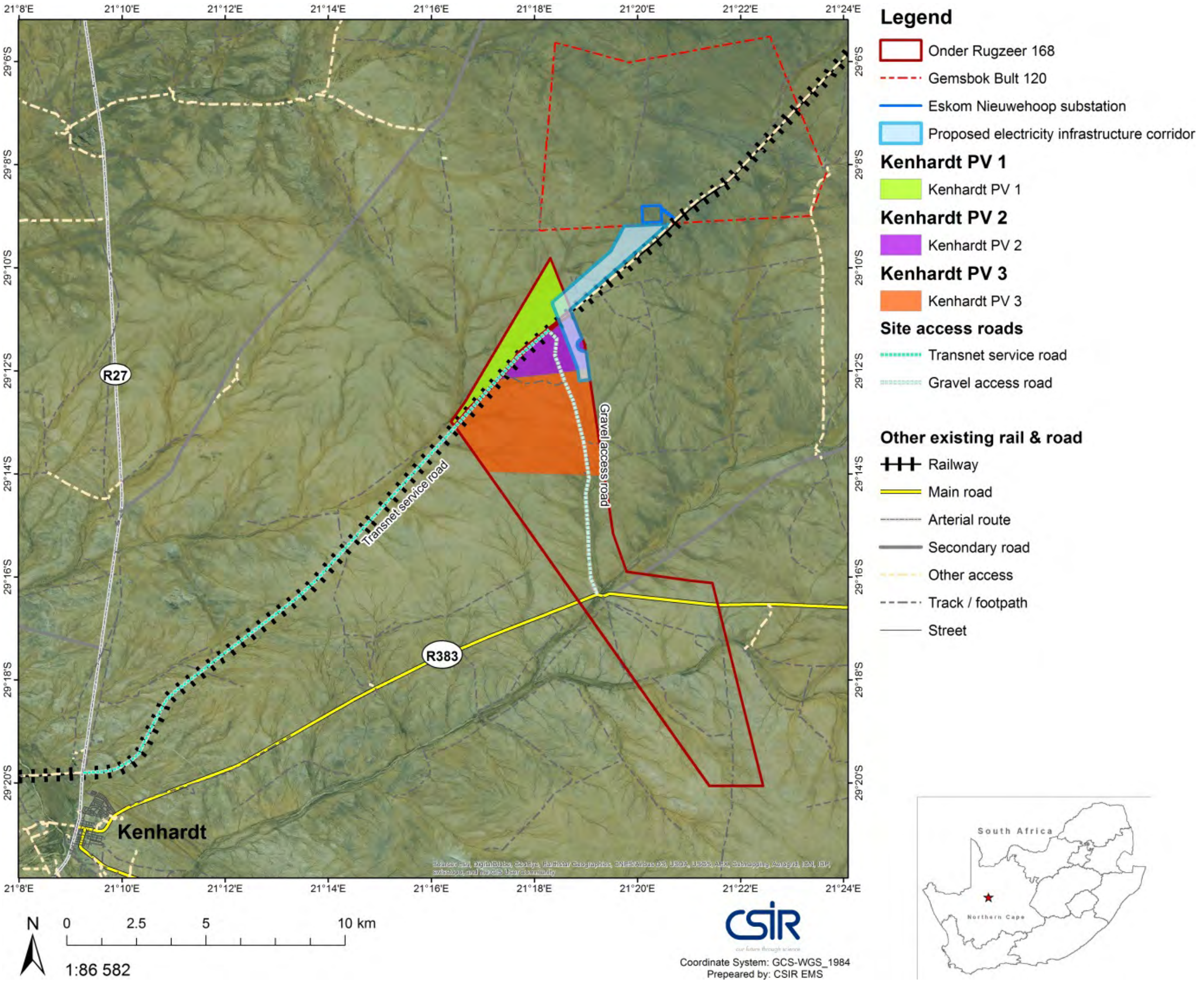

Figure 2.1 Preferred site locations of the three proposed Kenhardt PV solar developments (namely Kenhardt PV 1 (outlined in green); Kenhardt PV 2 (outlined in purple); and Kenhardt PV 3 (outlined in orange), and the transmission line projects (namely Kenhardt PV 1 – Transmission Line; Kenhardt PV 2 – Transmission Line; and Kenhardt PV 3 – Transmission Line) which will collectively occur within an electrical infrastructure corridor (outlined in blue).

The current land use of the proposed project areas, as well as the surrounding land parcels is zoned for agricultural development and use. The construction phase of each proposed solar PV facility would last approximately 14 months. The construction phase of each proposed transmission line (which is subject to the BA Process) is expected to last 12 to 14 months. However, it should be noted that the construction period is subject to the final requirements of Eskom and the REIPPPP Request for Proposal provisions at that point in time. Employment opportunities created during the construction phase for the PV projects equates to approximately 1 260 – 2 100 man months (for skilled opportunities) and approximately 5 600 - 6 400 man months (for unskilled opportunities) per project (i.e. three 75 MW PV projects in total). Employment opportunities created during the construction phase of each transmission line project are estimated to range between 1 560 and 1 820 man months. Table 2.1 lists the anticipated number of skilled and unskilled employment associated with the solar PV plant developments as well as the associated transmission lines projects. It should be noted that the employment opportunities provided in this report are estimates and is dependent on the final engineering design and the REIPPPP Request for Proposal provisions at that point in time.

Employment opportunities to be created during the operational phase equate to approximately 4 800 man months (for skilled opportunities) and approximately 9 600 man months (for unskilled opportunities) per project (i.e. three 75 MW PV projects in total) over the 20 year plant lifespan.

Scatec further proposes an Economic Development Plan which sets out to achieve the following:

- Create a local community trust which has an equity share in the project life to benefit historically disadvantaged communities;
- Initiate a training strategy to facilitate employment from the local community; and
- Give preference to local suppliers of components for the construction of the facility.

Table 2.1: Anticipated skilled and unskilled employment opportunities created during construction and operational phases of the project

EIA SOLAR PV PROJECTS:	
Construction Phase	**Man Months** **(Man months is also known as "Person Months": means the total number of Employees in each of the Contract Months, within the Construction Measurement Period and the Operating Measurement Period, as applicable, which are adjusted for the actual working time, compared to normal working time).**
Kenhardt PV 1 - between 90 and 150 skilled and 400 and 460 unskilled employment opportunities are expected be created during the construction phase.	Skilled: 90 * 14 months = 1260 man months Skilled: 150 * 14 months = 2100 man months Unskilled: 400 * 14 = 5600 man months Unskilled: 460 * 14 = 6440 man months
Kenhardt PV 2 - between 90 and 150 skilled and 400 and 460 unskilled employment opportunities are expected be created during the construction phase.	Skilled: 90 * 14 months = 1260 man months Skilled: 150 * 14 months = 2100 man months Unskilled: 400 * 14 = 5600 man months Unskilled: 460 * 14 = 6440 man months
Kenhardt PV 3 - between 90 and 150 skilled and 400 and 460 unskilled employment opportunities are expected be created during the construction phase.	Skilled: 90 * 14 months = 1260 man months Skilled: 150 * 14 months = 2100 man months Unskilled: 400 * 14 = 5600 man months Unskilled: 460 * 14 = 6440 man months
Operation Phase	
Kenhardt PV 1 - approximately 20 skilled and 40 unskilled employment opportunities will be created over the 20 year lifespan of the proposed facility	Skilled: 20 * 240 months = 4800 man months Unskilled: 40 * 240 months = 9600 man months
Kenhardt PV 2 - approximately 20 skilled and 40 unskilled employment opportunities will be created over the 20 year lifespan of the proposed facility.	Skilled: 20 * 240 months = 4800 man months Unskilled: 40 * 240 months = 9600 man months
Kenhardt PV 3 - approximately 20 skilled and 40 unskilled employment opportunities will be created over the 20 year lifespan of the proposed facility.	Skilled: 20 * 240 months = 4800 man months Unskilled: 40 * 240 months = 9600 man months
BA TRANSMISSION LINE PROJECTS:	
Construction Phase	
Transmission Line for PV 1 – about 130 employment opportunities, 30 % of which will accrue to previously disadvantaged individuals.	130 * 12 construction months = 1560 man months 130 * 14 construction months = 1820 man months
Transmission Line for PV 2 – about 130 employment opportunities, 30 % of which will accrue to previously disadvantaged individuals.	130 * 12 construction months = 1560 man months 130 * 14 construction months = 1820 man months
Transmission Line for PV 3 – about 130 employment opportunities, 30 % of which will accrue to previously disadvantaged individuals.	130 * 12 construction months = 1560 man months 130 * 14 construction months = 1820 man months
Operational Phase	
There will no additional new employment opportunities as the operation and maintenance of transmission lines is an Eskom competency.	n/a

It is important to note that a detailed project description is provided in Chapter 2 of the EIA Report and Section A of the BA Report.

2.2 LEGAL, POLICY AND PLANNING CONTEXT

The Draft Integrated Development Plan (IDP) (2014) for the Kai! Garib Local Municipality was considered in the drafting of this specialist study, due to its specific relevance to social and economic considerations related to proposed developments. Note that other key statutes were also considered in drafting this study (i.e. National Environmental Management Act (NEMA); National Heritage Act; and the Development Facilitation Act), but are discussed in greater detail in Section A of the BA Report and Chapter 4 of the EIA Report.

2.2.1 Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996)

Section 24 of the Constitutional Act states that everyone has the right to an environment that is not harmful to their health or well-being and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures, that –

i. Prevents pollution and ecological degradation;
ii. Promotes conservation; and
iii. Secures ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

In support of the above rights, the environmental management objectives of proposed projects are to protect ecologically sensitive areas and support sustainable development and the use of natural resources, whilst promoting justifiable socio-economic development in the towns nearest to the project sites.

2.2.2 National Environmental Management Act, 1998 (Act No. 107 of 1998)

The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) requires cooperative environmental governance by establishing principles for decision making on matters affecting the environment, institutions that will promote cooperative governance and procedures for coordinating environmental functions exercised by organs of state. NEMA also aims to achieve sustainable development. In this regard NEMA requires the integration of social, economic and environmental factors into planning, implementation and decision-making to ensure that development serves present and future generations.

2.2.3 National Heritage Resources Act, 1999 (Act No. 25 of 1999)

The National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) transfers responsibility for the identification of local heritage resources and the inclusion of heritage areas to all municipalities in South Africa. Developers/proponents need to integrate the NHRA into relevant planned projects and obtain approval (if necessary) from the relevant heritage authorities or municipalities before commence of the project.

2.2.4 Draft Integrated Development Plan, 2014 for the Kai !Garib Local Municipality

The objective of the IDP is to create an economically viable and maturely developed municipality, which enhances the standard of living of all the inhabitants and communities through good governance and excellent service. The IDP has identified key priority issues for the municipality.

2.2.5 Development Facilitation Act (Act 67 of 1995)

The Development Facilitation Act, 1995 (Act 67 of 1995) (DFA) sets out a number of key planning principles which have a bearing on assessing proposed developments in light of the national planning requirements. The planning principles most applicable to the study area include:

- Promoting the integration of the social, economic, institutional and physical aspects of land development;
- Promoting integrated land development in rural and urban areas in support of each other;
- Promoting the availability of residential and employment opportunities in close proximity to or integrated with each other;
- Optimising the use of existing resources including such resources relating to agriculture, land, minerals, bulk infrastructure, roads, transportation and social facilities;
- Contributing to the correction of the historically distorted spatial patterns of settlement in the Republic and to the optimum use of existing infrastructure in excess of current needs;
- Promoting the establishment of viable communities; and,
- Promoting sustained protection of the environment.

3 AFFECTED SOCIO-ECONOMIC ENVIRONMENT

The intention of this section is to provide background information of the socio-economic baseline conditions present in the study area. Information sources used to compile the socio-economic baseline consists of both primary (a site visit conducted on the 30 July 2014) and secondary research (relevant published literature and policy documents).

3.1.1 Socio-economic Baseline Data

3.1.1.1 Secondary Data

The study area is located within the ZF Mgcawu District Municipality (formally known as the Siyanda District Municipality). The actual project footprint (I.e. the remaining extent of Onder Rugzeer Farm 168 and the remaining extent of Portion 3 of Gemsbok Bult Farm 120 (for the connection points to the Eskom Nieuwehoop Substation)) is located in the !Kheis Local Municipality (part of the ZF Mgcawu District Municipality). However, the closest urban centre, Kenhardt, is located in the Kai !Garib Local Municipality. Given the proximity of the proposed projects to the town of Kenhardt; the focus of this SIA will be on the Kai !Garib Local Municipality (Figure 3.1), as this is where the vast majority of potential project impacts (both positive and negative) might manifest.

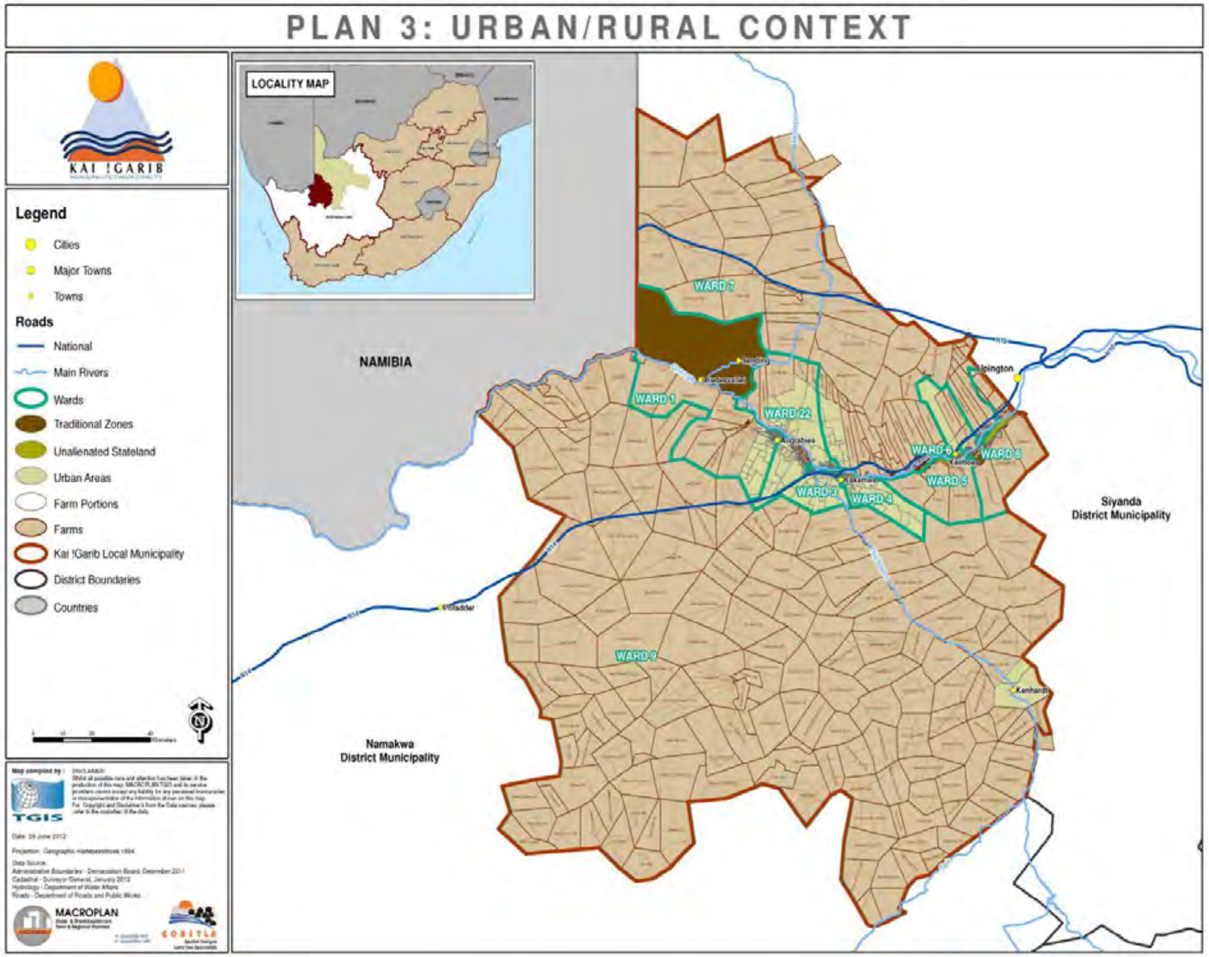

Figure 3.1 Kai !Garib Local Municipality

(Source: Kai !Garib Draft IDP, 2014)

According to the Kai !Garib Draft IDP (2014) and the Stats SA 2011 Census data, the total population of the Kai !Garib municipal area is 65 869; of which 6 679 resides in the Kenhardt area. A total of 16 703 households resides in the Kai !Garib Local Municipality, with 35% of households being female headed. The total female population dominates the total male population by 8.5% (Kai !Garib Draft IDP, 2014). Population of the working age demographic (15 to 65 years) makes-up 70.5% of the population, whereas those below 15 years of age comprises 24.4% of the population; the + 65 years age group makes-up 5.1% of the population. Accordingly, the dependency ratio (the economically active population vs the non-economically active population) is 41.9% (Stats SA, 2011).

The official unemployment rate of 10% has decreased by 6.1% since the 2011 Census measurement of 16.1%. The economic sector is dominated by agriculture which provides 51.8% of jobs, followed by the Community and Government Services sector with 15.9% (Figure 3.2).

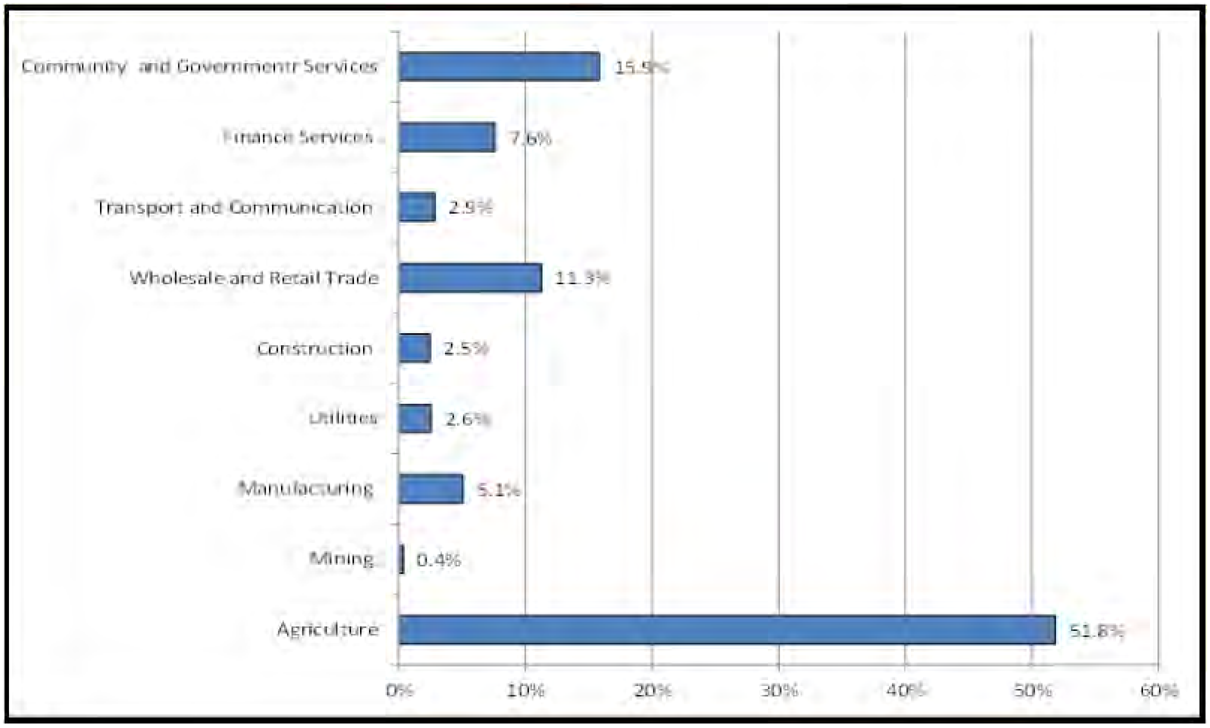

Figure 3.2 Most active economic sectors within the Kai !Garib Local Municipality
(Source Kai !Garib Draft IDP, 2014)

The major social challenges faced in the Kai !Garib Municipal area include (Kai !Garib Draft IDP, 2014):

- Increases in drug abuse;
- Increases in children under 10 years abusing alcohol;
- Increases in teenage pregnancies;
- Increased crime linked to alcohol and drug abuse;
- High youth unemployment rates; and
- Increased prevalence of HIV & AIDS.

3.1.1.2 Fieldwork

Clearly, the above mentioned figures and findings relate to the larger municipal area and subsequently provide limited detailed information regarding the actual study area (i.e. Kenhardt and surrounding areas). Furthermore, a dramatic difference in landscape character and environmental features occurs throughout the Kai !Garib municipal area that are due to the availability of irrigation water along the areas immediately adjacent to the Orange River. For example, due to the higher productivity of areas under irrigation, the total employment opportunities in the municipal area (especially in the agricultural and support services sector) tend to be limited to the banks of the Orange River. It is therefore safe to assume that Kenhardt, being located approximately 70 km away from the Orange River, has a different profile in terms of employment figures, as well as the various socio-economic impacts resulting from gainful employment. Consequently, it was deemed necessary to supplement the limited secondary data with a site visit to Kenhardt and the surrounding area to try and obtain useful data relating to socio-economic conditions.

Informants[4] in Kenhardt indicated that levels of unemployment in the town are particularly high. All informants interviewed indicated that the vast majority of the economically active population is dependent on some form of government subsidy (reported to be approximately R 1300 per person per month). These statements appear to be reliable given the very limited amount of businesses operating within Kenhardt. Businesses generally consist of liquor stores, restaurants and accommodation (Bed and Breakfast), with only one observed clothing store (PEP) and one general dealer (KLK). Employment figures for these businesses appear to range from a minimum of one to a maximum of four employees. Agriculture in the Kenhardt area is dominated by sheep farming which requires particularly low levels of labour (approximately 2-4 labours per farm) (R. Grobbelaar, personal communication, 31 July 2014), with limited seasonal increases in labour requirements during the shearing season. Larger employers in Kenhardt include the local high school, the Kai !Garib municipal offices, the Department of Social Development satellite office and the local police station.

Subsequently, the local labour market appears to offer very limited absorption of the economically active component (i.e. approximately 4675 employment opportunities, based on a 70.5% working age demographic for the Kai !Garib municipal area) of the 6679 inhabitants of the Kenhardt area.

Participant observation further supports the claim of high unemployment. Groups of young men (approximately 16 to 30 years of age) where observed loitering on various street corners during the normal working hours of both days of the site visit (a Wednesday and Thursday during the weekday). Furthermore, public infrastructure (public telephones, the public swimming pool and benches) where vandalised to such an extent that further use of these facilities is impossible. Acts of social disorder, such as loitering and vandalism, are

[4] Sociological research ethics dictates that the identity of informants (i.e. those being interviewed) should be protected if *any* possibility of physical, mental, emotional or legal harm exists. Accordingly, the identities of informants are not disclosed in this study.

regularly associated with poverty and elevated levels of distress within communities (Richardson & Shackleton, 2014). According to Fisher and Baron's (1982) Equity-Control Theory (ECT), acts of vandalism are often triggered by a perceived violation of norms related to fairness in terms of social and environmental arrangements. From this perspective, acts of vandalism can be understood as an attempt to reduce inequality.

Ceccato and Haining (2005) report that vandalism is particularly obvious in areas with low social integration and organisation; whereas Nowak *et. al.* (1990) reports higher levels of vandalism in areas with high unemployment rates and low private property ownership. A possible alternative interpretation of social disorder could be the "Broken Windows" theory put forward by Wilson and Keeling (1982). According to this theory, the presence of vandalism (or social disorder), however minor, creates a condition in which further vandalism is sanctioned; thereby increasing its frequency. However, acts of vandalism in Kenhardt were perpetrated in the formal, well maintained precinct of the town, as well as in the informal, poorly maintained precinct. This suggests that the "Broken Windows" theory does not apply to the observed social disorder in Kenhardt.

Informants further indicated that teenage pregnancies and drug abuse were major social issues in Kenhardt, and that the prevalence of these issues is increasing. This claim is validated by secondary data contained in the Kai !Garib Draft IDP (2014), which lists teenage pregnancy and drug abuse as major social challenges within the larger municipal area. Both these issues elevate the local dependency ratio, thereby placing already stressed livelihood strategies under even more strain.

Teenage pregnancy may be positively related to elevated levels of poverty, associated idleness and inappropriate forms or recreation (Were, 2007). Recreational opportunities in Kenhardt are extremely limited. A public rugby field and an oval racing track just outside of town are the only public recreational facilities offered. Informants identified an informal nightclub on the north-eastern outskirts of Kenhardt, which is associated (according to informants) with alcohol abuse and other forms of inappropriate recreation. Informants further confirmed that no internet cafes or public internet facilities are available in Kenhardt, which contributes to the overall lack of recreation/entertainment opportunities. Poverty and limited recreation opportunities may be contributing factors to the high teenage pregnancy rate. However, poor sex education, limited understanding of and access to modern contraception and lack of parental guidance are likely exacerbating factors.

With regards to teenage pregnancy; interviewed parents communicated disappointment and indignation, rather than concern about the practical implications of teenage pregnancy. This suggests a violation of existing cultural norms. It is therefore assumed that further escalation of teenage pregnancies (and/or teenage sexual activity) would continue to disrupt the Kenhardt community not only in terms of livelihoods, but also in terms of family relations. The relative lack of employment in and around Kenhardt is suggestive of a community heavily reliant on kinship and reciprocity for its economic survival. Accordingly, further deterioration of kinship ties as a result of cultural taboos might jeopardize the already precarious livelihood strategies of young mothers and their children.

A study of Kenhardt's urban form is revealing. The town displays typical apartheid planning structure, with a distinct poorer urban node (previously a coloured township) to the north and a wealthier urban node (previously white urban node) to the south. A clear buffer zone (*cordon sanitaire)* separates the two areas (Figure 3.3). The poorer urban node to the north is characterised by small ERF sizes, erratic street patterns, a significant informal housing component and no business nodes.

Conversely, the wealthier urban node to the south is characterised by larger ERF sizes, a clear grid patterned road infrastructure, a complete absence of informal structures and a business node in the shape of a ribbon development along the R 27. Furthermore, the secondary school, municipal offices, and local clinic are all located within the wealthier southern node. During fieldwork, it was also observed that informal traders are located throughout the poorer northern node, but are virtually absent from the wealthier southern node. Informants complained that informal shop owners and traders are generally foreign nationals and are not seen as 'members' of the community. This outsider versus insider experience, coupled with a dependency of the local community on the services offered by outsiders appears to generate feelings of distrust and vulnerability. A secondary issue might also be the potential "leakage" of investment from the local economy due to foreign nationals not reinvesting in Kenhardt, but rather evacuating their funds to friends and family abroad or residing elsewhere. This existing outsider versus insider phenomenon suggests that the local community could be sensitive to the influx of job seekers and other forms of in-migration into Kenhardt.

Interestingly, the poorer northern node is expanding, while the wealthier southern node remains unchanged. Figure 3.4 indicate the expansion of the northern urban node through satellite imagery from 2005 and 2013, respectively. The yellow polygons indicate new informal residential units and the orange polygons indicate densification of informal units. These images show a potentially significant residential growth in the poorer community of Kenhardt.

Figure 3.5 indicate the wealthier southern node in 2005 and 2013, respectively. No discernable growth in the formal residential housing stock can be observed. Fieldwork also revealed that some houses in the southern node are for sale. This suggests that the southern urban node may be shrinking.

The growth of informal housing in Kenhardt is difficult to explain as the town does not appear to offer any significant social or economic pull factors. Recent declines in local rainfall and subsequent knock-on effects on agriculture are unlikely to fully account for increased urbanisation, as sheep farming does not generate significant employment opportunities. It therefore seems reasonable to assume that the increase can, to a large degree, be attributed to natural growth. This would suggest that wealthier residents (residing in the south) have the ability to 'escape' from the area, should they wish to; whereas the poorer residents (residing in the north) are 'trapped' in the area, thereby causing a natural growth in population numbers. The general trend of declining birth rates among white South Africans might also be a contributing factor. This increase in population is bound to add additional strain on the livelihoods of the poor community.

The fastest growing industry in Kenhardt appears to be Bed and Breakfast (B&B) establishments. Observations during fieldwork indicated that B&Bs were the single largest industry (in terms of number of establishments, not turnover) in the town. This observation is supported by local informants who suggested that the growth in the industry is attributable to the recent increases in energy–related projects (solar energy and Eskom transmission lines) proposed in the area.

Informants further reported frustration regarding job creation expectations created by other developments in the area. Apparently, other energy-related developments in the Kenhardt area, for which EIA processes are currently underway, communicated to the community that employment opportunities will be offered to local residents. When residents established that these jobs would only materialise in 5 to 10 years' time; considerable frustration and anger was (and is) experienced. According to Barbour (2007), the expectation of an occurrence (in social terms) should be considered as an impact resulting from a planned development. Consequently, the Kenhardt community is likely to be particularly sensitive to similar expectation which could be created by the proposed development.

3.1.2 Vulnerability Context

According to the Department for International Development (DFID) (1999), a community's vulnerability context is a product of *trends*, *shocks* and *seasonality* within the context of the community being researched. Informants indicated that very little seasonal variation is experience in income levels and livelihood strategies; therefore seasonality is of negligible interest in the vulnerability context of the Kenhardt community. Shocks, interpreted as an impact of sudden occurrence which directly destroy assets or livelihood strategies, also appears to have a limited role in the Kenhardt community. Trends do however seem to have a significant impact on those living in the area. Of particular importance are the increasing trends in unemployment and social deviance (teenage pregnancies and drug abuse), as well as the decreasing trend in the relative contribution of agriculture to job creation in Kenhardt.

Figure 3.3 Urban form of Kenhardt, with the (i) red polygon indicating the historical coloured township, (ii) the yellow polygon indicating the historical white urban node; and (iii) the green arrow indicating the cordon sanitaire

Figure 3.4 Satellite image of the poorer (northern) urban node of Kenhardt in 2005 on the left, and a satellite image of the same node in 2013 on the right; with (i) the yellow polygons indicating urban expansion; and (ii) the orange polygon indicating densification.

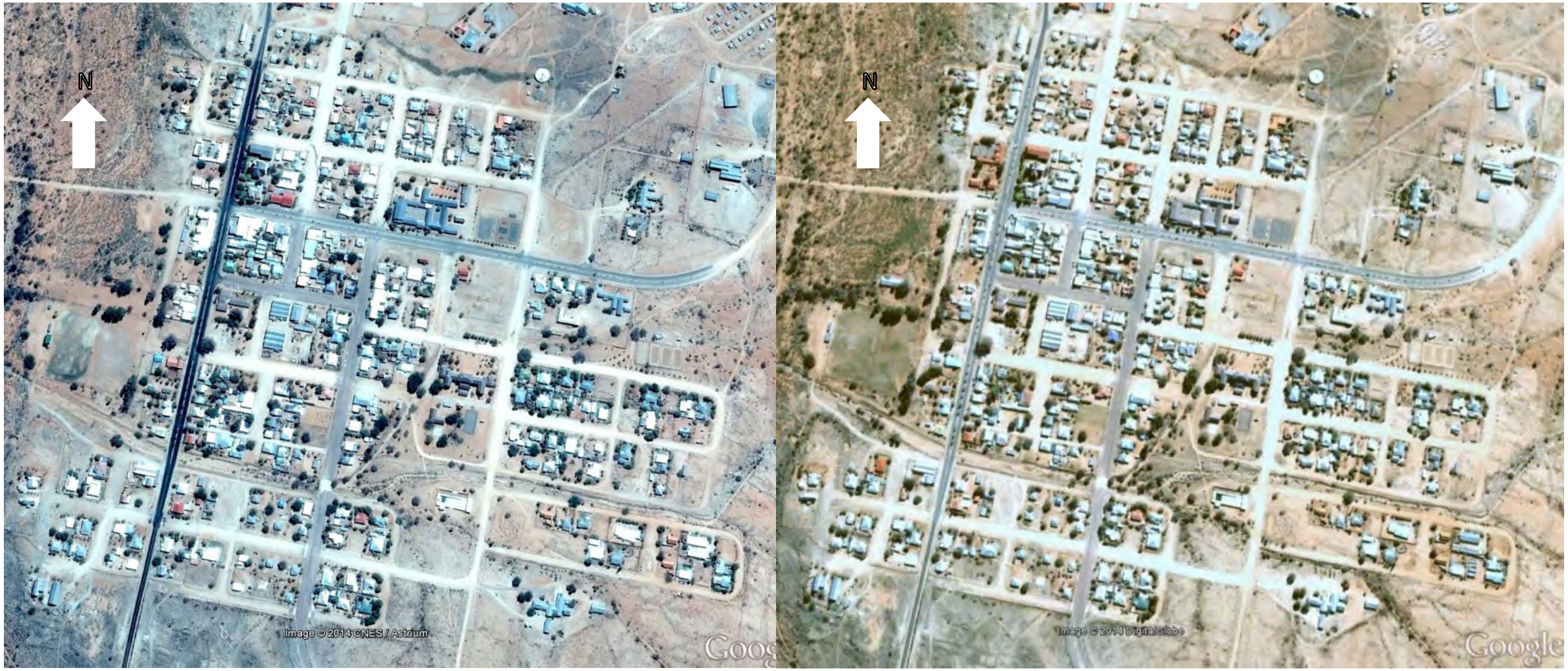

Figure 3.5 Satellite image of the wealthier (southern) urban node of Kenhardt in 2005 on the left, and satellite image of the same node of Kenhardt in 2013 on the right; indicating no discernible expansion or densification

People's access to productive assets (Human-, Social-, Natural-, Physical- and Financial capital) lie at the heart of their vulnerability context. Table 3.1 provides a brief explanation of the various forms of capital. Generally, the greater access people have to assets, the more livelihood strategies they have available and the easier it is for them to 'switch' from one strategy to the next. An effective way to assess access to assets is by using an Asset Pentagon (Figure 3.6).

The Asset Pentagon schematically represents variations in people's access to assets. The centre of the pentagon represents zero access to assets. Consequently, a resilient[5] community will have a pentagon characterised by a relative balance between all 5 forms of capital. Conversely, a pentagon wherein one or two capital classes dominate could be indicative of a vulnerable community.

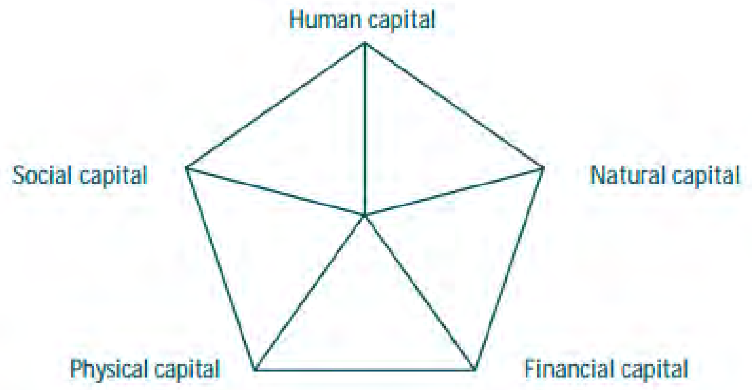

Figure 3.6 Example of an Asset Pentagon with 100% access to all 5 forms of capital

Table 3.1: Brief definition of the 5 capital forms

Capital class	Description
Human capital	Human capital signifies the ability to perform labour, skills-set, knowledge and health that empowers people to pursue different livelihood strategies and attain their livelihood objectives.
Social capital	These are the social resources available to people in the pursuit of their livelihood strategies. These include: networks and social connectedness, membership of formalised groups and/or relationships of trust reciprocity and exchange.
Natural capital	Natural capital refers to the natural resource stocks, flows and services which are beneficial for livelihoods. There are numerous natural resources that make up natural capital, from intangible services such as the atmosphere, to divisible assets used directly for production.
Physical capital	Physical capital is the basic infrastructure and producer goods, necessary for people to pursue their relevant livelihood strategies. Such capital includes; inexpensive transport, affordable energy, secure shelter, adequate and safe potable water supply, and access to information.
Financial capital	Financial capital simply refers to the financial resources people use to achieve their livelihood strategies. Generally financial capital consists of available stocks (savings, livestock, jewellery, etc.) or, regular inflows (pensions, remittances, government subsidies, etc.).
Source: DFID (1999)	

[5] The use of the term 'resilient' in this context should not be confused with 'resilience theory' (i.e. the ability of a system to accommodate change while still maintaining its core function structure and identity), but is here merely used to refer to adaptability and robustness.

The Kenhardt community appears to have acceptable access to both Human and Social capital. Informants reported that community members are generally in very good health and that most young adults have a secondary education. The high level of unemployment and the increasing number of teenage pregnancies present in Kenhardt requires robust social capital to prevent affected community members from falling into abject poverty. The relative success of the local community in preventing this, suggests that access to Social capital is satisfactory.

Access to Physical capital in Kenhardt seems average to low. The community has access to bulk services (water, electricity and waste collection), and a range of housing types ranging from formal to informal. Transport is not a significant factor within Kenhardt, due to its very small size; however, access to other urban areas (e.g. Keimoes, Kakemas and Upington) is limited to private transport. Informants also indicated that access to information and awareness of basic rights and public services are very low. Natural capital in Kenhardt is limited due to the harsh climatic conditions and general lack of irrigation water. As a result, community members appear to have limited access to productive natural assets. Finally, access to financial capital is very limited as the bulk of the vulnerable section of the Kenhardt community seems to be dependent on government subsidies and pensions.

Represented as an Asset Pentagon; the Kenhardt community's access to assets is indicated in Figure 3.7.

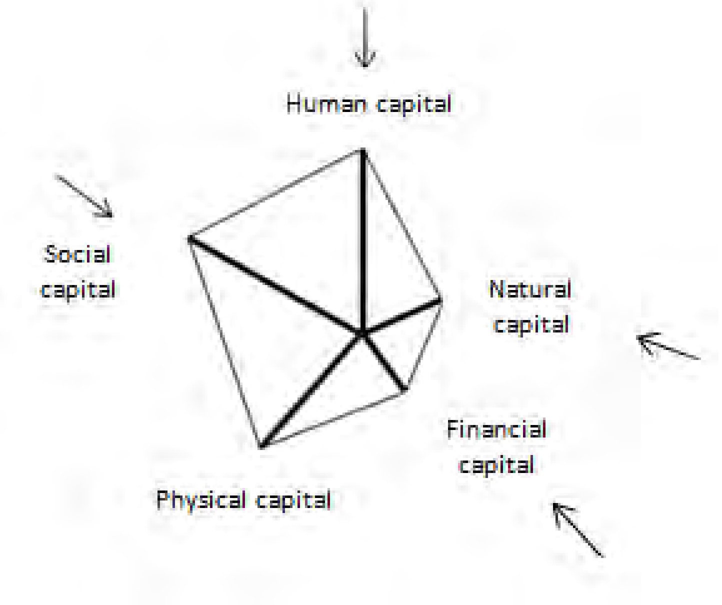

Figure 3.7 Kenhardt Asset Pentagon

The Kenhardt community appears to be vulnerable in terms of its livelihood strategies due to a relative imbalance in access to assets classes, with Human and Social capital dominating the pentagon. The arrows (Figure 3.7) indicate downward pressure (or trends) on the various asset classes. Climate change is expected to continue to deteriorate Natural capital; while high levels of unemployment coupled with a growth in population size is likely to weaken Human, Social and Financial capital. Future development in the Kenhardt area needs to take cognisance of the community's current vulnerability context. In this context, the proposed solar energy development could offer much need relief in terms of Human, Social and Financial capital through the creation of employment (even short-term employment) and local spending. Accordingly, the receiving social environment is not deemed to be sensitive (in a negative sense) to the proposed development, its structures and associated infrastructure.

3.1.3 Systems Analysis

A systemic analysis of the SES of Kenhardt is informed by the discipline of Systems thinking. According to Systems thinking, development (as proposed by Scatec) is introduced in complex systems of human-nature interaction. Such systems are open, functions in non-linear ways, are characterised by feedback loops and display emergence. Emergence is simply the creation of system characteristics which are not present in the individual variables constituting the system. Put differently, the sum of the individual parts does not necessarily equal the whole.

Systems thinking has been applied in this SIA for its ability to engage with complexity and uncertainty; something conventional reductionist and empirical research methods fails to do effectively. Of particular interest are the unintended consequences or causal relationships of the proposed development (indirect impacts), as well as the cumulative impacts likely to result from it. Such impacts are systemic consequences and are therefore complex in nature.

The CLD presented in Figure 3.8 is a simplified representation of the SES of which Kenhardt is part. The CLD contains system variables (i.e. goods, services and stocks of capital) displayed as boxes; linking relationships indicating the causal flow of goods, services and/or impacts which are displayed as arrows; and the polarity of causal flows (i.e. is the causal flow reinforcing or diminishing a subsequent variable), indicated by a "+" or "-" at the head of each arrow (reinforcing relationships are depicted in blue and diminishing relationships are depicted in red). Linking relationships represented by dashed arrows indicate weak causality, while solid arrows show strong causality (the thicker the arrow, the stronger the causal relationship). Together, these attributes of the CLD enables a more holistic understanding of causality and the relative impact of causal relationships.

Figure 3.8 consists of 27 causal relationships. However, of greatest importance to this study are relationships 9, 11 and 12. Relationship 9 indicates a strong causal relation between "Government subsidies" and "Livelihoods", wherein subsidies are heavily contributing to the livelihoods of the local community. Relationship 11 explains a strong causal link between "Energy sector developments" in the study area with "Livelihoods". Accordingly, new energy-related developments in the area are contributing significantly to livelihoods. Relationship 12 indicates that "Sheep farming" has a weak causal link with "Livelihoods", as it has a limited contribution to local livelihood strategies.

Both "Government subsidies" and "Energy sector developments" are variables which are sustained by exogenous capital flows (i.e. it is *not* generated and maintained by the

Kenhardt SES); however, both contribute significantly to local livelihood strategies. “Sheep farming” is endogenous to the SES (i.e. it *is* generated and maintained by the Kenhardt SES), but it is suggested that it only contributes weakly to local livelihoods. This suggests that the Kenhardt SES is vulnerable to exogenous shocks. Any proposed developments within the Kenhardt SES should therefore aim to reduce this vulnerability by growing the number of alternative endogenous livelihood strategies. The ability to choose from a variety of income streams (redundancy[6]) enables adaptive capacity within the system.

A second observation relates to relationships 21 and 22. Relationship 21 indicates a diminishing causal relationship between “Energy sector developments’ and “Biodiversity”. Similarly, relationship 22 explains a diminishing causal link between “Energy sector developments and “Tourism”. These relationships demonstrate that energy related developments in the study area will ultimately reduce biodiversity and could also negatively impact on tourism. Clearly, this could impact negatively on livelihood strategies related to biodiversity and tourism. However, the significant vulnerability of the SES to exogenous shocks and the subsequent need to transform exogenous capital flows into endogenous adaptive capacity; suggests that *limited* loss of biodiversity, tourism and subsequent income is acceptable in order to achieve greater *systemic* resilience.

[6] Redundancy is used here in a systems perspective, and aims to indicate that the SES under consideration does not necessarily function at equilibrium levels (i.e. a balance between supply and demand of goods, services and functions). Accordingly, an oversupply of income generating options, though not resulting in equilibrium, does cause greater adaptive capacity by allowing people to change from one option to the next as needed.

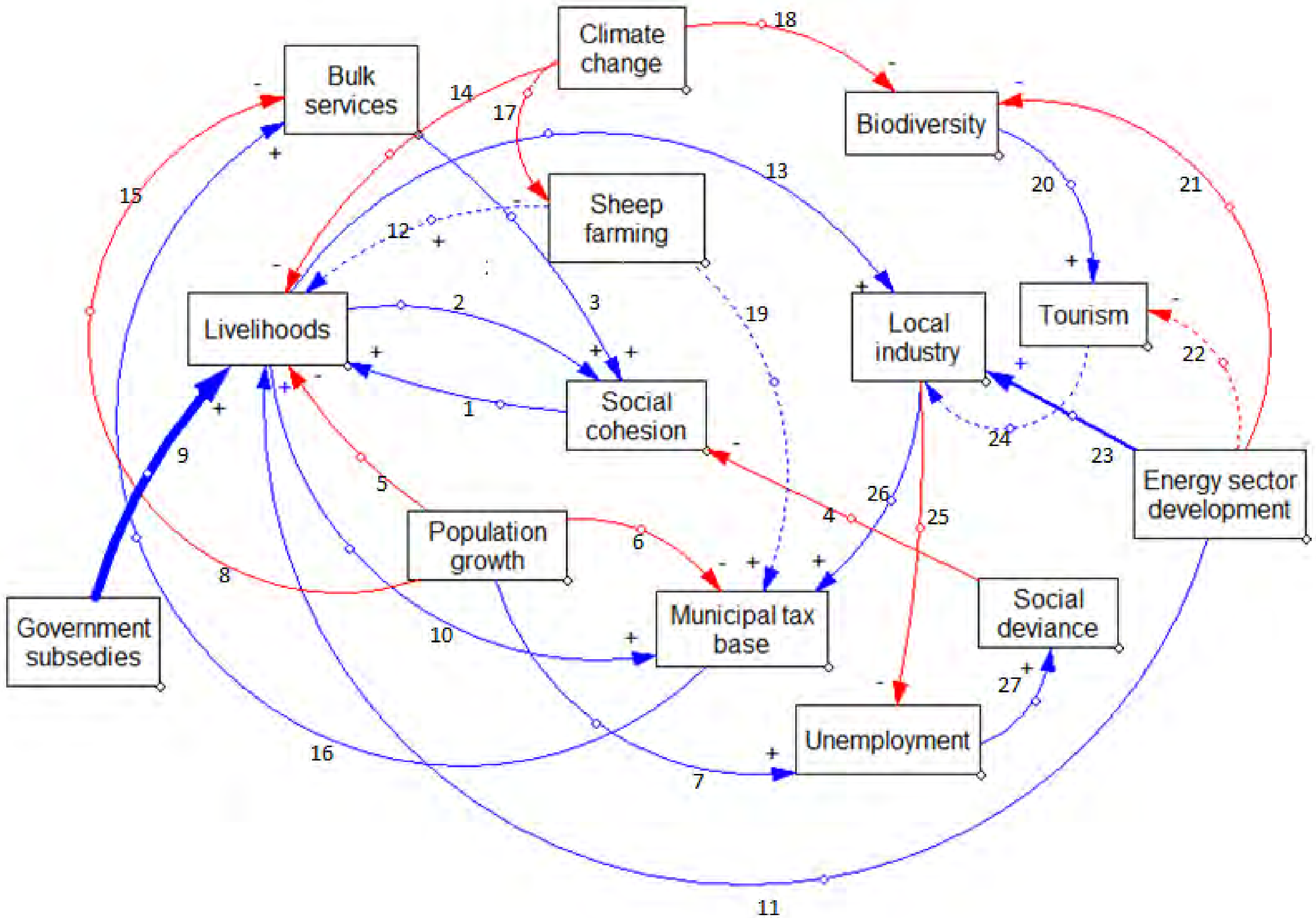

Figure 3.8 Causal Loop Diagram (CLD) of the Kenhardt Socio-ecological System (SES)

4 IDENTIFICATION OF KEY ISSUES AND ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

This section of the report discusses the expected social impacts resulting from the proposed Solar PV and transmission line projects near Kenhardt. These impacts are discussed in terms of its construction-, operational- and/or decommissioning phase impacts. Impacts are determined based on the assessment methodology discussed in Section D of the BA Report and Chapter 4 of the EIA Report.

All proposed projects will result in the same anticipated impacts. This is due to the remote location of the actual project footprint and the subsequent absence of substantial concentrations of people (i.e. communities) wherein socio-economic impacts could manifest. As previously noted, Kenhardt is the closest settlement; accordingly, most of the significant socio-economic impacts are expected to be experienced here.

4.1 KEY ISSUES IDENTIFIED DURING THE PROJECT INITIATION AND SCOPING PHASE

By far the most significant driver of change likely to result from the proposed project is the influx of people into the study area, and the corresponding increase in spending and employment. Such an influx of "strangers" into the receiving environment is likely to cause a disturbance in the order of the existing social structure and might also lead to increases in social deviance. Increased spending and employment (even though such employment might be short-term) generates positive impacts through the multiplier effect and by providing much needed financial relief in the area. However, it also creates significant, and often unrealistic, expectations regarding potential employment. The specific influence of anticipated impacts on woman and children will be an important consideration in the SIA.

During the Project Initiation Phase in July 2015, the Background Information Document was made available to I&APs for a 30-day comment period. The Scoping Report was released for a 30-day comment period which extended from 25 September 2015 to 27 October 2015. The Addendum to the Scoping Report was also released for a 30-day comment period, extending from 6 October 2015 to 5 November 2015. To date, no specific comments have been raised by I&APs that relate to social impacts. However, the following comment relating to the change in land use was raised by the Northern Cape Department of Environment and Nature Conservation on 5 November 2015:

- The EIA should indicate how the Social-Agricultural-Conservation dynamic will change in terms of land use. Will the properties on which the developments occur still be actively farmed or will they become dormant or effectively be converted into conservation land with minimal land use management. Will problem animal control still occur as in standard practice in small livestock farming? How will fencing infrastructure change around the properties which has a bearing on problem animal control, but also on wildlife movement and landscape connectivity.

The above comment asks multiple questions, some of which fall beyond the scope of the SIA (e.g. issues related to conservation management, land-use management, fencing and problem animal control). However, the issue of whether the farms on which the developments are proposed will still be actively farmed once the developments are operational appears to have at least some bearing on social impacts likely to result from the project.

Given the limited footprint of the proposed developments in relation to the overall size of the relevant properties, and given the large surface area but low density nature of sheep farming; the likelihood of property owners abandoning their commercial farming operations as a result of the presence of the proposed solar PV plants on their properties appears unlikely. This is due to the fact that sheep farming will remain commercially viable and profitable on the remaining extents of the affected properties and it would therefore be economically irrational to abandon such a profitable income generating activity (in which the property owners have invested money over extended periods of time) simply because an additional income generating activity (i.e. solar PV plants) is present on their properties. Furthermore, to the best of the author's knowledge, other South African farms on which commercial-scale solar PV plants have been constructed are still being actively farmed. This would suggest that the abandonment of farming in favour of limited passive income from solar PV plants is a conceivable, but relatively unlikely impact to result from the proposed projects.

4.2 IDENTIFICATION OF POTENTIAL IMPACTS

Based on the status quo conditions of the study area and the nature of the proposed development, the following social impacts are identified:

- Influx of jobseekers;
- Increases in social deviance;
- Increases in incidence of HIV/AIDS infections;
- Expectations regarding jobs;
- Local spending;
- Local employment;
- Human development resulting from the proposed Economic Development Plan; and
- Job losses at the end of the project life-cycle.

The above mentioned impacts are discussed and assessed according to its relevant construction phase and operational phase (Section 4.3) and decommissioning phase (Section 4.4) impacts, as well as expected residual (Section 4.5) and cumulative impacts (Section 4.6) below.

4.3 CONSTRUCTION AND OPERATIONAL PHASE IMPACTS

Social impact discussed in this section is expected to occur in the construction phase and persist into the operational phase of the project.

4.3.1 Potential Impact 1: Influx of job seekers

Construction of the proposed projects is likely to attract job seekers to the town of Kenhardt. Such an influx generally causes a disturbance in the existing social order as prevailing leadership, kinship and social control mechanisms are challenged by new and alternative values, beliefs and practices. Disturbance of the existing social order commonly results in the deterioration of social capital and general disorientation of affected communities. Furthermore, in-migration is likely to place additional strain on formal housing and bulk services. This can lead to a growth in informal housing and a deterioration of hygiene conditions in informal areas. It should however be noted that influx of job seekers is considered as a social disruptor and not an impact in itself. Accordingly, disturbance in the existing social order might result from such an influx, or it might not. The influx of job seekers, in the interest of the precautionary principle, is treated as an impact for the purposes of this impact assessment process.

The potential impact is expected to be ***long to medium term*** in duration and ***local in extent***. Influx of job seekers into the study area is therefore rated as having a ***moderate significance (negative)*** rating before mitigation. Should the mitigation measures discussed below be implemented, this significance rating will drop to ***low***.

Mitigation

The proponent (Scatec) must develop a Workforce Recruitment Policy. This policy must clearly state the criteria used to allocate jobs. It is strongly recommended that the Workforce Recruitment Policy should reserve employment, where practically possible, for local residents (particularly for vulnerable groups such as women and previously disadvantaged individuals). This requirement should be contractually binding. Local in this regard is defined as firstly, the residents of Kenhardt (given its close proximity); followed by the residents of the other urban nodes in the immediate area (I.e. Grobelaarshoop, Marydale and Keimoes). Position should only be filled with outsiders should the requisite skills not be available in the study area.

The proponent must also clearly define who is considered to be local (Kenhardt) residents; known as the Project Affected People (PAP). This should ideally be conducted in collaboration with the local community and local government structures. The purpose of demarcating the PAP is to develop a criterion of characteristics considered to identify a given job seeker as a PAP. Once this criterion is known; all subsequent job seekers can be screened against it in order to determine whether they qualify for employment. The criterion for a PAP should be incorporated into the Workforce Recruitment Policy.

It is also suggested that the proponent assembles a database of local residents and their relevant skills and experience (in collaboration with local structures such as the NGO

Marcyrox: www.marcyrox.org) well in advance of the construction phase of the project. This will assist in the early identification of a suitable workforce. Should a similar database already be available in the study area; it can be used by the proponent to achieve the same purpose. However, such an existing database must be regarded as legitimate by the local community in order for it to be used as a substitute by the proponent.

Finally, the proponent must develop a Stakeholder Engagement Plan which sets-out the communication strategy to be followed with regards to the proposed projects. This should be done well in advance of the construction phase of the project. The intention of the plan should be to ensure that all project related information (including those related employment) is communicated: (*i*) accurately; (*ii*) timeously; (*iii*) to the appropriate constituency; (*iv*) in an appropriate format; and is aimed towards fostering realistic expectations.

4.3.2 Potential Impact 2: Increases in social deviance

In-migration into the study area, particularly Kenhardt, could lead to an increase the incidence of teenage pregnancies, drug abuse, prostitution and other socially deviant behaviour. As discussed above, such increases are associated with the social disturbance caused by in-migration; however, it is also related to a growth in alternative livelihood strategies (e.g. prostitution) and conflict regarding limited employment opportunities. Increase in socially deviant behaviour could deteriorate both Social and Human capital through the violation of cultural norms and values (Social capital), as well as through the spread of Sexually Transmitted Diseases (STDs) (Human capital).

This impact is expected to be ***long term to medium term*** in duration and ***local*** in extent. Increases in social deviance within the study area are therefore rated as having a ***moderate significance (negative)*** rating before mitigation which drops ***to low significance*** after mitigation. Increases in social deviance are extremely difficult to control and often lies outside the exclusive control of the proponent as it is driven by complex socio-ecological conditions related to poverty and feelings of hopelessness.

Mitigation

Mitigation against increases in social deviance is largely indirect in nature. In other words, the overall success of the project and the ability and commitment of the proponent to involve the local community in the benefits of the project is of much greater importance than direct interventions. This is due to the need to change the prevailing conditions of unemployment, poverty and disempowerment, as opposed to command and control mechanisms aimed at simple regulation of activities.

The mitigation measures proposed for Potential Impact 1 must also be used to mitigate impacts resulting from increases in social deviance, as Potential Impact 1 is a precursor to Potential Impact 2. Furthermore, the proponent should be contractually bound to deliver on its Economic Development Plan for the area once the proposed projects are successfully awarded preferred bidder status.

Though not an official mitigation measure; it is proposed that the proponent seeks to actively engage with Marcyrox NPC to investigate possible synergies in community development within Kenhardt.

4.3.3 Potential Impact 3: Expectations regarding jobs

Informants in the Kenhardt area indicated a significant level of frustration with other potential developments in the area due to expectations related to possible employment. Unrealised expectations in a poor community could lead to feelings of desperation, disempowerment, anger and a general distrust in developers. In isolated cases, such frustration of expectations might lead to malicious damage of project property and intimidation of employees.

The impact is expected to be ***short term*** in duration and ***local in extent***. Influx of job seekers into the study are is therefore rated as having a ***low (negative)*** rating before mitigation. Should the mitigation measures discussed below be implemented, this significance rating will drop to ***very low***.

Mitigation
It should be recognised that expectations of employment are probably unavoidable in totality. However, proper implementation of the Stakeholder Engagement Plan proposed for Potential Impact 1 should lead to realistic expectation of employment for most of the local community. It is important to note that communication should not only elaborate on what kind of employment is on offer and to whom it is offered; but also the worst-case timeframe for such employment to commence. Forewarned community members are better equipped to adjust livelihood strategies to the variability of the project timeframe.

4.3.4 Potential Impact 4: Local Spending

Procurement of goods and services in the Kenhardt area during the construction and operational phases of the proposed projects is likely to hold socio-economic benefits as a result of the multiplier effect (i.e. the increase in final income resulting from a new injection of spending). Such benefits are already evident in Kenhardt as a result of other energy-related developments in the area. As indicated earlier, B&B establishments appear to dominate local industry in Kenhardt as a result of increased numbers of consultants and project staff frequenting the area. It is therefore reasonable to assume that the proposed project will result in similar positive impacts.

A secondary positive impact might result from entrepreneurial development in the project area, whereby niche and/or supporting goods and service industries are developed in response to the demand created for such services in the area. It is important to note the unintended consequence related to this positive impact. Clearly, the economic pull factors created by demand could lead to the in-migration of outsiders.

The impact is expected to be ***medium to long term*** in duration and ***local in extent***. Local spending in the study area is therefore rated as having a ***low significance (positive)*** rating.

Enhancement

The proponent must procure goods and services, as far as practically possible, from within the project area (with a focus on Kenhardt). Only if required goods and services are not available in the study area should the proponent seek to obtain it elsewhere. It is also suggested that regularly required goods and services (e.g. food and accommodation) be obtained from as large a selection of service providers as possible to ensure distribution of project benefits.

4.3.5 Potential Impact 5: Local Employment

The creation of short term employment for low skilled community members in the study area, though not ideal, does provide much needed temporary financial relief, while also contributing to a sense of empowerment and dignity. The limited number of long term employment offered by the proponent provides long term (small scale) socio-economic benefit to the affected community and may also contribute to the multiplier effect, as more income generally results in greater spending.

Local employment not only improves access to Financial capital, but also boosts Human and Social capital as skills sets and experience increases and reciprocal and kinship relationships are invigorated through the ability to give and support. Importantly, on an individual level, employment has the ability to empower people. Such empowerment could lead individuals (and communities) to perceive themselves not as suffering entities, but as active, doing entities that has the ability and potential to change their environment in a positive way (Davids, Theron & Maphunye, 2005).

The impact is expected to be ***long term*** in duration and ***local in extent***. Local employment is therefore rated as having a ***moderate significance (positive)*** rating.

Enhancement

As recommended for Potential Impact 1, the proponent must develop a Workforce Recruitment Policy. This policy should reserve employment, where practically possible, for local residents (particularly for vulnerable groups such as women and previously disadvantaged individuals). This requirement should be contractually binding on the proponent.

Though not an official mitigation measure; it is proposed that the proponent actively engages with the local government and other NGOs and CBOs to investigate how skills can be developed to enable short term workers to gain the necessary skills in pursuit of longer-term employment. Such employment does not necessarily have to be with Scatec.

4.3.6 Impact 6: Human development via the proposed Economic Development Plan

Scatec indicated that an Economic Development Plan will be developed, should the proposed project be successful (i.e. selected as a preferred bidder, not merely obtaining a positive Environmental Authorisation). The proposed Economic Development Plan aims to achieve the following broad objectives:

- Create a local community trust which has an equity share in the project life to benefit historically disadvantaged communities;
- Initiate a training strategy to facilitate employment from the local community; and
- Give preference to local suppliers of components for the construction of the facility.

It is recognised that this plan is still in its infancy and will be refined once the proposed project has reached maturity. However, it is clear that even the obtainment of the broad objectives alone will result in significant positive and negative impacts.

The positive impacts are self-evident and will relate to the creation of employment, local spending and human capacity development. However, the attainment of these positive impacts will create substantial social and economic pull factors which are likely to attract job seekers. Such job seekers will not only be attracted by the employment offered by Scatec, but also by the secondary growth and development which might result from the Economic Development Plan. Accordingly, negative socio-economic impacts resulting from in-migration are inherent to the positive impacts of the Economic Development Plan. Such negative impacts are however considered to be acceptable in light of the much needed development in the area. Furthermore, these negative impacts are largely unavoidable, especially through EIA-level (i.e. project-level) interventions; as it is caused by complex structural inequalities which needs to be addressed at a strategic policy level. Subsequently, no mitigation is proposed.

The impact is expected to be ***long term*** in duration and ***local in extent***. Human development is therefore rated as having a ***moderate significance (positive)*** rating.

<u>Enhancement</u>

A systems thinking approach (discussed in Section 2.2.3) reveals that the SES of which the Kenhardt area is a part of, can be considered to be vulnerable. This vulnerability is attributed to, amongst others, the system's disproportional dependence on exogenous flows of capital for its continued existence. It is therefore imperative to build resilience within the SES to enable greater adaptive capacity. Such adaptive capacity could be created by growing the skills base of the local community. However, such skills development should not be limited to vocational training relevant to the solar energy industry, but should also be extended to address life skills and other relevant skills/competencies as might be required.

The Economic Development Plan, once fully developed, must be implemented. It is also proposed that the proponent should engage with local NGOs, CBOs and local government structures to identify and agree upon relevant skills and competencies required in the Kenhardt community. Such skills and competencies should then be included in the proponent's Economic Development Plan. The proponent must also align economic development and skills development initiatives with the Kai !Garib Local Municipality's IDP objectives.

4.4 DECOMMISSIONING PHASE IMPACTS

Impacts identified in this section are expected to occur during the decommissioning phase of the proposed projects. Decommissioning of the proposed solar energy developments and transmission lines entails termination of most (if not all) local created employment opportunities.

4.4.1 Impact 7: Job Losses

It is expected that the proposed projects could be decommissioned after an operational lifespan of approximately 20 years. Decommissioning of the proposed development will result in job losses. Though unavoidable in projects of this nature, appropriate measures should be taken to plan for such retrenchments and to provide the affected community with alternatives where practical and appropriate. Secondary impacts might result from incorrect decommissioning of project infrastructure which might be used for inappropriate purposes. This in turn could result in health and safety impacts on the local community.

This impact is expected to be ***long term*** in duration and ***local*** in extent. Job losses resulting from decommissioning within the study area are therefore rated as having a ***moderate significance (negative)*** rating before mitigation and ***low (negative)*** with mitigation. This impact is however considered to be acceptable in light of the local need for employment and development.

<u>Mitigation</u>
The proponent must comply with relevant South African labour legislation when retrenching employees. Scatec should also consider appropriate succession training of locally employed staff earmarked for retrenchment during decommissioning. Such training could gradually equip workers to enter gainful employment in other locally viable sectors. Finally, all project infrastructures should be decommissioned appropriately and thoroughly to avoid misuse.

4.5 RESIDUAL IMPACTS

A number of potential negative socio-economic impacts resulting from the proposed projects are likely to persist regardless of proposed mitigation measures. Increases in social deviance are unlikely to be mitigated completely and a certain measure of social disruption and loss of social capital must be accepted as part of the proposed developments. Secondly, an influx of job seekers will occur in spite of the mitigation proposed. In-migration is a double edged sword; as not all in-migration necessary leads to social disruption. Lastly, job losses once the project reached the end of its operational lifespan are unavoidable.

4.6 CUMULATIVE IMPACTS

Socio-ecological cumulative impacts associated with the proposed projects, as with most cumulative impacts, are notoriously difficult to predict. Part of this challenge is due to the fact that a certain level of educated guesswork is required in order to construct a probable picture of the future as it relates to socio-economics in particular and the development in the area in general. Significant subjectivity in this regard should not be denied, nor should it be rejected. When faced with complex problems, like cumulative impacts, conventional reductionist and empirical processes tend to become less useful. It is therefore appropriate to employ subjective (but informed) reasoning as a pragmatic solution.

Development of more solar energy facilities and associated electrical infrastructure (such as transmission lines) in the study area is likely to negatively impact on biodiversity, farming and tourism. These impacts might further negatively affect local industries, and consequently diminish certain livelihood strategies. However, the relationship of biodiversity, tourism and farming to the majority of local livelihood strategies is weak (Section 3.3.3). As a result, cumulative impacts on biodiversity, tourism and farming in the study area appear to be acceptable.

Similarly, the incidence and severity of the in-migration of job seekers as well as increases in social deviance might increase as more solar energy facilities and associated electrical infrastructure (such as transmission lines) are developed in the study area. This is of importance as several other solar energy developments are being proposed in the Kenhardt area (e.g. the Mulilo Renewable Project Developments (PTY) Ltd Nieuwehoop Phase 1 and Phase 2 solar energy developments), as listed in Section D of the BA Report and Chapter 4 of the EIA Report. However, such increases are also associated with most other forms of economic and social development and should therefore be expected from any industrial scale developments in the study area.

Finally, the cumulative success of the proposed project and other projects offering significant socio-economic benefits are likely to present a major economic pull factor which might exacerbate in-migration into the study area as well as increases in social deviance. However, the cumulative socio-economic benefit offered by industrial scale development in the study area outweighs the negative impacts associated with economic growth. It should also be borne in mind that influx of job seekers does not necessarily equate in social deviance; i.e. influx of job seekers is a social disruptor which *could* result in social impacts. Given the relative balance between cumulative benefits and impacts, the significance rating ascribed to the cumulative impact of the proposed development is rated as is expected to be of ***long term to medium term*** in duration, ***local*** in extent and of ***moderate significance*** (negative) rating.

Table 4.1: Impact rating table

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
CONSTRUCTION AND OPERATIONAL PHASE													
Impact 1: Influx of job seekers into the Kenhardt area	Disruption of existing social structures	Negative	Local	Medium to Long-term	Substantial	Likely	Low	Moderate	• Develop and implement a Workforce Recruitment Plan • Reserve employment, where practical, for local residents • Clearly define and agree upon the PAP • Develop a database of PAP and their relevant skills and experience • Develop and implement a Stakeholder Engagement Plan	Moderate	Low	4	Medium

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
Impact 2: Outsiders moves into the Kenhardt area	Increases in social deviance	Negative	Local	Medium-term	Substantial	Likely	Low	Moderate	• Develop and implement a Workforce Recruitment Plan • Reserve employment, where practical, for local residents • Clearly define and agree upon the PAP • Develop a database of PAP and their relevant skills and experience • Develop and implement a Stakeholder Engagement Plan • Delivery on the Economic development Plan must be contractually binding on the proponent	Moderate	Low	4	Medium

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
Impact 3: Expectations created regarding possible employment	Increased frustration in the local community	Negative	Local	Short-term	Moderate	Likely	High	Moderate to low	• Develop and implement the Stakeholder Engagement Plan	Low	Very low	5	Medium
Impact 4: Local spending	Socio-economic benefits as a result of the multiplier effect	Positive	Local	Medium to long-term	Moderate	Likely	n/a	n/a	• Procure goods and services, where practical, within the study area • Obtain regularly required goods and services from as large a selection of local service providers as possible	Low	Low	4	Medium
Impact 5: Local employment	Socio-economic benefits	Positive	Local	Long-term	Substantial	Very likely	n/a	n/a	• Develop and implement a Workforce Recruitment Policy	Moderate	Moderate	3	High

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
Impact 6: Economic Development Plan	Contribute to local employment, local spending and human capacity development	Positive	Local	Long-term	Substantial	Very likely	n/a	n/a	• The proponent should engage with local NGOs, CBOs and local government structures to identify and agree upon relevant skills and competencies required in the Kenhardt community • Such skills and competencies should then be included in the Economic Development Plan • Where possible, align Economic development Plan with Local Municipality's IDP	Moderate	Moderate	3	High
DECOMMISSIONING PHASE													

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
Impact 7: Decommissioning of the proposed development	Job losses	Negative	Local	Long-term	Substantial	Very likely	Moderate	Moderate	• The proponent should comply with relevant South African labour legislation when retrenching employees • Scatec should also implement appropriate succession training of locally employed staff earmarked for retrenchment during decommissioning • All project infrastructures should be decommissioned appropriately and thoroughly to avoid misuse	Moderate	Low	4	High

Aspect/ Impact pathway	Nature of potential impact/risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/resource	Potential mitigation measures	Significance of impact/risk = consequence x probability		Ranking of impact/risk	Confidence level
										Without mitigation /management	With mitigation /management (residual risk/impact)		
CUMULATIVE IMPACTS													
Exacerbated in-migration	Disruption of social structures	Negative	Local	Medium to long-term	Substantial	Likely	Low	Moderate	n/a	Moderate	Moderate	3	Medium

5 INPUT TO THE ENVIRONMENTAL MANAGEMENT PROGRAMME

The key mitigation measures proposed by the specialist, and which needs to be included in the EMPr are listed below.

Construction and Operational Phase Mitigations:

- Develop and implement a Workforce Recruitment Plan;
- Reserve employment, where practical, for local residents;
- Clearly define and agree upon the PAP;
- Develop a database of PAP and their relevant skills and experience, or use an existing legitimate database of skills and expertise;
- Develop and implement a Stakeholder Engagement Plan;
- Delivery on the Economic Development Plan must be contractually binding on the proponent;
- Procure goods and services, where practical, within the study area;
- Obtain regularly required goods and services from as large a selection of local service providers as possible;
- The proponent should engage with local NGOs, CBOs and local government structures in the Kenhardt community to identify and agree upon relevant skills and competencies required;
- Such skills and competencies should then be included in the Economic Development Plan; and
- Where possible, align the Economic Development Plan with Local Municipality's IDP.

Decommissioning Phase Mitigations

- The proponent should comply with relevant South African labour legislation when retrenching employees;
- Scatec should also consider appropriate succession training of locally employed staff earmarked for retrenchment during decommissioning; and
- All project infrastructures should be decommissioned appropriately and thoroughly to avoid misuse.

Monitoring recommendations for the above mitigation measures are included in the complete EMPr (included as Part B of the EIA Report and Appendix G of the BA Report).

6 CONCLUSION AND RECOMMENDATIONS

Very little socio-economic data is available for the study area. Census data and information from the Kai !Garib Local Municipality Draft IDP (2014) was obtained; however, these only deal with the larger municipal area and offer no site specific data on socio-economic conditions within and around the town of Kenhardt. Secondary data was subsequently augmented by a site visit. The site visit suggests that Kenhardt is an area of low employment, substantial poverty and limited livelihood strategies. Access to Human and Social capital appears to be acceptable, while access to Physical capital seems average. However, access to Natural and Financial capital is limited. This constrained access to capital limits the ability of vulnerable members of the community to adapt livelihood strategies should it be required; which results in vulnerability.

The main income source among vulnerable communities appears to be government subsidies, with limited income generated from employment within industries operating in Kenhardt. Social deviance (i.e. teenage pregnancy and drug abuse) is a major challenge in the area. Such deviance could threaten Social capital on which much of the existing livelihood strategies depend. Unemployment seems to be the single greatest challenge and problem driver in Kenhardt. Not only does unemployment deprive community members from income, it also constrains empowerment and the subsequent ability to perceive one’s subjective social reality as meaningful. This more often than not exacerbates social deviance.

Vulnerable community members might be negatively impact by the proposed project through the influx of opportunistic job seekers. Such an influx might threaten existing social structures and could lead to increased pressure on bulk services and housing. Social deviance might also be increased as a result of the proposed project; as deviant behaviour (e.g. prostitution and teenage pregnancy) are likely to increase as more outsiders migrate into Kenhardt in search of employment. Frustrated expectations of employment, created by the proposed development, could also contribute feelings of distrust in the developer and, in isolated instances, damage to project property and potential intimidation of staff. Furthermore, the likelihood of job losses once the proposed project reaches its decommissioning phase is high.

Positive socio-economic impacts likely to result from the project are increased local spending, the creation of local employment opportunities and the proposed development of an Economic Development Plan. These impacts will benefit the community through the creation of income generation opportunities and human development through skills development and training.

No conditions are proposed for inclusion in the environmental authorisation.

It should be noted that from a social perspective, the applicant can select any 250 ha area within the larger **surveyed** area to build the PV plants and associated transmission lines, provided that the recommended mitigation measures are implemented as applicable. As explained earlier, this is due (i) to the relative homogenous nature of the surveyed area, and (ii) the relative remoteness of the surveyed area in relation to any major urban node or human settlement where social impacts are likely to manifest.

6.1 OVERALL SIGNIFICANCE RATING AND SPECIALIST OPINION

The overall significance rating of the *negative* socio-economic impacts associated with the proposed project is ***low to moderate***; whereas the overall significance rating of the *positive* socio-economic impacts associated with the proposed development is ***moderate***.

It should be accepted that the development of the proposed projects is likely result in some form of negative social impact to the local community. However, such a negative impact needs to be weighed against the potential benefit likely to result from the same development. Given the overall medium significance negative impact of the project, as compared to the overall medium-high significance positive impact of the project; it can be concluded that the prospective socio-economic benefits of the proposed project outweighs the socio-economic losses/impacts. In addition, the local vulnerability context strongly suggests that acceptable, though declining, levels of Social and Human capital is present within the Kenhardt community, which should assist with the mitigation of potential negative socio-economic impacts resulting from the proposed project. Conversely, very limited Financial capital is available in the local community, which in turn adds to the erosion of existing Social and Human capital. Accordingly, there appears to be a clear need to invest in the development of Financial capital within the Kenhardt community in order to restore some level of balance between asset classes which in turn should facilitate more options to local community members in terms of viable livelihood strategies.

From a social impact perspective, in light of the above argument, the specialist conducting this SIA is of the opinion that the proposed projects should be authorised by the competent authority.

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APPENDIX A: EXTERNAL REVIEW REPORT

EXTERNAL PEER REVIEW

OF THE REPORT:

Social Impact Assessment for the Proposed 75 MW Solar Photovoltaic Facility and associated Transmission Lines on the remaining extent of Farm Onder Rugzeer 168, north-east of Kenhardt, Northern Cape Province.

PEER REVIEWER	**LIZA VAN DER MERWE**
EXPERTISE	• Resettlement Planning and Implementation • Social Impact Assessment • Land Acquisition • Social Monitoring
YEARS OF EXPERIENCE	• 28 Years
ORGANISATION	• Independent Consultant

PROJECT	Proposed 75 MW Solar Photovoltaic Facility and associated Transmission Lines
LOCATION	Remaining extent of Farm Onder Rugzeer 168, north-east of Kenhardt, Northern Cape Province
PROPONENT	Scatec Solar SA 163 (PTY) Ltd
EAP	CSIR
REPORT AUTHOR AND AFFILIATION	Rudolph du Toit (CSIR)
REPORT DATE	January 2016

3 February 2016

CONTENTS

1. BACKGROUND

I was appointed by the CSIR on 22 January 2016 to provide expert peer review of the above mentioned Social Impact Assessment (SIA) report. The peer review encompasses issues which include:

- Adequacy of the Social Impact Assessment (SIA);
- Validity of the report content; and
- Benchmarking against best practice.

2. DECLARATION

I **Liza van der Merwe**, declare that I am independent expert and that no conflict of interest exists in the performance of my review for the CSIR. In familiarising myself about the project, I have read the SIA report.

Liza van der Merwe
31 January 2016

3. SCOPE OF REVIEW

The scope of the review of the SIA report includes a focus on:

- Objective and non-judgemental presentation of information;
- Scientific validity and robustness of SIA methods;
- Technical credibility of report content;
- Impacts to be disaggregated from the impacts of other projects and the background social environment;
- Clear and systematic logic in identification of cause and effect relationships in terms of impact identification, quantification and assigning significance;
- Appropriateness and soundness of proposed mitigation and/or enhancement actions;
- Logical and systematic presentation of information;
- Identification of information gaps;
- Probability of alternative interpretations of impacts; and
- SIA Report is consistent with best practice.

4. REVIEW CRITERIA

The review is structured to assess the report in a systematic manner in terms of content, methodology, information gathering, data analysis, assessment and conclusions. The review is divided into the following sections:

1	**Project and SIA Context**: • Project description (project inputs and project activities) • Terms of reference • Issues of concern from Scoping Report	5	**Mitigation and Enhancement**: • Identification of mitigation options • Identification of enhancement opportunities • Identification of appropriate management actions
2	**Methodology**: • Data gathering • Method description	6	**Information Gaps, Uncertainty and Assumptions:** • Qualifying data sufficiency and reliability
3	**Social Baseline**: • community profile • Project affected people • Economic activities and livelihoods • Social systems • Use of natural resources	7	**References and Data Sources:** • Credible sources are listed
4	**Impact Assessment and Significance**: • Identification and understanding of social issues and linkages • social impact pathways • zones of influence • sensitive receptors • Linking social processes to social impacts • Differentiation of social impacts at the individual, household level and	8	**Report Structure:** • Organisation of information • Presentation of information

	community level • Job Creation • Population change • Social networks • Displacement and relocation • Economic opportunities (Lease Payments) • Tourism • Quality of Life • Social Cohesion • Health, noise and visual • Safety and security • Use and access to natural resources • Sense of place • Land acquisition		

5. PEER REVIEW SCORING SYSTEM

For each question posed under the Review Criteria, professional judgement is expressed in relation to the requirement for decision-making. Commentary is also provided to compare report content against best practice. The specific terminology used to express professional judgement is explained below:

- **Exceeds (E) requirements**: information exceeds requirements for decision-making. No changes to report section is required.
- **Meet (M) requirements**: the information meets requirements for decision-making. Minor edits/changes to report section is required.
- **Fail (F) to meet requirements**: the information does not meet the requirements for decision-making. Major edits/changes to report section is required.
- **Reject (R)**: Information cannot be used to decision-making. Major gaps in logic and content. Poor report writing and analysis. Section needs to be re-written.

6. PEER REVIEW SUMMARY FINDINGS

	Professional Judgement (E/M/F/R)	Comments
1. Project and SIA Context	**F**	The project description needs to be improved as suggested in this review. Examples of how the project description can be improved are given in Section 10 of this Review Report.
2. Methodology	**E**	The choice of systems theory and the application of social methods are commended. However, it is not carried through in the assessment, interpretation and design of mitigation measures.
3. Social Baseline	**M**	Social baseline is adequate, but can be improved as suggested in this review.
4. Impact Assessment and Significance	**M**	In general, impact assessment and significance ratings are adequate. However, there are areas for improvement and suggestions in this regard are provided in Section 11 of this Review Report.
5. Mitigation and Enhancement	**M**	Mitigation and enhancement measures proposed are adequate.
6. Information Gaps, Uncertainty And Assumptions	**E**	The SIA report clearly indicates the assumptions and inherent uncertainties.
7. References and Data Sources	**E**	The data sources and references are more than adequate.
8. Report Structure	**E**	The report structure is good.

7. PEER REVIEW CONCLUSIONS

The conclusion of the peer review is that the report is:

☐ **Good***:* The report exceeds the level and quality of information that is required for decision-making. No edits required to the report.

☑ **Adequate***:* The report meets the level and quality of information that is required for decision-making. Relatively minor information gaps in the report; requiring minimal changes.

☐ **Poor:** The report is of poor quality with flawed scientific logic. Major information gaps, requiring a complete report re-write. The report should be rejected.

8. PEER REVIEW RECOMMENDATIONS

In general the SIA report is adequate. Specific areas in the report have been identified in this peer review where the report can be improved.

9. DETAILED REVIEW QUESTIONS AND EVALUATION

		Professional Judgement (E/M/F/R)	Comments
1. PROJECT AND SIA CONTEXT			
i.	Does the report provide information on the project inputs, activities, sequencing of activities, nature of infrastructure and footprint of land required? Does the project description contain sufficient detail to understand the resultant social processes and likely impacts. Is there information on labour requirements (actual numbers, by sex and skills-base) and source(s) of such labour for both construction and operational phases?	**F**	The information provided in Section 2.1 (Project Information) does not give an indication of the spatial footprint (in hectares or m^2) of the infrastructure (e.g. PV facilities and transmission lines). There is also a lack of detailed information on the sequence of project activities. For social processes to be identified it needs to be linked to the detailed project activities during all phases of the project. It is suggested that a detailed "Project Activities Register/Table" be developed as a first step (a generic list of project activities is provided in Section 10 of this Review Report as an example). This should form the "y-axis" input to develop a detailed "social processes" list that forms the "x-axis" information in the matrix. The value of such a matrix gives the reader an immediate understanding of the social processes that can potentially be triggered by the individual project activities. Table 2.1 which outlines the employment opportunities and duration is useful, but not easily understood. It would be useful to differentiate between the specific skilled, semi-skilled and unskilled job categories. For example, it would be useful for local I&APs to know at this stage what the estimates are for semi-skilled labour such as for construction vehicle/heavy equipment operators (e.g. a rough estimate of the number of semi-skilled construction workers required to operate loaders, dump trucks, backhoes, excavators, bulldozers and graders). It is likely that for some local people are able to take advantage of the semi-skilled vehicle operator jobs on offer.
ii.	Does the report contain a terms of reference outlining the scope of the SIA?	**M**	Adequate terms of reference described.
iii.	Has the study area been delineated? Has the SIA defined the area of direct and indirect influence of the project? Has the social area of influence, likely impacted and beneficiary communities and stakeholders been identified?	**M**	SIA study area is defined as the urban node or human settlement at the town of Kenhardt. The project sites are on farm portions which have extremely low population densities.
iv.	Have location maps and existing land-use	**M**	It would be useful to include an additional map indicating the location of the PV facilities

	Professional Judgement (E/M/F/R)	Comments
patterns been provided?		and the transmission lines in relation to Kenhardt.
2. METHODOLOGY		
i. Is the theory and methods for the SIA explained? Is the selected SIA methodology appropriate for the project and location?	**i. E**	The author has a good grasp of social theory and methods and uses them appropriately. However, the author does not robustly use the theory and methods to inform data gathering, interpretation and analysis. The use of systems theory is commended; however, it is not carried through in the assessment, interpretation and design of mitigation measures.
ii. Are the data gathering techniques described?	**ii. M**	iii. Data gathering techniques are adequately described.
3. SOCIAL BASELINE		
i. Has the location of the local population in relation to the proposed project area been indicated?	**M**	SIA study area is defined as the urban node or human settlement at the town of Kenhardt.
ii. Has demographic information been provided (population size, age composition, growth, literacy levels, education, etc)?	**F**	Sufficient demographic and health information has not been provided to contextualise the background social environment (at the municipal level) within which the proposed project will be located. Information presented in Section 3.3.1 needs to answer the “so what” question to make it relevant for the project. Currently the demographic information and primary qualitative data (gathered from field work) is presented without sufficient interpretation and does not assess the implications of the data for the project. For example, what are the implications to the project of having “35% of households being female headed”? Or, what are the implications to the project of having a high unemployment rate. It would be useful to include demographic graphs on key social indicators such as population diversity, sex and age distribution, employment, income, households, education and poverty levels. Information on the amount of people in the local community who access social grants would have been useful to know.
iii. Has local community health status information been provided (HIV and AIDS prevalence, causes	**F**	No quantitative information has been presented on the health status of the local community. It needs to be stated whether this information is lacking. Qualitative

		Professional Judgement (E/M/F/R)	Comments
	of mortality, incidences of diseases such as TB, STIs; Life expectancy in project area)?		information from interviews reveals the prevalence of teenage pregnancies. Information on the health status of the local community has implications for the proposed project, as it provides an indicator of the ability of the local population to access opportunities from the project.
iv.	Have the Project affected people been identified?	**M**	The project affected people form the human settlement of the town of Kenhardt.
v.	Have the existing land uses and economic activities in the project area been described?	**M**	Adequate information is provided in Section 3.3.1
vi.	Has information on public safety and security been provided?	**F**	No information is provided on the existing levels of safety and security. In farming communities there is typically a feeling of over exposure to crime and stock theft. It would have been useful to even have a qualitative narrative on the perceived sense of safety and security.
vii.	Have the implications of the Local Integrated Development Plans and Spatial Development Plans for the project been analysed? What are the spatial policy and planning frameworks for the site and surround areas?	**F**	A cryptic overview is provided on relevant legislation and local plans and the implications for the project are not assessed. No indication is given whether a Spatial Development Framework exists for the Municipality and whether it covers the project site. A brief evaluation of the implications of the municipal planning frameworks would be useful. Even an indication that there are no implications would be useful to know, as well as a general recommendation that if the proposed project were to proceed, a significant development of this nature would need to be included in future municipal plans.
viii.	Does the report analyse the potential resilience and status of affected communities?	**E**	The report analyses vulnerability of the local community using an "Asset Pentagon", as well as provide an insight into social dynamic by applying systems theory in the form of a "Socio-ecological System Causal Loop Diagram". However, it would be useful if Figure 3.7 (Kenhardt Asset Pentagon) were to be analysed on much more detail, rather than the current high level generic evaluation. Section 3.3.2 (Vulnerability Context) can be much improved by a more in-depth analysis.
ix.	What are the existing land uses and land tenure patterns in the area?	**M**	Adequate information is provided (in Section 2.1) on land use and land tenure patterns for the project farm portions and surrounding area. Detailed information is provided for Kenhardt (in Section 3.3.1.2).
x.	What are the existing levels of municipal services (housing, water, electricity, schools, clinics, policing etc) and current state of infrastructure in	**F**	Information on the level of municipal services and the state of local infrastructure is not provided. An indication needs to be given whether there are any projects implications of the quality of municipal services and the state of infrastructure. Is the project (if it goes

	Professional Judgement (E/M/F/R)	Comments
the area?		ahead) totally independent of municipal services and the state of local infrastructure?
4. IMPACT ASSESSMENT AND SIGNIFICANCE		
4.1 General		
i. Does the SIA focus on the issues that most concern the community? Are the social issues that have been identified in the Scoping Report referred to in the SIA?	**M**	Issues raised in the Scoping Report are carried through to the SIA Report. However, I am not convinced that issues of concern from the landowner and farming community are reflected in the SIA report. An influx of job seekers, as well as a migrant construction workforce associated with the development, tends to increase the anxiety/concerns of farmers (real and perceived) with regards to issues of security, crime (stock theft) and negligence (e.g. the contractor leaving farm gates open).
ii. Are the discrete social impacts clearly identified?	**F**	The impacts identified in Section 4.2 are not impacts in my opinion. What are mostly listed are social processes. The impacts are the actual experiences by sensitive receptors to social processes triggered by the development. Section 4.2 needs to be edited to clearly differentiate what social processes are triggered by the different project activities and then identify what the actual social impacts are that are felt by the individual sensitive receptor groups. For example, the influx of job seekers is not a social impact, it is a social process. How receptors (be it the municipality or certain sections of the local community) experience this social process is what matters and is where the impacts are experience and manifested. To explain what I mean, I've included a generic list of social processes and social impacts (at the individual and community level) as an example in Section 11 of this Review Report.
iii. Are the social impact pathways identified?	**F**	Social impact pathways have not been identified. In addition, there is no clear link between project activities, social processes and the resultant social impacts.
iv. Are the spatial zones of influence identified?	**M**	Kenhardt is considered to be the area of influence.
v. Are the sensitive receptors (individuals, households and communities) clearly identified?	**F**	Particular sensitive receptors are not clearly identified. An analysis of the sensitive receptors and their levels of vulnerability need to be undertaken. For analysing "receptor sensitivity" you need to consider the type of receptor (namely, biological/ecological, human and physical receptor/feature) and their resilience to identified stressors. This is a particularly weak aspect of the SIA report.

	Professional Judgement (E/M/F/R)	Comments
		For each impact identified (in Section 4.2 and Table 4.1), there needs to be an identification of the particular "sensitive receptors". There is no way that a defined impact as a homogenous and equal impact across all community groups. The SIA makes the common mistake of not disaggregating impacts and differentiating how different groups experience impacts (e.g. women, unemployed men, farmers, etc.).
vi. Is there an indication whether residual impacts would be acceptable?	F	Discussion on residual impacts for each identified "impact" (in Section 4.2 and 4.3 and Table 4.1) is not adequately dealt with. There is hardly any indication of what the residual impacts are and whether they would be acceptable.
4.2 Community impacts		
i. <u>Population change</u>: Will the development lead to an increase in a certain section of the population? What would the impact of such a change be on the existing social environment?	F	The SIA report acknowledges the background local population increase. However, the report does not clearly distinguish what population segment will form the job seekers from outside.
ii. <u>In-migration of unemployed work seekers</u>: Will the development intentionally or unintentionally contribute to the in-migration of work seekers into the area? What would the impact of this change be on the existing social environment? Is rapid population growth predicted?	M	The report acknowledges the potential impact of the influx of job seekers on the population. However, the author assigns a "moderate negative significance" rating to the social process of "influx of job seekers. I disagree with this rating and believe that "with and without mitigation", the significance rating should be high. The reason is that no matter how good the Proponent is at communication and no matter the type of mitigation, it is inevitable that there will be an influx of job seekers and that it is highly likely that these job seekers will remain in the area after the construction period. No qualitative estimation is made of whether there is likely to be rapid in-migration. It is important to recognise that the dominant way in which governments and project proponents understand in-migration, is as a problem. In-migration of job seekers cannot be prevented. There is a powerful negative discourse around in-migration. In-migration is not a problem but rather a response to extreme poverty. In-migration needs to be acknowledged as an irreversible and integral part of rural livelihoods. A pragmatic approach to in-migration needs to be taken with the aim of facilitating the benefits and mitigating against the negative impacts faced by both the host community as well as the

		Professional Judgement (E/M/F/R)	Comments
			migrants. When in-migration is viewed through this lens, it then becomes clear that job seekers from elsewhere are also sensitive receptors that need to be acknowledged in the SIA report.
iii.	Disruption of social networks: Will the development impact on existing social networks? (e.g. due to the presence of outsiders in communities with a high degree of homogeneity and social cohesion)	**M**	Adequately dealt with in report.
iv.	Relocation or displacement of individuals or families: Will the development lead to relocation of residents? What will the implications be for their livelihood sustainability?	**M**	Not relevant.
v.	Disruption in daily living and movement patterns: Will the development change the lifestyle of residents? Will it impact on movement patterns? Will it divide communities physically	**M**	Adequately dealt with in report.
vi.	Job creation opportunities: Will the development lead to an increase or decrease in employment opportunities? Does the report clearly describe the gender, number and type of permanent and temporary employees required for each phase of the project, where the labour will be sourced from and the company's employment policies? Will skilled workers be imported? Will the local labour pool be qualified for professional, technical, and supervisory jobs? Has the report identified the secondary employment created indirectly by the facility (e.g. local stores, Bed & Breakfast, services)? Is loss of local labour from current jobs predicted (current workers may be tempted to	**M**	The report provides general information on job opportunities but does not disaggregate the jobs into the specific and typical type of jobs for unskilled, semi-skilled and skilled classes. No indication is given on whether the local labour would only be able to access the unskilled jobs. The SIA states that: "decommissioning of the proposed developments will result in job losses". The report needs to state what categories of permanent jobs would be lost. Section 10 in this Review Report outlines the activities/services that need to be performed during the Operation and Maintenance Phase. It is the jobs performing these services that will be lost.

		Professional Judgement (E/M/F/R)	Comments
	leave their jobs in pursuit of improved wages)?		
vii.	Infrastructure and services: Will the development create increased demand for basic services, e.g. water, electricity, sewerage, roads?	**M**	The SIA predicts that "in-migration is likely to place additional strain on formal housing and bulk services". I think it would be more plausible to suggest that in-migration is likely to be done by unemployed people desperate for jobs and who would likely stay in the informal settlement (which would not place a strain on formal housing and bulk services). In-migration in the short-term will cause a population increase and result in more job seekers for the limited available jobs.
viii.	Change in housing demands: Will the development create a housing need, e.g. due to the in-migration of construction workers?	**M**	The SIA report suggests that there will be additional strain on formal housing. No indication is given how the Proponent will deal with this matter. The Proponent may choose to specify to the Main Contractor, to price for the construction of temporary accommodation close to the construction site. In this instance, there will be no need for housing for the project. I recommend that the SIA Report includes a provision for the Proponent to commit to providing temporary accommodation.
ix.	Impact on other businesses: Will the development impact on tourism?	**M**	The SIA report considers tourism to only be affected at a cumulative level (when considered with the impact of all the regional renewable projects). No indication is given of whether this project would have any impact on tourism. It is likely that there will be no impact, except as a "curiosity feature" by South African tourists. A positive mitigation measure that can be considered, is for the Proponent to commit to installing interpretative signage on site and working with the local Municipality (to train tour guides) to include the PV facility as a tourism destination option.
x.	Local Content (economic): Will the development provide opportunities for local procurement and training? (e.g. rental housing, restaurants and stores, etc.)	**F**	The SIA report recommends that the proponent "must procure goods and services, as far as practically possible, from within the project area (with a focus on Kenhardt)". The report is lacking in detailing what the specific goods and services are that would be required. Section 10 below in this Review Report provides a list of the project activities and it can be inferred from this list what goods and services can realistically be provided from the local area.
xi.	Staff accommodation: Has accommodation (male and female) for construction and permanent staff been identified?	**F**	The SIA report recommends that: "accommodation be obtained from as large a selection of local service providers as possible to ensure distribution of project benefits". There is no indication in the report whether this is even possible. The SIA should at least have gathered data on whether there is sufficient rooms/housing available for construction staff.

	Professional Judgement (E/M/F/R)	Comments
4.3 Health impacts		
i. Spread of disease, addiction and antisocial behaviours: Has the the spread of HIV and its impacts on vulnerable groups such as women and children been identified? What are the health vulnerabilities of the host community? What are the predicted spread of the disease by construction workers, truck drivers and sex workers?	**F**	The SIA report does not provide any information on the existing health status of the local community and neither is there any indication and assessment of the likely spread of disease from the migrant construction workforce. This is a deficiency in the report.
ii. Gender (women and girls): Will the project have a negative effect on women and girls?	**F**	The SIA report gives no indication on the discrete and separate impacts of the project on women and girls. The gendered nature of impacts is totally ignored. The report needs to acknowledge that typically, construction work is mostly provided to males in the demographic group between 18-50 years old. The report does however highlight the need for the "Workforce Recruitment Policy" to provide opportunities for women.
iii. Psychosocial disorder: What impact will the project have on psychosocial disorders of local residents?	**F**	No indication is given of potential psychosocial disorders such as: stress, substance abuse, social disruption, unrest, violence and decreased tolerance.
4.4 Quality of life and social well-being impacts		
i. Quality of Life: Have impacts on the landscape character, natural setting and visual amenity been identified?	**F**	No indication is given on the impacts to "quality of life".
ii. Crime and safety: Will the development impact on existing crime (petty crime and stock theft) and safety patterns?	**F**	No indication is given on the impacts to "crime and safety".
iii. Social well-being: Will the development impact on the peaceful coexistence of communities? Will the development lead to conflict between sectors of the social environment? Will tensions form in communities where the economic benefits are not	**F**	Social well-being issues are not addressed in the report. There is no indication of issues related to: social cohesion and support structures, self-determination, human rights and equity.

	Professional Judgement (E/M/F/R)	Comments
necessarily equally shared among the residents? Will the community identity be preserved?		
4.5 Cultural and heritage impacts		
i. Heritage: Will the development impact on archaeological, historical or cultural resources?	**M**	Heritage issues appear to not be applicable for this site. However, there is no mention in the report that heritage issues are not relevant.
ii. Culture: Will the development impact on the customs, values, religious and spiritual beliefs?	**F**	No mention is made of the existing cultural patterns and whether it is an issue.
4.6 Land and natural resource impacts		
i. Livelihoods: Will the development impact on the landowners and local people's (legal or illegal, formal or informal) access to natural resources that help to sustain their livelihoods?	**M**	The SIA report clearly indicates that the livelihoods of landowners will not be affected.
ii. Land acquisition: Will the development negatively impact the landowner/land users by having a large spatial footprint that limits existing land use (such as loss of grazing land)?	**F**	The SIA report does not mention land acquisition at all. It can be inferred that land acquisition (even through lease contracts) will not impact the landowner. However, an indication should be given that land acquisition is not an issue.
iii. Land rezoning: Will the existing land be required to be rezoned before the Project can commence?	**M**	It can be inferred from the report that rezoning will not be an issue.
4.7 Economic Impacts		
Have the social implications of economic impacts been assessed?: • Change in modes of production • Changes in property values	**M**	It can be inferred from the report that there are no negative economic impacts.
4.8 Impact Identification		
i. Have direct and indirect/ secondary effects of construction activities and, where relevant, operation and decommissioning of the project been clearly explained (including both positive	**F**	The SIA report can be improved by clearly indicating what the individual project activities are (see Section 10 in this Review Report) and the consequential primary and secondary impacts (see Section 11 in this Review Report).

		Professional Judgement (E/M/F/R)	Comments
	and negative effects)?		
ii.	Is there a clear understanding of impact causation processes, by first listing in detail the project activities per phase and the corresponding social effect? Have social processes clearly been differentiated from social impacts?	F	This is an area of deficiency in the SIA report and needs to be addressed. See Section 10 and 11 in this Review Report for suggestions on improvements to the report.
iii.	Have impacts been identified in a non-judgemental manner?	M	The SIA report by and large uses non-judgemental language in the identification of impacts. My preference is not to use the term “socially deviant behaviour”, but rather “social disorders” or “psychosocial disorder”.
iv.	Are there clear linkages (in impact identification) to health and ecosystem services issues?	F	There is no clear link with other specialist study areas and no link with health and ecosystem services issues.
v.	Have cumulative impacts been assessed?	M	Adequately addressed in Section 4.6.
4.9 Assessment of Impacts			
i.	Are impacts described in terms of the nature, magnitude and probability of the change occurring and the effect (location, number, value, sensitivity) on sensitive receptors?	M	Impacts are adequately described in a consistent manner. However, no mention is made of “sensitive receptors”.
ii.	Has the timescale over which the effects will occur been predicted such that it is clear whether impacts are short, medium or long term, temporary or permanent, reversible or irreversible?	M	Timescale are adequately described in a consistent manner.
iii.	Have qualitative predictions of impacts been adequately expressed?	M	Qualitative predictions of impacts have been adequately expressed.
iv.	Where quantitative predictions have been provided is the level of uncertainty attached to the results described?	M	No quantitative impact predictions have been made in the SIA report.
v.	Have the impacts of the social environment on the construction and operation of the project been	F	The impacts/implications of the dynamics of the existing social environment on the project is not adequately described.

		Professional Judgement (E/M/F/R)	Comments
	considered?		
4.10 Impact Significance			
i.	Does the information include a clear indication of which impacts may be significant and which may not and to whom?	**M**	Significance is adequately dealt with in the report. However, the report can be improved by answering the question: "to whom is this impact significant"?
ii.	Has the significance of effects been discussed taking account of appropriate national and international standards or norms, where these are available?	**M**	Significance is adequately dealt with in the report.
iii.	Where there are no generally accepted standards or criteria for the evaluation of significance, is a clear distinction made between fact, assumption and professional judgement?	**M**	There is a clear distinction in the report between assumption and professional judgement.
iv.	Have the magnitude, location and duration of the impacts been discussed in the context of value and sensitivity?	**F**	Issues of value and sensitivity are not addressed.
5. MITIGATION AND ENHANCEMENT			
i.	Is there evidence of the application of the Mitigation Hierarchy? (in terms of the sequential application of the mitigation options from avoid ⇨ minimise ⇨ restore ⇨ compensate)	**F**	There is no evidence of the application of the Mitigation Hierarchy.
ii.	Does the report clearly state the objectives and specific goals for the management of social impacts, socio-economic conditions and historical/cultural aspects?	**M**	There is a clear indication of performance objectives.
iii.	Does the report describe the appropriate technical and management options to address each social impact, socio-economic condition and historical/cultural aspects for each phase of the	**M**	Appropriate management actions and mitigation measures have been proposed.

		Professional Judgement (E/M/F/R)	Comments
	project?		
iv.	Where appropriate, do mitigation methods considered include modification of project design, construction and operation, the replacement of facilities/ resources, and the creation of new resources?	**M**	Suitable mitigation measures have been proposed.
v.	Is it clear to what extent the mitigation methods are likely to be effective?	**F**	There is no indication of the likely effectiveness of the proposed mitigation measures. A “Workforce Recruitment Policy” is recommended. Employment in its totality cannot be reserved for local residents, as the report recommends. Neither can this requirement be contractually binding. In any case, who would be the two contracting parties to make this mitigation measure contractually binding? Local residents may not have the requisite skills to take advantage of the job opportunities. In addition, they may be untrainable for a variety of reasons and therefore not suited for the available jobs. In any event, it is the responsibility of the Contractor to recruit people for jobs and not the Proponent. All the Proponent can do is to define the overall project objectives (for unskilled, semi-skilled and skilled jobs and training). The objectives can then form part of the contractual obligations for the Main Contractor. How the objectives should be achieved should be left up to the Main Contractor. It is recommended that the Proponent develops a local skills database. The SIA report should clearly identify the performance objective for this mitigation measure. It should be recognised that the responsibility for developing the skills database can lie with the Proponent, but how it is used to achieve the objective of optimising local employment is dependent on the nature of the Contract for project implementation (e.g. whether a EPC contract is used). The Proponent would need to hand over the skills database for the Main Contractor to use.
vi.	Have negative social effects of mitigation measures been investigated and described?	**F**	The negative social effects of mitigation measures proposed have not been described.

		Professional Judgement (E/M/F/R)	Comments
6. INFORMATION GAPS, UNCERTAINTY AND ASSUMPTIONS:			
i.	Has field work been undertaken and if not, has the implications been acknowledged?	**M**	Field work has been undertaken and the qualitative information from the interviews has added richness to the social baseline.
ii.	Has issues of data sufficiency and reliability been addressed?	**F**	The SIA report needs to make a statement in this regard.
iii.	Have information gaps been identified and its implications assessed?	**F**	The SIA report needs to clearly identify the information gaps.
iv.	Have the SIA assumptions been disclosed?	**M**	Assumptions have been fully disclosed. The author states that the "The project boundary, in terms of socio-economics, is therefore arbitrarily constructed". This is not the case. The project boundary for socio-economics has been logically deduced, based on available information and the locality of settlements in the area.
v.	Has any scientific uncertainty inherent been acknowledged and communicated?	**M**	The SIA report does allude to areas of uncertainty.
7. REFERENCES			
i.	Does the report contain a reference list?	**M**	All sources have been fully referenced.
ii.	Are the reference sources credible and reliable?	**M**	Reference sources are scientifically credible.
8. REPORT STRUCTURE			
8.1 Organisation			
i.	Does the report contain an Executive Summary which provides a concise presentation of the most significant issues contained in the body of the SIA?	**M**	Clear Executive Summary provided.
ii.	Is the information logically arranged in sections?	**M**	Report is logically structured.
iii.	Is the location of the information identified in an index or table of contents?	**M**	Table of Contents provided.
iv.	Are the credentials of the report authors and specialists presented, with a clear indication of	**M**	CV of report author included in report.

		Professional Judgement (E/M/F/R)	Comments
	their respective contributions?		
8.2 Presentation			
iv.	Has information and analysis been offered to support all conclusions drawn?	**M**	Information and analysis is adequate, but interpretation can be improved as suggested in sections in this Review Report.
v.	Has information and analysis been presented so as to be comprehensible to the non-specialist, using maps, tables and graphical material as appropriate?	**M**	Information is adequately presented in graphics, maps and tables where appropriate.
vi.	Is the information balanced and unbiased?	**M**	Information is presented in a balanced manner.
vii.	Is the layout, language and overall presentation of the information accessible to both the lay public and decision-makers?	**E**	The author writes well and the language is clear and unambiguous.

10. GENERIC EXAMPLE OF CONSTRUCTION ACTIVITIES FOR THE DEVELOPMENT OF A PV FACILITY

	PROJECT PHASE	SEQUENCE OF DETAILED ACTIVITIES
1	Mobilisation / Site Preparation	• Installing perimeter fencing around the site • Locating temporary construction offices and construction equipment to site • Earthworks for construction of road access and construction parking areas, including vegetation clearing • Minor grading and trimming of areas for permanent site office and switchyard • Minor grading and trimming in array areas • Drum rolling and compaction of array areas • Installation of onsite erosion and sediment controls
2	Construction	• Install steel support posts for array tables • Trenching and wiring of underground cabling (DC and AC) • Attachment of tilt brackets and rails using prefabricated steel members • Connection of PV modules to the brackets • Installation of inverter and transformer skid • Commencement of site rehabilitation works within the development area
3	Commissioning	• Commissioning and testing of solar plant, noting that each array block would be commissioned as it is completed.
4	Demobilisation	• Removal of temporary construction facilities and completion of works within the development area and of temporary access tracks within the site.
5	Operation and Maintenance	Compared to other power generating technologies, solar PV power plants have low maintenance and servicing requirements. Activities include: • Inverter servicing • ground-keeping • security • Low technology module cleaning using brush trolley or dust broom

11. GENERIC EXAMPLE OF THE DIFFERENTIATION BETWEEN SOCIAL PROCESSES AND SOCIAL IMPACTS

Selected list of social processes	***Selected list of social impacts at the individual and household level***	***Selected list of social impacts at the community level***
Demographic processes ▪ Increase in population size (in-migration) ▪ Presence of newcomers (perceived or real cultural differences) ▪ Presence of temporary construction workers ▪ Presence of tourists *Economic processes* ▪ Conversion of economic activities ▪ Conversion of land use ▪ Increase in economic activity ▪ Decrease in economic activity ▪ Job creation or job loss *Social processes* ▪ Prostitution ▪ Excessive alcohol, drug use and gambling ▪ Opposition ▪ Pollution (air, water and dust) ▪ Litter ▪ Traffic ▪ Vandalism	▪ Debt bondage ▪ Reduced level of health ▪ Reduced mental health, increased stress, anxiety, alienation, apathy, depression ▪ Uncertainty about impacts, development opportunities, about own life as a result of social change ▪ Reduced actual personal safety ▪ Reduction in perceived quality of life, subjective well being ▪ Worsening of economic situation, level of income, property values ▪ Change in status or type of employment or becoming unemployed ▪ Decrease in occupational opportunities ▪ Objection/opposition to project, NIMBY (not-in-my-back-yard) attitude ▪ Dissatisfaction due to failure of a project to achieve heightened expectations ▪ Annoyance because of dust, noise, strangers or more people ▪ Increased density and crowding ▪ Reduced aesthetic quality, outlook, visual impacts	▪ Reduced adequacy of infrastructure (water supply, sewerage, services and utilities) ▪ Reduced adequacy of community social infrastructure, health, welfare, education facilities ▪ Reduced adequacy of housing ▪ Increased workload on institutions ▪ Increase inequity (economic, social, cultural) ▪ Increased unemployment level ▪ Loss of other options (opportunity cost) ▪ Increased actual crime or violence ▪ Increased social tensions, conflict or divisions within community

BASIC ASSESSMENT REPORT

Appendix D.8:
Traffic Impact Statement

TRAFFIC IMPACT STATEMENT:

Basic Assessment for the proposed development of a 132 kV Transmission Line to connect to the proposed 75 MW Solar PV Facility (Kenhardt PV 1) on the Remaining Extent of Onder Rugzeer Farm 168, and the Remaining Extent of Portion 3 of Gemsbok Bult Farm 120, north-east of Kenhardt, Northern Cape.

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March 2016

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FIGURES

TRAFFIC IMPACT STATEMENT

1 INTRODUCTION AND METHODOLOGY

As per the Plan of Study included in Scoping Report and subsequently approved by the DEA, it was indicated that a Traffic Impact Statement (TIS) will be produced by the CSIR to show the amount of traffic that can be expected during the construction and operational phases from the development of the proposed Kenhardt PV 1, Kenhardt PV 2, and Kenhardt PV 3 solar energy projects, as well as the proposed Kenhardt PV 1 – Transmission Line, Kenhardt PV 2 – Transmission Line, and Kenhardt PV 3 – Transmission Line projects near Kenhardt in the Northern Cape. In this regard, the study focuses on the regional setting in which these projects are proposed and the roads that will be utilised for these projects. The report has therefore been produced for all the projects due to the scale of the assessment and the fact that all the projects are going to use the same road infrastructure.

1.1 Terms of Reference

The key issues associated with the construction and operational phases of the project that will be assessed as part of the TIS are:

- Increase in traffic generation throughout the lifetime of the project;
- Decrease in air quality; and
- Increase in road maintenance required.

1.2 Assumptions and Limitations

The TIS has been based on the traffic information provided by Scatec. The traffic information was obtained from previous projects and estimates of similar projects currently proposed by Scatec.

2 APPROACH AND METHODOLOGY

2.1 Objectives

- Determine the current traffic conditions in sufficient detail so that there is a baseline against which impacts can be identified and measured;
- Identify potential impacts and cumulative impacts that may occur during the construction, operational and decommissioning phases of development;
- Provide recommendations with regards to potential monitoring programmes;
- Determine mitigation and/or management measures which could be implemented to as far as possible reduce the effect of negative impacts and enhance the effect of positive impacts; and
- Incorporate and address all issues and concerns raised by I&APs and the public (if applicable).

2.2 Methodology

The key steps followed in this assessment are:

- Review of available desktop information, including the South African National Roads Agency (SANRAL) National traffic count information, google earth images and similar projects; and
- Liaison with Transnet SOC Ltd regarding access roads to be used and requirements associated with it.

3 AFFECTED ENVIRONMENT

During all phases (construction, operation and decommissioning) of the project, traffic will be generated. The highest traffic volumes will be created during the construction phase. This includes activities associated with:

- Site preparation and transporting the construction materials, and associated infrastructure to the site; and
- Transportation of employees to and from the site on a daily basis.

The proposed project site can be accessed via an existing gravel road (an unnamed farm road) and the existing Transnet Service Road (private). Both access routes will be considered in the design of the facility and have been included in the proposed project. The R27 extends from Keimoes (in the north) to Vredendal in the south. The R27 is 6 m wide and falls within a 45 m road reserve. This National Road is designed for minimum daily traffic exceeding 1000 vehicle units. The Transnet Service Road can be accessed from the R27. The existing gravel road can be accessed from the R383 Regional Road also via the R27 National Road. The Transnet Service Road and unnamed farm road are both 7-8 m wide.

Should the Transnet Service Road be considered the preferred access road, it is proposed that an internal gravel road be constructed from the road to the proposed site. This internal gravel road is not expected to exceed 6 m in width. The length of the internal gravel road will be confirmed as the location, design and layout of the facility progresses. Discussions have been initiated and held with Transnet and the Project Applicant during the Scoping and EIA Process regarding the potential use of the Transnet Road and associated specific requirements. Transnet have informed the Project Applicant of their requirements that need to be met by the Project Applicant should the Transnet Service Road be used as to gain access to the site. These requirements will be considered in the design of the facility where required, and the details of the agreement will be finalised outside of this EIA Process.

A photo plate is included (Photos 1 - 4) to show the intersection of the Transnet Service Road with the R27 and the current condition of the roads.

Photo 1: R27 towards the south (taken towards Kenhardt). The board shows "Loop 14", located to the left, which is accessed via the Transnet Service Road. (Image source: Google, 2010)

Photo 2: The intersection of the R27 and Transnet Service Road, going towards Kenhardt. As can be seen on this image, the R27 was being upgraded in 2010 (Image source: Google, 2010)

Photo 3: The intersection of the R27 and Transnet Service Road, going towards Keimoes (Image source: Google, 2010)

Photo 4: The access point to the Transnet Service Road (Image taken: July 2014)

The closest roads to the site for which traffic counts are available show that the R383 (road between Kenhardt and Marydale) and the R361 (between Van Wyksvlei and Kenhardt) have Average Daily Traffic (ADT) counts of 35 and 41, respectively (SANRAL, 2007). The ADTs how that the current traffic volumes are well below the maximum traffic limits for the roads discussed above. Even though traffic will be generated during the construction and operation of the solar energy facility, given the low ADTs of the surrounding roads, it is not expected that the traffic generated by the solar energy facility will exceed the maximum daily traffic limits for the abovementioned roads.

4 TRANSPORT INFORMATION

The general current limitations on road freight transport are:

- Axle load limitation of 7,7t on front axle, 9,0t on single rear axles;
- Axle unit limitations are 18t for dual axle unit and 24t for 3 axle unit;
- Gross vehicle mass of 56t. This means a typical payload of about 30t;
- Maximum vehicle length of 22m for interlink, 18,5m for horse and trailer and 13,5 for a single unit;
- Width limit of 2,6m; and
- Height limit 4,3m.

Abnormal permits are required for vehicles exceeding these limits.

4.1 Solar Farm Freight

Materials and equipment transported to the site comprise of:

- Building materials (concrete aggregates, cement and gravel);
- Construction equipment such as piling rigs and cranes;
- Solar panels (panels and frames); and
- Transformer and cables.

The following is anticipated:

A. Building materials comprising of concrete materials for strip footings or piles will be transported using conventional trucks which would adhere to legal limits listed above.
B. Solar Panels and frames will probably be transported in containers using conventional heavy vehicles within the legal limits. The number of loads will be a function of the capacity of the solar farm and the extent of the frames (the anticipated number of loads are discussed below).
C. Transformers will be transported by abnormal vehicles.

4.2 Traffic generation

The traffic generation estimates detailed below have been determined based on a single solar energy facility and the associated electrical infrastructure (collector substation and transmission line).

- ***Construction Phase***

Approximately 800 x 40ft containers resulting in more or less 450 double axel trucks will come to site during the construction phase (i.e over a period of 9 to 24 months). In addition to this, more or less 20 light load trucks will come from and go to site on a daily basis during the construction phase. It is estimated that a total of 14 850 trips to the site, based on a 24 month construction phase.

In terms of water supply, the current proposal is to truck water to site via municipal water supply. It is estimated that 1 trip will be made by the water truck every 2 days. In total, this adds up to 365 trips by the water truck over a period of 24 months.

It is important to note that the construction period is likely to extend 12-14 months (as noted in Section A of the BA Report), however the worst case scenario has been considered in this TIS.

- ***Operational Phase***

More or less 4 light load trucks will come from and go to site on a daily basis and 1 small single axel truck to and from site on a weekly basis. The lifetime of the project is 20 years which means that the total amount of trips would be 30 240 over this period. For water supply, the current estimate is that 2 trips per month will be made by a water truck.

- ***Decommissioning Phase***

As per the construction phase, approximately 800 x 40ft containers resulting in more or less 450 double axel trucks will come to site during the decommissioning phase. The decommissioning phase usually takes 12 months (i.e over a period of 9 to 24 months). In addition to this, more or less 20 light load trucks to and from site will come and go to site on a daily basis.

5 IDENTIFICATION OF IMPACTS

The traffic impacts that will be generated by the proposed facility are detailed below. The impacts will largely occur during the construction phase of the project, since this is when the highest amount of traffic will be generated by the proposed facility (refer to Section 4.2).

The impacts identified and further assessed are:

1. Increase in traffic generation.
2. Accidents with pedestrians, animals and other drivers on the surrounding tarred/gravel roads.
3. Impact on air quality due to dust generation, noise and release of air pollutants from vehicles and construction equipment.
4. Decrease in quality of surface condition of the roads.
5. Cumulative impact of traffic generation of three projects and related projects.

6 ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

This section assesses the significance of the impacts identified in Section 5. Appropriate mitigation and management measures to reduce the significance of the negative impacts and promote the positive impacts have been included in the draft EMPr.

6.1 Increase traffic generation

As discussed in Section 4 of this report, conventional trucks, conventional heavy vehicles and abnormal vehicles transporting loads will need to come to site to deliver the infrastructure required for the solar facility. The impact of this on the general traffic would be negligible as the additional peak hour traffic would be at most 2 trips.

Significance of impacts without mitigation

Although the construction phase would have the greatest impact on traffic generated by the proposed project, the increase in traffic will only result in an addition of 2 trips during peak hour traffic (worst case scenario). Based on the traffic counts discussed in Section 3 of this report, the ADT for this area is between 35 - 41 vehicles. The R27 is designed for 1000 units per day and therefore, the additional traffic generated during the construction phase will have a **low** negative impact.

The operational phase will have a lower traffic generation since only the personnel permanently employed on site would need to go to site every day. It is not expected that this would exceed 4 trips per day. This negative impact would therefore be **very low.**

Since is it unclear at this stage what the traffic numbers will be in the Kenhardt area in 20 years' time and the amount of trucks required for decommissioning, the impacts associated with this phase of the project were based on the construction phase details given that this is the worst case scenario in terms of traffic generation. Therefore, the significance of the impact would be **low** negative.

Proposed mitigation

Even though the traffic generated would not be significant, the following requirements should still be met by the developer during the construction and decommissioning phases:

- Should abnormal loads have to be transported by road to the site, a permit needs to be obtained from the Provincial Government Northern Cape (PGNC) Department of Public Works, Roads and Transport;
- Provide a Transport Traffic Plan to SANRAL;
- Ensure that roadworthy and safety standards are implemented at all time for all construction vehicles; and
- Plan trips so that it occurs during the day but avoid construction vehicles movement on the regional road during peak time (06:00-10:00 and 16:00-20:00).

Requirements to be met during the operational phase:

- Adhere to requirements made within Transport Traffic Plan;
- Limit access to site to personnel; and

- Ensure that where possible, staff members carpool to site.

6.2 Accidents with pedestrians, animals and other drivers on the surrounding tarred/gravel roads.

During all phases, vehicles will need to access the site via the R27 and the Transnet Service Road/alternative gravel access road. As shown in the photo plate in Section 3, the Transnet Service Road intersects with the R27 just outside of Kenhardt. There is the potential that should vehicles not indicate soon enough that they are turning off from the R27, an accident can occur. In addition, not adhering to the relevant speed limits may cause accidents with other drivers and collisions with animals.

Significance of impacts without mitigation

The significance of causing an accident with pedestrians, animals and other drivers would have a **high** negative impact significance since the probability of the impact occurring would be likely and could be fatal and therefore would cause irreplaceable loss.

Proposed mitigation

- Road kill monitoring programme (inclusive of wildlife collisions record keeping) should be established and fences installed, if needed to direct animals to safe road crossings;
- Adhere to speed limits applicable to all roads used; and
- Implement clear and visible signalisation indicating movement of vehicles and when turning off or onto the Transnet Service Road to ensure safe entry and exit.

Significance of impact with mitigation

By implementing the abovementioned mitigation measures the probability of the impact occurring would be lowered significantly which would reduce the significance of the impact to **moderate** negative impact during all the phases of the project.

6.3 Impact on air quality due to dust generation, noise and release of air pollutants from vehicles and construction equipment.

During all the phases of the projects, there will be a decrease in air quality due to the noise created by and pollutants released from vehicles coming to site during all phases of the projects, construction activities occurring on site and dust created from driving on the Transnet Service Road or gravel farm road. Since the site is located in a very rural setting, no sensitive receptors are present within close proximity of the proposed project. Therefore, the extent of the impact would remain local.

Significance of impacts without mitigation

As discussed above, the decrease in air quality would be local in extent. The worst case scenario for impacts on air quality is that no dust suppression is implemented on the Transnet Service Road, gravel access road, on site or that construction activities occur throughout very windy conditions. This negative impact would be **moderate** for all phases of the project, without mitigation.

Proposed mitigation

- Implement management strategies for dust generation e.g. apply dust suppressant on the Transnet Service Road, exposed areas and stockpiles;
- Postpone or reduce dust-generating activities during periods with strong wind;
- Limit noisy maintenance/operational activities to daytime only;
- Earthworks may need to be rescheduled or the frequency of application of dust control/suppressant increased;
- Ensure that all construction vehicles are roadworthy and respect the vehicle safety standards implemented by the Project Developer; and
- Avoid using old and noisy construction equipment and ensure equipment is well maintained.

Significance of impact with mitigation

With the implementation of the mitigation measures detailed above, the probability of noise emissions and dust realised would be lowered and the impact would be of a **low** significance.

6.4 Change in quality of surface condition of the roads

The Transnet Service Road or gravel farm road is going to be used as the main access road to the site. As discussed in Section 3. The Transnet Service Road and farm road are gravel roads and would require additional maintenance to ensure that the traffic generated would not decrease the surface condition of the road.

Significance of impacts without mitigation

The Transnet Service Road is currently being maintained by Transnet and it is unclear whether any maintenance is currently being undertaken on the gravel farm road. Since the Developer is going to use these roads during all phases of the project, it is expected that, should no mitigation measures be implemented, the road's surface condition would decrease significantly. This would have a **low** negative impact on the road (due to the local spatial extent of the impact).

Proposed mitigation

- Construction activities will have a higher impact than the normal road activity and therefore the road should be inspected on a weekly basis for structural damage;
- Ensure that road network is maintained in a good state for the entire operational phase;
- Implement management strategies for dust generation e.g. apply dust suppressant on the Transnet Service Road, exposed areas and stockpiles; and
- A Road Maintenance Plan should be developed for the section of the Transnet Service Road that will addresses the following:
    - Grading requirements;
    - Dust suppressant requirements;
    - Drainage requirements;
    - Signage; and
    - Speed limits.

Significance of impact with mitigation

Provided that the above mitigation measures are implemented and agreed to by Transnet and the land owner whose farm road will be used, the impact would be a **low** positive impact since this section of the road would be well maintained.

6.5 Cumulative impact of traffic generation

The cumulative impact assessment assumes that all the projects outlined within the cumulative impact section occur at the same time. Even though there will most likely be overlap in the operational phases of these projects, it is unlikely that the construction phases for all these projects would occur at the same time. Since the construction phase will give rise to the most amount of trucks coming to site, this would be considered the worst case scenario in terms of traffic generation. The projects that are proposed within close proximity of each other are detailed within Table 1 below. The estimates detailed within the table below have been obtained from the Developers. Based on these current estimates, the total amount of additional trips that would occur on the R27 during the construction phase is 261.81, which is still well below the daily average limit of 1000 units. The impact on this road is therefore not anticipated to be significant but should the Transnet Service Road be used for all the projects, a maintenance plan, agreed upon all parties involved must be implemented to ensure that the road's quality and integrity is maintained.

Significance of cumulative impacts

It is assumed that the mitigation measures discussed in the Section 6 of this TIS and included in Table 2 below are implemented, that the traffic generation impacts would be suitable managed to ensure that the traffic impacts are suitably managed. Based on this, the cumulative negative impact is **low**.

Table 1. Cumulative daily traffic generation estimates for all PV projects proposed north-east of Kenhardt

PROJECT NAME		DAILY TRAFFIC GENERATION ESTIMATES		
		Construction Phase	**Operational Phase**	**Decommission Phase**
1	Proposed construction of Gemsbok PV1 75 MW Solar PV facility	20	10	20
2	Proposed construction of Gemsbok PV2 75 MW Solar PV facility	20	10	20
3	Proposed construction of Boven PV1 75 MW Solar PV facility	20	10	20
4	Proposed development of a 75 MW Solar PV Facility (Kenhardt PV 1) and proposed development of a 132 kV Transmission Line to connect to the proposed 75 MW Solar PV Facility (Kenhardt PV 1)	20.62	4.14	20.62
5	Proposed development of a 75 MW Solar PV Facility (Kenhardt PV 2) and proposed development of a 132 kV Transmission Line to connect to the proposed 75 MW Solar PV Facility (Kenhardt PV 2)	20.62	4.14	20.62
6	Proposed development of a 75 MW Solar PV Facility (Kenhardt PV 3) and proposed development of a 132 kV Transmission Line to connect to the proposed 75 MW Solar PV Facility (Kenhardt PV 3)	20.62	4.14	20.62
7	Proposed construction of the Mulilo Solar Development consisting of seven 75 MW PV or Concentrated PV Solar Energy Facilities and associated infrastructure	140	70	140
	TOTAL	**261.86**	**112.42**	**261.86**

Table 2. Traffic Impact Assessment Table

Aspect/Impact Pathway	Nature of impact	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility	Irreplaceability	Mitigation Measures	Significance of Impact/Risk = Consequence x Probability		Ranking of Impact/ Risk	Confidence Level
										Without Mitigation	*With Mitigation*		
CONSTRUCTION AND DECOMMISSIONING PHASES													
Traffic generation	Increase in traffic	Negative	Regional	Short term	Moderate	Very likely	Yes	Replaceable	• Should abnormal loads have to be transported by road to the site, a permit needs to be obtained from the Provincial Government Northern Cape (PGNC) Department of Public Works, Roads and Transport • Provide a Transport Traffic Plan to SANRAL • Ensure that roadworthy and safety standards are implemented at all time for all construction vehicles • Plan trips so that it occurs during the day but avoid construction vehicles movement on the regional road during peak time (06:00-10:00 and 16:00-20:00).	**Low**	**Low**	4	**Medium**
	Accidents with pedestrians, animals and other drivers on the surrounding tarred/gravel roads	Negative	Local	Long term	Extreme	Likely	No	High irreplaceability	• Road kill monitoring programme (inclusive of wildlife collisions record keeping) should be established and fences (such as Animex fences) installed, if needed to direct animals to safe road crossings. • Adhere to all speed limits applicable to all roads used. • Implement clear and visible signalisation indicating movement of vehicles and when turning off or onto the Transnet Service Road to ensure safe entry and exit.	**High**	**Moderate**	3	**Medium**
	Impact on air quality due to dust generation, noise and release of air pollutants from vehicles and construction equipment	Negative	Local	Medium term	Moderate	Unlikely	Yes	Replaceable	• Implement management strategies for dust generation e.g. apply dust suppressant on the Transnet Service Road, exposed areas and stockpiles. • Postpone or reduce dust-generating activities during periods with strong wind. • Earthworks may need to be rescheduled or the frequency of application of dust control/suppressant increased. • Ensure that all construction vehicles are roadworthy and respect the vehicle safety standards implemented by the Project Developer. • Avoid using old and noisy construction equipment and ensure equipment is well maintained.	**Moderate**	**Low**	4	**Medium**
	Change in quality of surface condition of the roads	Positive	Local	Long term	Slight	Likely	Yes	Replaceable	• Construction activities will have a higher impact than the normal road activity and therefore the road should be inspected on a weekly basis for structural damage; • Implement management strategies for dust generation e.g. apply dust suppressant on the Transnet Service Road, exposed areas and stockpiles; and • A Road Maintenance Plan should be developed for the section of the Transnet Service Road that will be used to addresses the following: o Grading requirements; o Dust suppressant requirements; o Drainage requirements; o Signage; and o Speed limits.	**Low**	**Low**	4	**Medium**

Aspect/Impact Pathway	Nature of impact	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility	Irreplaceability	Mitigation Measures	Significance of Impact/Risk = Consequence x Probability		Ranking of Impact/ Risk	Confidence Level
										Without Mitigation	*With Mitigation*		
OPERATIONAL PHASE													
Traffic generation	Increase in traffic	Negative	Regional	Short term	Slight	Very likely	High	Replaceable	• Adhere to requirements made within Transport Traffic Plan; • Limit access to the site to personnel; and • Ensure that where possible, staff members carpool to site.	**Very low**	**Very low**	5	**Medium**
	Accidents with pedestrians, animals and other drivers on the surrounding tarred/gravel roads	Negative	Local	Long term	Extreme	Likely	No	High irreplaceability	• Road kill monitoring programme (inclusive of wildlife collisions record keeping) should be established and fences installed, if needed to direct animals to safe road crossings. • Adhere to all speed limits applicable to all roads used. • Implement clear and visible signalisation indicating movement of vehicles and when turning off or onto the Transnet Service Road to ensure safe entry and exit.	**High**	**Moderate**	3	**Medium**
	Impact on air quality due to dust generation, noise and release of air pollutants from vehicles and construction equipment	Negative	Local	Medium term	Moderate	Unlikely	Yes	Replaceable	• Implement management strategies for dust generation e.g. apply dust suppressant on the Transnet Service Road, exposed areas and stockpiles; • Limit noisy maintenance/operational activities to daytime only.	**Moderate**	**Low**	4	**Medium**
	Change in quality of surface condition of the roads	Positive	Local	Long term	Slight	Likely	Yes	Replaceable	• Implement requirements of the Road Maintenance Plan.	**Low**	**Low**	4	**Medium**
CUMULATIVE IMPACTS													
Traffic generation	Increase in traffic	Negative	Regional	Long term	Moderate	Very likely	High	Replaceable	n/a	**Low**	**Low**	4	**Medium**

7 TRAFFIC IMPACT STATEMENT

Based on the assessment of the potential impacts that can be associated with the traffic to be generated during the construction, operation and decommissioning phases of these projects, the overall impact from traffic generation is deemed to be **low** when implementing suitable mitigation measures, discussed in Sections 5 and 6 of this Statement. The highest traffic will be generated during the construction phase.

The measures included within the EMPr must be adhered to, with the main requirements outlined below:

- Should abnormal loads have to be transported by road to the site, a permit needs to be obtained from the Provincial Government Northern Cape (PGNC) Department of Public Works, Roads and Transport.
- Provide a Transport Traffic Plan to SANRAL.
- Ensure that roadworthy and safety standards are implemented at all time for all construction.
- Adhere to all speed limits applicable to all roads used.
- Implement clear and visible signalisation indicating movement of vehicles and when turning off or onto the Transnet Service Road to ensure safe entry and exit.
- Implement management strategies for dust generation e.g. apply dust suppressant on the Transnet Service Road, exposed areas and stockpiles.
- Construction activities will have a higher impact than the normal road activity and therefore the road should be inspected on a weekly basis for structural damage.
- A Road Maintenance Plan should be developed for the section of the Transnet Service Road.
- Ensure that road network is maintained in a good state for the entire operational phase.